CURRENT PERSPECTIVES ON SOCIAL COMPARISONS AND THEIR EFFECTS

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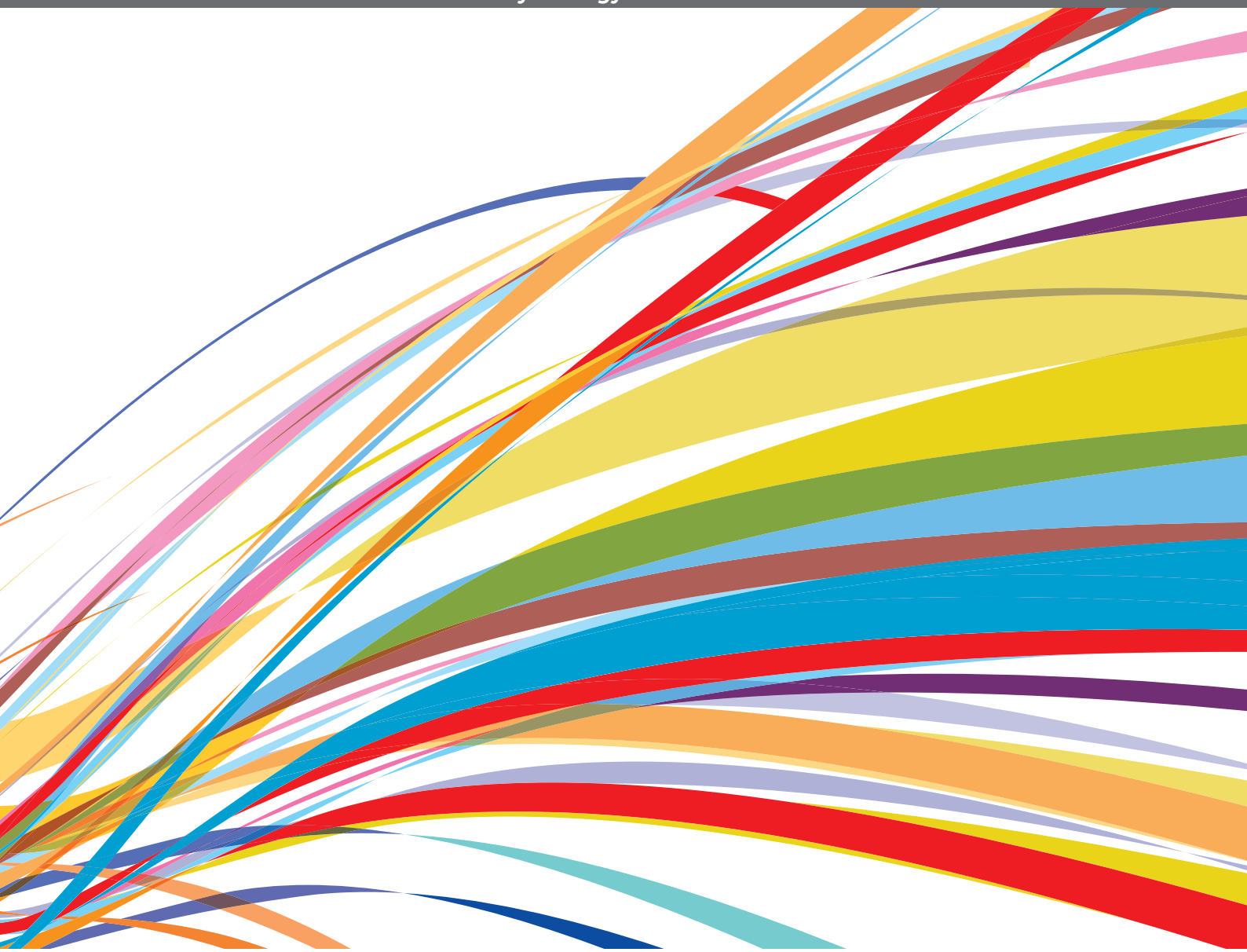

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CURRENT PERSPECTIVES ON SOCIAL COMPARISONS AND THEIR EFFECTS

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EDITORIAL
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Editorial: Current Perspectives on Social Comparisons and Their Effects

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Editorial on the Research Topic

Current Perspectives on Social Comparisons and Their Effects

Every day in different contexts and with different purposes we engage in social comparison processes, whether consciously or at subliminal level (e.g., Kahneman and Miller, 1986; Mussweiler and Rüter, 2003). Indeed, social comparisons represent a powerful tool people attend to infer their self-worth or to judge on their abilities by "stacking [oneself] up against the others" (Festinger, 1954). The information retrieved this way is treated as more accurate and objective and strategically useful, especially under tight timelines or in situations of uncertainty (e.g., Corcoran et al., 2011; Lockwood et al., 2012; van Dick et al., 2018). Recently, Gerber et al. (2018) presented a meta-analysis of social comparison research, where they identified mechanisms that enhance the social comparison effects. This work showed that besides manipulation of self through priming, novel information assessment indeed showed a consistent increase in social comparison effects as well as proximity of the standards (perceived relevance, similarity, or identification with the standard). The latter was associated with immediacy or salience of the standard perception of which outweigh general comparison (Buckingham and Alicke, 2002; Zell and Alicke, 2013). Finally, the meta-analytical analysis demonstrated that people generally choose upward comparison (better-off) standards, even when such comparison poses a threat to their self-esteem, bridging their interests, and that these comparisons tend to undermine well-being and ability self-evaluations. According to Gerber et al. (2018), contrast is a default reaction to social comparisons, whereas assimilation appears when conditions that suggest these processes are provided through priming, identification with the standard, or situations of uncertainty. Overall, this evidence only partly confirms the Self-Evaluation Model (SEM; Mussweiler, 2003), which suggested assimilation as a default mechanism and a threat to self-esteem to guide the use of social comparison information not allowing to inflict a traumatic conclusion.

To further the meta-analysis and existing knowledge on social comparisons, the 12 articles comprising this collection, reflect most recent perspectives and trends concerning social comparisons in Psychology and related disciplines, covering a wide range of aspects. First, conceptual and methodological issues were the focus of several papers. In Arigo's et al. scoping review on methods used to assess social comparison processes within persons in daily life argued that an ecological momentary assessment or daily diaries utilised in social and clinical research represent a more powerful and valid method to measurement rather than a traditional aggregated retrospective self-report. Furthermore, Whillans et al. proposed their conceptual framework on the long-term benefits of worse-than-average beliefs in domains including motivation, task performance, and subjective well-being, which generates novel insights in skill learning and provides recommendations for future research. In their conceptual paper, Caricati and Owuamalam argued that social comparison processes can act as a tool allowing justification of

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†In Memoriam:
This paper is dedicated to the memory of Prof. Nikos Chatzisarantis (1968–2020).

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the existing societal systems where intermediately positioned disadvantaged through downward assimilation to the worse off.

Experimental and applied research on health and well-being examined specific issues and the mechanism by which social effects are derived. Specifically, Corcoran et al. found that social comparisons can be beneficial for cancer patients if they engage in the right process by engaging in downward comparison processes by contrasting from poorly adjusted patients and assimilating to well-adjusted ones. Interestingly, Arnold et al. also found that downward social or temporal comparisons (i.e., evaluated their contact with others as better-off) related to lower loneliness levels compared to upward comparisons, even when controlling for baseline levels. Furthermore, Wayment et al. provided evidence in support of social comparison processes and their functionality: lateral (similarity) and upward social comparisons were instrumental for meeting accuracy and self-improvement motives during weight loss, while for the self-enhancement motive were lateral and downward social comparisons. In application to the population of women with fibromyalgia, Cantero et al. found that patients with higher level of pain perception, anxiety and depression attend to more disadvantage types of comparison such as upward contrast and downward identification as opposed to those with lower levels of pain perception, anxiety and depression use upward identification and downward contrast. In a 2.5-year longitudinal study, Brycz et al. found that individuals with a larger insight for their biases (stronger metacognitive self) sought more social comparisons information, of both directions, for self-improvement purposes. Next, the moderating effects of athletic mental energy on the athletes' life stress–burnout relationship was examined by Chiou et al., as an ability to ignore social comparisons in competitive environment buffering debilitating effects for well-being.

Finally, several studies examined social comparison processes and effects in relation to performance and decision-making. For example, Akay et al. found that empathy, defined via its affective and cognitive aspects, cause positional concerns (i.e., choices), positively relating to self-gain choices and negatively relating to choices reflecting losing (other gain). Taking an organisational psychology perspective, Sijbom and Parker found that leaders who attend to self-referenced standards (mastery-approach goals) during self-evaluations were more receptive to their subordinates, while leaders who base their self-evaluations on social comparisons (performance-approach goals) were less receptive to their subordinates in threatening situations of low power. Finally, Dolean and Călugăr demonstrated that SES-driven social comparison processes can explain most of the inter-ethnic differences in general non-verbal intellectual abilities (IQ measured with Raven Progressive Matrices) in a Roma ethnic minority in Rumania, indicating that Roma's students poor performance on such tests is not a true reflection of the population mean. In line with social comparison theory (Festinger, 1954) and SEM (Mussweiler, 2003), the identity processes linked to in-out-Roma-group can produce lower performance on IQ tests by means of unfavourable effects of downward assimilation with lower performing children (Roma group) and contrast from higher performing ones (non-Roma group), increasing the ethnic separation.

The current collection of articles presents different takes on social comparisons, their nature and effects they produce, and we hope that this special issue will be of interest to researchers from a variety of fields, practitioners and policy makers.

AUTHOR CONTRIBUTIONS

SK and NC contributed to the conceptualisation of the special issue. SK, NC, and AP reviewed and edited articles included in the issue, and contributed to the editorial at its different stages.

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ORIGINAL RESEARCH
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Standing in Others' Shoes: Empathy and Positional Behavior

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Studies show that people are concerned with other people's consumption position in a varying degree with respect to the type of goods consumed and individual characteristics. Using both survey experiments and a large survey of subjective well-being (SWB) dataset, this paper aims to investigate the association between the degree of empathic capacity and positional concerns for consumption items involving pleasure and pain. The paper exploits both empathy quotient (EQ) and interpersonal reactivity index (IRI) measures of empathic capacity, i.e., dispositional empathy, which are sufficient measures capturing affective and cognitive aspects of empathy. Positional concerns are identified directly using a series of stated choice experiments and indirectly using the SWB approach. The main result of the paper is that positional concerns vary substantially with the levels of empathic capacity. Both EQ and IRI are found to be *positively* associated with positional concerns for "goods" (e.g., after-tax income, market value of a luxury car), reflecting a degree of self-regarded feelings and behavior to reduce personal distress, and *negatively* associated with positional concerns for "bads" (e.g., working hours and poverty rates), reflecting a degree of other-regarding feelings and behavior. The results are robust with respect to various checks including statistical specifications, reference groups, and omitted variables (e.g., prosocial behavior and competitivity) that could bias the results.

Keywords: dispositional empathy, survey experiments, positional concerns, utility, subjective well-being

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"As we have no immediate experience of what other men feel,
we can form no idea of the manner in which they are affected,
but by conceiving what we ourselves should feel in the like situation."
Adam Smith, *The Theory of Moral Sentiments*

INTRODUCTION

Empathy is one of the basic processes that make us connect with other people's feelings, emotions, and experiences (Batson, 1987, 1991; Eisenberg and Miller, 1987; Eisenberg et al., 1994; Brandstätter, 2000; Keum and Shin, 2016). It is most often considered to be the capacity or skill of "projecting yourself into what you observe" (Davis, 1980; Batson, 1991; de Waal, 2008, 2012). In *The Theory of Moral Sentiments* (Smith, 1759), Adam Smith extensively discussed the importance of empathy[1]—as quoted above—in particular how it is associated with the

[1]The term empathy was not yet available when Adam Smith discussed the relationship between "sympathy" and non-selfish behavior. He used the term sympathy almost synonymously to the current meaning of empathy. In recent literature, sympathy is considered an "affective" component of empathy (de Waal, 2008). See Fontaine (2001) and Sugden (2001) for historical accounts of the terms.

other-regarding and self-interested behaviors in human life. Indeed, studies in fields ranging from neurobiology to psychology have already accumulated a bulk of evidence that empathy has evolved to predict other people's behavior, feelings, and experiences of pleasure and pain (e.g., Batson, 1991; Baron-Cohen and Wheelwright, 2004; Singer et al., 2006; de Waal, 2008; Cronin, 2012; Klimecki et al., 2016)[2]. Thus, it is not surprising that behavioral economists give attention to how empathy is related to prosocial behavior including altruism, cooperation, and fairness considerations (e.g., Edele et al., 2013; Klimecki et al., 2016). How we emotionally connect with and react to other people's feelings, emotions, experiences of pleasure and pain might also be one of the building blocks of *processes of social comparisons* ("positional" or "status" concerns) with others (Tesser et al., 1988; Tesser, 1991; Brandstätter, 2000). The present paper aims to investigate how people's degree of empathic capacity relates to their positional concerns with respect to consumption goods associated with experiences of pleasure and pain.

Positional concerns have long been discussed by various scholars including Adam Smith, Karl Marx, and Veblen, and the topic is currently attracting substantial empirical interest among social psychologists and economists (Senik, 2004; Ferrer-i-Carbonell, 2005; Clark et al., 2008; Akay et al., 2013). These concerns imply that individuals' utility is related not only to their own absolute level of consumption but also to their level of consumption relative to that of relevant others, i.e., their reference or comparison groups (Clark and Senik, 2010). One consequence of these comparisons is the negative externality causing personal distress and large welfare loss (Clark et al., 2008). The literature has identified important impacts of these externalities on economic issues ranging from labor supply and migration to optimal taxation (e.g., Neumark and Postlewaite, 1998; Aronsson and Johansson-Stenmann, 2014; Akay et al., 2017). However, little is known about the fundamental processes underlying positional behavior. Recently, another strand in the literature has focused on how positional concerns relate to contextual factors, individual socio-demographic characteristics, and trait-like constructs including emotions, personality characteristics, and empathy (e.g., Buunk et al., 1990; Tesser, 1991; VanderZee et al., 1996; Brandstätter, 2000; White et al., 2006; Akay and Martinsson, 2011, 2019; Blázquez Cuesta and Budría, 2015; Budria and Ferrer-i-Carbonell, 2018). Drawing on this literature, to best of our knowledge first time, this study takes a comprehensive approach to investigate the relationship between the levels of "dispositional" or "trait" empathy and positional concerns. To this end, we use both a series of tailor-made survey experiments (e.g., Solnick and Hemenway, 2005; Carlsson et al., 2007) dealing with an array of goods and the subjective well-being (SWB) approach that is based on a large survey of SWB and empathy-related information (e.g., Ferrer-i-Carbonell, 2005; Akay and Martinsson, 2011).

Researchers seem to agree that empathy operates as an affective ("empathic emotions") and cognitive ("perspective taking") *reflection process* that helps the person connect to other people's feelings and experiences (Batson, 1991; Tesser, 1991; Chopik et al., 2017). The empathic reflection process is also expected to operate when people compare their levels of consumption with those of other people (Tesser et al., 1988; Tesser, 1991; Brandstätter, 2000; Batson et al., 2002; de Waal, 2008, 2012). This process may function as a source of information about the experience of others and might lead to substantial heterogeneity in the degree of positional concerns, which might also differ by the type of good under consideration, e.g., whether it is "a luxury car" or "poverty experience" (Tesser et al., 1988; Brandstätter, 2000). An increase in the consumption level of a "good[3]"—a consumption item that is associated with pleasure or utility—by an "average" relevant other person in an individual's reference group is expected to increase the personal distress and reduce the individual's well-being (Clark et al., 2008). Yet someone with higher empathic capacity might become more distressed than other people as this person identifies the pleasure experience of others better. This person may try to selfishly seek a better consumption position to get a similar pleasant experience. Thus, we predict that a higher level of empathy might trigger a higher degree of self-regarding behavior and competition for a better consumption position for a "good" (Zillmann and Cantor, 1977; Batson, 1987; Lanzetta and Englis, 1989; Batson et al., 1991; de Waal, 2008; Cronin, 2012). Yet, the empathic reflection process regarding other people's level of consumption of a "bad"—a consumption item associated with pain or disutility—might lead to completely different feelings and reactions. In this case, empathic reflection on the feelings and experiences of others might trigger "compassion" or "pity." Thus, a person with higher empathic capacity is expected to act altruistically by competing less for a better position in the case of consumption items signaling suffering of others (Batson et al., 1991; de Waal, 2008). Thus, we expect that greater empathic capacity is negatively related to positional concerns about items involving pain or disutility.

To investigate the associations between the levels of empathic capacity and positional concerns, we use two approaches that are often used to identify positional concerns. The first approach is based on a stated choice experiment with a hypothetical scenario where respondents make a series of decisions about the consumption levels of their "future relative" compared to "strangers" living in the same society or country, i.e., their reference group (Carlsson et al., 2007). The survey experiments identify the heterogeneity in positional concerns directly on individual utilities for a series of consumption items and elicit the long-form of empathy quotient (EQ) to capture the degree of empathic capacity (e.g., Baron-Cohen and Wheelwright,

[2]Different strands of literature from a wide variety of disciplines have investigated the evolutionary, neurobiological, and genetic roots of affective and cognitive dimensions of empathy (de Waal, 2008, 2012; Preckel et al., 2018; Blagrove et al., 2019). In studies involving humans and animals, neurobiologists identify mirror-neurons that operate during empathic processes (e.g., Rizzolatti and Craighero, 2004; Fogassi, 2011; Khalil, 2011; Molnar-Szakacs, 2011; Bernhardt and Singer, 2012; Cronin, 2012).

[3]The term good should be clarified. We use it to mean any tangible or intangible commodity. To differentiate between goods associated with pleasure/utility and pain/disutility, we use the terms "goods" and "bads" (always in quotation marks), respectively.

2004; Edele et al., 2013). The second approach is based on SWB information in which the degree of positional concern is indirectly identified using the absolute and relative level of consumption of individuals (Ferrer-i-Carbonell, 2005; Luttmer, 2005). The SWB dataset used is obtained from the General Social Survey (GSS), which is high-quality representative cross-sectional data (Einolf, 2008). In this approach, the interpersonal reactivity index (IRI) by Davis (1980, 1983) is used as a measure of empathy. It is obtained from the National Altruism Study Module supplied as a part of GSS for the years 2002 and 2004. Our extensive investigation shows that two alternative approaches with two measures of empathy produce strikingly similar results. Highly in line with the expectations, both the EQ and IRI measure of empathy are *positively* related with the degree of positional concerns for "goods" implying self-regarded feelings and behavior and *negatively* related with the degree of positional concerns for "bads" implying other-regarded feelings and behavior. We find that these results are highly robust with respect to control variables, functional form, reference groups, estimators, and proxies for the potential omitted variables (e.g., prosocial behavior, competitivity, envy, and self-esteem).

The remaining part of the paper is organized as follows. Next section describes our survey experiment, i.e., the setup, descriptive and conditional results, and a detailed robustness analysis. Section Evidence from Subjective Well-Being Data gives the evidence from the SWB approach, where we present the dataset, econometric specifications, results, and robustness analysis. Finally, section Concluding Discussions concludes the paper.

EVIDENCE FROM SURVEY EXPERIMENTS

Setup

Procedure

The survey experiment consisted of two parts[4]. First, our experiment assistants presented a script with a scenario and a set of hypothetical binary choice questions to 307 randomly recruited respondents[5]. They were asked to imagine "a future relative," for example a grandchild who is going to live two generations from now. The choice situations in the survey experiment involved a series of decisions about the best society/country for the imaginary grandchild to live in. In the second part of the survey experiment, the respondents completed a questionnaire aimed to elicit (*i*) socio-demographic and -economic characteristics, (*ii*) psychological measures including empathy measures obtained using 60 questions of the EQ, personality characteristics (Big-5), self-esteem, and emotions, and (*iii*) attitudes to prosocial behavior, competitivity, and inequality. That is, the respondents first made experimental decisions and then answered a series of neutral questions including questions about socio-demographic characteristics such as age, gender, university department, and family characteristics. Finally, the EQ questionnaire was distributed. To control for a possible trend (due to, e.g., fatigue, conformity, or alienation) across the repeated answers by the respondents, the decisions were arranged in six different orders of goods. Our empirical model specifications are also controlled for the order of questionnaire dummies to allow this sort of confounders.

Utilities

In the first part of our survey experiment, the respondents were asked to decide which society, Society (A) or (B), they would like their imaginary grandchild to live in. Both societies consist of "strangers" and differ only in terms of the grandchild's *absolute* and *relative* amount of consumption. The experimental assistants carefully described the hypothetical scenario and the example choice situation (see **Appendix A**). To measure individual-specific positional concerns for a good g, we begin with a utility function $U^g(Y^g, Y^g - Y^{gR})$ involving absolute level of consumption Y^g and relative level of consumption $Y^g - Y^{gR}$ of good g. The functional form of the utility function is chosen to be linear for simplicity:

$$U^g(Y^g, Y^g - Y^{gR}) = \left(1 - \lambda^g\right) Y^g + \lambda^g (Y^g - Y^{gR}). \quad (1)$$

In Equation (1), λ^g is the parameter capturing the degree of positional concerns with respect to good g. λ^g can be interpreted as the fraction of marginal utility due to an increase in relative consumption of good g. Thus, a higher level of λ^g implies that individuals show a higher level of positional concern with respect to good g. The main aim of the experiment was to identify the *mean degree of positional concerns* (MDPC hereafter) for each good g. We used relatively large reference groups R, which consisted of "strangers" in a society or country. The design aims to exclude potential confounding emotions stemming from the socio-cultural and genetic proximity between individuals and the people in their reference groups (see, e.g., Tesser et al., 1988 and Brandstätter, 2000 for discussions on the empathic reflection process in relation to liked and disliked particular others).

Having specified the utility function for the whole population, we generate a series of binary choice situations with different combinations of absolute and relative levels of consumption for the future grandchild and other people in each society/country. **Appendix A** presents the outlines of the hypothetical scenario and the example choice situation for after-tax income/month. The income levels were chosen so that they *implicitly* involve a degree of positional concern once Society (B) is chosen. Imagine that the respondent is indifferent between choosing Society (A) and Society (B). Then we can write

$$\left(1 - \lambda^g\right) Y_A^g + \lambda^g \left(Y_A^g - Y_A^{gR}\right) = \left(1 - \lambda^g\right) Y_B^g + \lambda^g \left(Y_B^g - Y_B^{gR}\right), (2)$$

[4]According to the Turkish law, the experiment did not require an ethical committee approval and also there was no institutional review board for the social sciences in the Istanbul University by the time of our experiment, 2014. A written consent was not obtained from participants. Students voluntarily registered for the experiment and consents of the participants was implied through survey completion.

[5]The respondents were recruited from three departments, economics, psychology, and law, of Istanbul University, Turkey. We announced the experiment with a poster on the boards of the student hall of each department. The experiment was conducted among the voluntary participants in three sessions in a large lecture hall. At the beginning of the experiment, the students were also told to feel free to leave the experiment anytime. The respondents were guided by five experimental assistants who presented the scenario of the experiment and answered any questions asked by the respondents. The experimental sessions lasted about an hour and the respondents were given a supplementary textbook that was priced about the average hourly wage in Istanbul at the time of the experiment in 2014.

and implementing the income levels given in **Appendix A**, we obtain

$$\lambda^g = \frac{Y_A^g - Y_B^g}{Y_A^{gR} - Y_B^{gR}} = \frac{2{,}000 - 1{,}800}{2{,}500 - 1{,}500} = 0.20. \quad (3)$$

This figure implies that the respondent's degree of positional concern should be at least 0.20 ($\lambda^g > 0.20$) once Society (B) is chosen. To find the marginal interval of a respondent's degree of positional concerns, we ask repeated binary questions involving combinations of absolute and relative levels of consumption corresponding to an increasing set of implicit degree of positionality as 0.25, 0.50, and 0.75 (see **Appendix B.1** for three binary choice situations in case of the after-tax income/month experiment). That is, the experiment identifies the "marginal" interval of positionality by identifying the question at which the respondent switches from choosing Society (B) to Society (A) for each individual and good g. We experiment with several goods that differ in terms of the feeling and attitudes they are expected to trigger. The list of goods, choice situations, absolute and relative consumption levels, and corresponding implicit degrees of positional concerns are presented in **Appendix B.2**.

Measuring Empathy

Several strategies to measure empathy are suggested in the literature (e.g., Davis, 1980, 1983; Baron-Cohen and Wheelwright, 2004; Gerdes et al., 2010; Neumann et al., 2015). Our measure of empathy is the empathy quotient (EQ), which is based on a set of survey items (Baron-Cohen and Wheelwright, 2004). EQ is found to be a sufficient measure to identify both affective and cognitive dimensions of dispositional empathy (Lawrence et al., 2004; Edele et al., 2013). The measure mainly identifies the "trait" or "skill" dimension of empathy, with a higher level implying a higher level of dispositional empathic capacity (see Baron-Cohen and Wheelwright, 2004 for a detailed account of the measure).

EQ is based on 60 survey items (see **Appendix C.1** for the full set of expressions/statements). Yet, only 40 items are actually used to construct the scale; the only purpose of the rest of the items is to distract attention and prevent answers that trigger social desirability and individual alienation. The EQ scale is generated as follows: Each statement/expression in the inventory is responded to on a four-point scale, i.e., "*strongly disagree*," "*disagree*," "*agree*," and "*strongly agree*." There are two groups of items. In the first group (numbered 1, 6, 19, 22, 25, 26, 35, 36, 37, 38, 41, 42, 43, 44, 52, 54, 55, 57, 58, 59, and 60 in **Appendix C.1**), respondents score 2 empathy points if they choose "*strongly agree*" and 1 point of empathy if they choose "*agree*." In the second group (numbered 2, 3, 5, 7, 9, 13, 16, 17, 20, 23, 24, 30, 31, 33, 40, 45, 47, 51, 53, and 56 in **Appendix C.1**), respondents score 2 empathy points if they choose "*strongly disagree*" and 1 point if they choose "*disagree*." The rest of the questions are scored as 0 as they merely serve as controls (numbered 2, 3, 5, 7, 9, 13, 16, 17, 20, 23, 24, 30, 31, 33, 40, 45, 47, 51, 53, and 56 in **Appendix C.1**). The Cronbach's alpha for the forty-items used in the construction of EQ scale is 0.84 which is very high and highly in line with the previous studies [e.g., alpha reported in Baron-Cohen and Wheelwright, 2004 is about 0.91].

In our experiment, we obtained 267 fully completed EQ questionnaires. Eliminating respondents with at least one missing answer and those with inconsistent answers[6] reduced the sample to 224 observations for after-tax income/month, 214 for the market value of a luxury car, 231 for weekly working hours and poverty rates (%) experiments. The distribution of EQ scores is highly symmetric with a mean (median) value of 47.8 (47) and a standard deviation of 11.01. The minimum EQ score is found to be 16 and the maximum 76. The distribution of EQ is highly similar to that of studies using EQ (see, e.g., Baron-Cohen and Wheelwright, 2004; Edele et al., 2013).

Unconditional Results

Overall MDPC

As the first step of our analysis, we present the share of positional respondents—unconditional estimates of MDPC—split by goods and choice situations in Column I of **Table 1**. Fifty-two percent of the respondents chose the positional alternative, Society (B), for after-tax income/month. Sixty-one percent of respondents are positional when the implicit degree of positional concerns is 0.25, while the proportion decreases to 52 and 43% as the implicit degree is increased to 0.50 and 0.75 in the subsequent choice situations. The percentage of positional respondents is 56% for the market value of a luxury car, which is slightly higher than that for after-tax income/month. Yet the difference in shares of positional choice across these two goods is not statistically significant at conventional levels. The next two items are working hours/week and poverty rates (%). Only 39% percent of the respondents chose the positional alternative for working hours/week. The share of positional choices is significantly smaller than that for after-tax income/month (Mann-Whitney-U-test $p < 0.001$). The share of positional choice is 45% for the poverty rates (%). The positional behavior regarding poverty rates (%) is also lower than that for after-tax income/month and the market value of a luxury car (Mann-Whitney-U-test $p = 0.043$ for after-tax income/month and $p = 0.002$ for the market value of a luxury car). Overall, the unconditional MDPC estimates are about 0.39–0.56, which are highly similar to the values in previous studies that used a similar sample and experimental design (c.f. Akay et al., 2013) and in samples from other countries (c.f. Carlsson et al., 2007).

Heterogeneity in MDPC by EQ

The remaining columns of **Table 1** present the descriptive results of our survey experiment for the different levels of EQ. Columns II and III show the share of positional choice for each good and choice situation split by low and high EQ levels. We identify individuals with a higher and lower level

[6]Some respondents make choices that are inconsistent with the utility maximization assumption. That is, the utility maximization assumption predicts that once a respondent chooses Society (A), she should not choose the positional alternative Society (B) for a larger implicit degree of positional concerns. We identified these respondents and simply removed them from the sample used in our analysis below. The share of inconsistent respondents is about 10–15% across the goods.

TABLE 1 | Unconditional results.

	Share of choosing positional alternative	Share of positional choice among		Mann-Whitney-*U*-Test (*p*-values)
		Low dispositonal empathy (EQ < Median)	High dispositional empathy (EQ > Median)	
	I	II	III	IV
After tax income/month (in TRY)	0.521	0.446	0.578	0.004
Society A				
Society B(1)	0.612	0.545	0.658	0.074
Society B(2)	0.520	0.446	0.575	0.046
Society B(3)	0.432	0.347	0.500	0.016
Market value of a car (in TRY)	0.558	0.511	0.582	0.069
Society A				
Society B(1)	0.642	0.589	0.676	0.090
Society B(2)	0.576	0.522	0.604	0.222
Society B(3)	0.457	0.422	0.464	0.540
Working hours (week/hours)	0.386	0.446	0.354	0.013
Society A				
Society B(1)	0.501	0.565	0.471	0.077
Society B(2)	0.363	0.435	0.321	0.071
Society B(3)	0.295	0.337	0.269	0.130
Poverty rates (%)	0.451	0.526	0.435	0.012
Society A				
Society B(1)	0.555	0.603	0.504	0.058
Society B(2)	0.484	0.532	0.448	0.093
Society B(3)	0.399	0.444	0.352	0.068

Authors' own calculations from the experimental data.
TRY is the new Turkish Lira. EQ is the empathy quotient (Baron-Cohen and Wheelwright, 2004).

of empathic capacity using the median level of EQ = 47 as threshold. The unconditional MDPC is higher among people with a higher empathic capacity for after-tax income/month and the market value of a luxury car, i.e., "goods." The share of positional choice is statistically different among people with lower and higher EQ for both after-tax income/month and the market value of a luxury car. The Mann-Whitney-*U*-test *p*-values are presented in the final column of **Table 1** (Column IV). In most cases, the *p*-values suggest significant differences at conventional levels.

The next two items involve individual pain or disutility, i.e., "bads." While people who work longer hours earn more and might obtain a better income position, they also suffer as working longer hours involves disutility (Knabe and Rätzel, 2010). The unconditional results suggest that a higher EQ level relates to a lower share of respondents with positional concern with respect to working hours/week. The difference in the share of respondents with positional preferences across the levels of EQ is statistically significant at the conventional levels, $p = 0.013$. Finally, we focus on the poverty rates (%), which is a public "bad" and expected to involve a high degree of suffering. Indeed, the poverty rate can be considered as an overall measure for the degree at which the people in the society suffer. In line with our predictions, the respondents with higher empathic capacity show a lower level of positional concern. The Mann-Whitney-*U*-test suggests that the difference in share of positional choice across the EQ levels is highly significant with $p = 0.012$.

Detailed Results by Choice Situations

Figure 1 presents unconditional results to give further ideas about the relationship between the levels of empathic capacity and positional concerns. First, to obtain higher degrees of freedom, we merge the experimental data from the after-tax income/month and the market value of a luxury car experiments as "goods," and working hours/week and poverty rates (%) as "bads." **Figure 1** presents the relationship by splitting for the three choice situations for both "goods" and "bads." Along the horizontal axis are the 10 deciles of the EQ distribution and on the vertical axis we present unconditional estimates of MDPC for each decile. We also show the linear regression line (using the underlying data−10 observations in this case) to illustrate the strength of the unconditional relationship between the level of empathic capacity and positional concerns. A clear pattern emerges, i.e., the relationship is positive for the "goods" (G.1–G.3) and negative for the "bads" (B.1–B.3) for each choice situation. The strength of the relationship is similar across the choice situations, which change only with respect to the underlying implicit degree of positional concern (0.25, 0.5, and 0.75).

Econometric Analysis

Model Specification

To identify the association between EQ and positional concerns conditional on a set of individual characteristics, we estimate a series of interval regressions as we measure positionality in an interval for each individual and good. The estimation model reads:

$$\tilde{\theta}_i^g = \mathbf{X}'\beta + \alpha EQ_i + \boldsymbol{P}'\phi + \epsilon_i^g, \tag{4}$$

where $\tilde{\theta}_i^g$ is the latent marginal positionality interval with upper $\tilde{\theta}_i^{g(lower)}$ and $\tilde{\theta}_i^{g(upper)}$ boundaries for each individual i and good g. The interval regression in model (4) allows for a set of observed characteristics, $\mathbf{X}$, including age, gender, household income (in seven category dummies), household size, number of siblings, health status (four dummies from "very poor" health to "very good" health), department of the university (dummies for economics, psychology, and law), and six order-effect dummies. β is the corresponding vector of parameters. The key variable in this study is our empathy measure EQ and the parameter of interest is α. The baseline model specification is based on the logarithm of EQ, which allows a degree of flexibility in

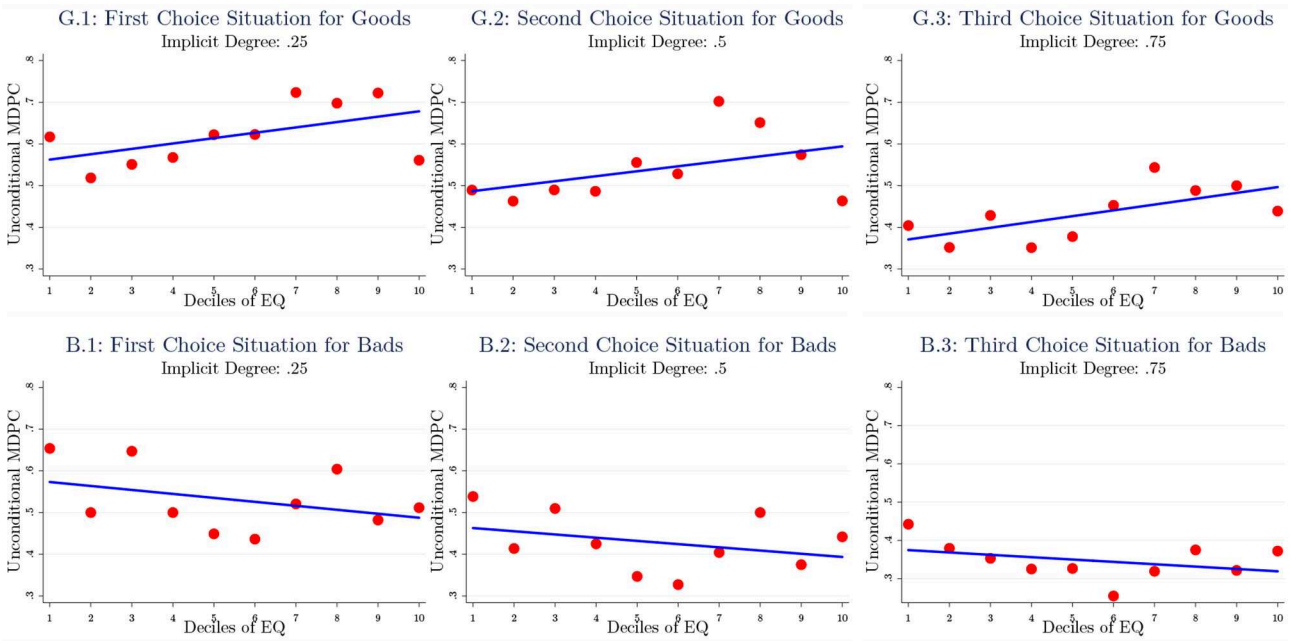

FIGURE 1 | The unconditional relationship between EQ and share of positional choice. The figure displays unconditional relationship between the deciles of EQ (horizontal axis) and the unconditional MDPC (vertical axis). (G.1–G.3) Merge the income and car experiments, and (B.1–B.3) merge the working hours and poverty rates experiments. The relationship is presented for three choice situations with 0.25, 0.5, and 0.75 implicit degrees of positional concerns. The lines represent the linear regression based on the underlying data.

the relationship between EQ and positional concerns. In our robustness checks, we also estimate models with alternative functional forms including the standardized levels of EQ and a dummy variable indicating high empathic capacity. The model specification (4) is estimated using the maximum likelihood estimator, which assumes the normal distribution for the good-specific error terms ϵ_i^g.

Stochastic Specifications

The experimental setup in this study does not allow us to make causal interpretations of the relationship between EQ and positional concerns. That is, the results should be interpreted as correlations. Clearly, EQ might be correlated with the good-specific error terms ϵ_i^g. Equation (4) might have omitted variables or positional concerns might determine people's empathy level, e.g., reverse causality. In both cases, our results might be substantially biased. In this paper, we assume that dispositional empathy is a trait exogenously given to individuals. Therefore, the variation in the levels of empathy is assumed to be temporal due to contextual factors. Nevertheless, there might still be some variables that are persistently correlated with both the level of empathy and positional concerns, leading to omitted variables bias.

Our approach to alleviate the omitted variables bias is to allow our model specifications for some proxies that are potentially correlated with EQ and error terms ϵ_i^g. We suggest three important proxies that could capture potential omitted factors. The first is *overall well-being*, measured using life satisfaction—a measure of SWB. Respondents with higher life satisfaction may engage more in social life and helping behavior and experience less positional concern (Diener and Larsen, 1984; see also Dolan et al., 2008 for a general review of the determinants of SWB). Second, we allow our regressions for a measure of *inequality aversion*, which might be one of the factors underlying non-positional behavior and may correlate with EQ (Fehr and Schmidt, 1999)[7]. The third set of proxies involves *personality* characteristics measured using the so-called five factor model (Big-5, *extraversion*, *agreeableness*, *conscientiousness*, *neuroticism*, and *openness-to-experience*)[8]. These characteristics are considered to measure non-cognitive skills, e.g., memory, social skills, and motivation, and have been found to be hard-wired constructs as they are stable after adolescence (McCrae and John, 1992; Cobb-Clark and Schurer, 2013). We then include these proxies in matrix **P**, and ϕ is the vector of corresponding parameters. In our robustness analysis, we will include several other proxies, e.g.,

[7]To measure the degree of inequality aversion, we elicit subjective attitudes to inequality using the questions as follows. Using a 1–7 scale, the participants reported their preference regarding two sets of statements, i.e., (A) "income should be more equal as incentives" (1) vs. "we need larger income differences for higher effort" (7) and (B) "an egalitarian society where the gap between rich and poor is small, regardless of achievement" (1) vs. "a society, where wealth is distributed according to ones' achievement" (7). Then we obtained the measure of subjective inequality aversion by simply adding the two scores reported for (A) and (B).

[8]The Big-5 is measured based on 15 questions obtained from the 2009 questionnaire of the German Socio-Economic Panel. See http://www.diw.de for further information.

prosocial behavior and competitivity as well as emotions (e.g., envy) and self-esteem, to tease out potential variables driving the relationship.

Conditional Results

Baseline

Our baseline model specification is an interval regression as presented in Equation (4). The maximum likelihood estimation of the model specification is summarized in **Figure 2**[9]. The full estimation results are not presented as the focus of our paper is on the relationship between EQ and positional concerns[10]. We are mainly interested in the sign, significance, and relative magnitude of EQ on positional concerns across goods. Conditional on the full set of socio-demographic and -economic variables (see the note in **Figure 2**), overall well-being, inequality aversion, and Big-5 personality traits, the logarithm of EQ is positively and significantly associated ($p = 0.031$) with positional concerns regarding after-tax income/month. The parameter estimate of EQ on positional concerns regarding the market value of a luxury car is also positive, but the magnitude of it is lower than that of after-tax income/month and it is not estimated with lower precision ($p = 0.122$). The positive parameter estimates of EQ on positional concerns for "goods" are highly in line with our predictions. In the third bar of the first group of goods (pleasure and utility), we present results by combining the experimental data from the after-tax income/month and the market value of luxury car experiments. The parameter estimate of EQ is positive and statistically significant on positional concerns ($p = 0.017$).

We now turn our attention to consumption items that involve pain or disutility. First, we estimate the baseline specification (4) for positional concerns regarding working hours/week. The parameter estimate of EQ is negative and statistically significant at conventional levels, $p = 0.051$. That is, a higher level of empathic capacity is associated with a lower level of positional concern regarding longer working hours/week. Second, we estimate the baseline model specification with the data from the poverty rates (%) experiment. In line with the predictions, the parameter estimate of EQ is negative, large in magnitude, and highly statistically significant, $p < 0.01$. The final bar combines these two items into one data set. Overall, a higher level of empathy is associated with a lower level of positional concerns with respect to "bads."

Heterogeneity

On average, the baseline results suggest a significant association between empathic capacity and positional concerns, yet the sign and magnitude of the association differ across goods. An important direction of analysis is to predict the MDPC across the levels of EQ conditional on the full set of individual characteristics. To this end, the estimated baseline interval regression is exploited to predict conditional MDPC for specific levels of EQ. MDPC is calculated for a more flexible functional form of EQ by adding the quadratic term in the baseline. Prediction is obtained by holding all control variables fixed at their mean values except EQ. Then, the MDPC and standard errors of predictions are calculated using several values of EQ from 20 to 80 in 5-point steps. Confidence intervals based on normal distribution are calculated to identify whether the degree of heterogeneity in MCPC is statistically significant across the levels of EQ.

The predicted conditional MDPC is given in the panels of **Figure 3**. **Figure 3A** presents the pattern of MDPC (horizontal axis) across the levels of EQ (vertical axis) for after-tax income/month and the market value of a luxury car, while **Figure 3B** illustrates the pattern for the working hours/week and poverty rates (%) experiments. As can be seen, the conditional MDPC is highly heterogeneous for alternative levels of EQ both for "goods" and "bads." Comparing confidence intervals across the levels of EQ unveils that MDPC for EQ levels from 45 to 65 are statistically significantly different from those MDPC for EQ levels below 40–45 for both "goods" (A) and "bads" (B). Among the unreported results, the standard errors obtained from the delta method are replaced with bootstrapped standard errors. The results hardly change. We also find a similar pattern in MDPC obtained from a non-parametric estimator, i.e., Spearman-Karber, and therefore the results are not presented in here.

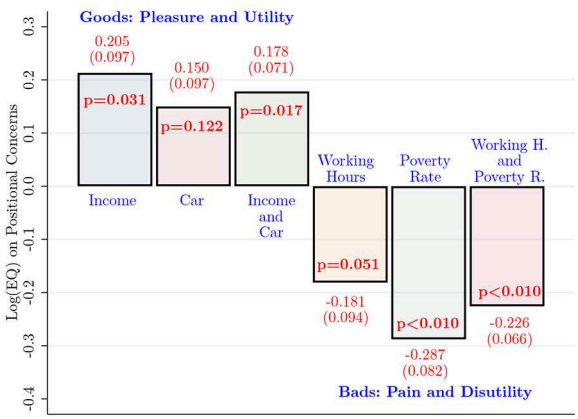

FIGURE 2 | Baseline results: interval regressions. The bars present parameter estimates of log EQ on positional concerns obtained from the baseline model specification (4). The dependent variable is the marginal positionality interval for each respondent. The interval regressions control for the full set of control variables: age, gender, household income after tax (in seven income categories), a dummy indicating whether the respondent lives with parents, university department (economics, psychology, or law), household size, overall well-being (five dummies), inequality aversion, Big-5 personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness-to-experience). Robust standard errors are presented in parentheses under the parameter estimates. *P*-values (*p*) are presented inside the bars.

[9]One important remark is that, in our baseline model specification, the first (last) boundaries of the marginal positionality intervals are assumed to be censored below (above). We also estimate models by assuming 0 and 1 for the censored boundaries. The results are practically the same.

[10]The full estimation results are not presented due to space reasons, but can be provided by the authors upon request.

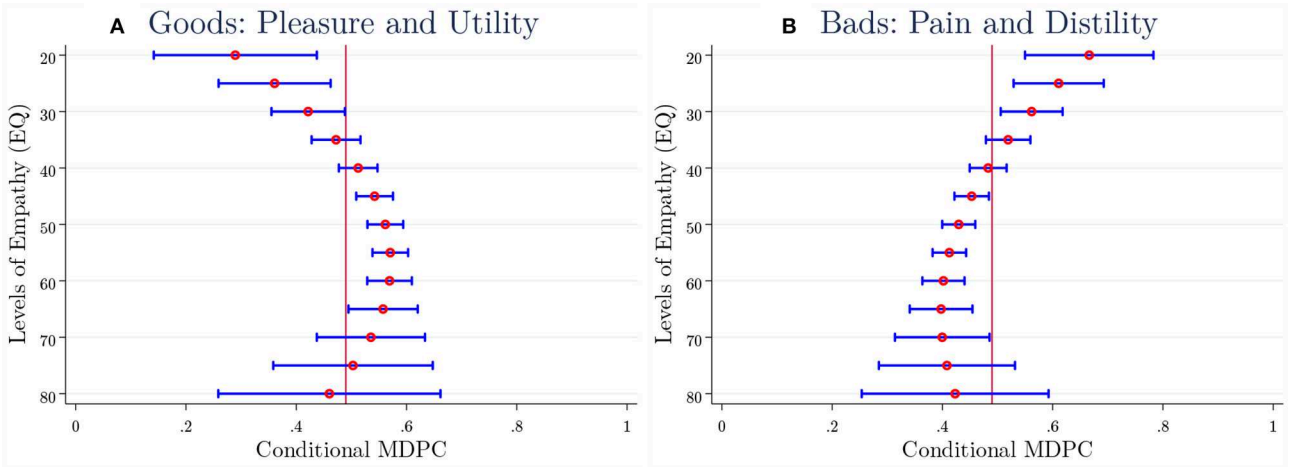

FIGURE 3 | Heterogeneity of Conditional MDPC by EQ Levels. The panels present predicted conditional MDPC (horizontal axis) from the baseline interval regression (4), which uses a quadratic function of empathy (EQ). The levels of EQ are given along the vertical axis. The dependent variable is the marginal positionality interval for each respondent. The interval regressions control for the full set of controls (see **Figure 2**). **(A)** Combines data for the after-tax income/month and market value of car experiments while **(B)** combines data from working hours/week and poverty rates (%) experiments. The horizontal lines represent 90% confidence intervals.

Robustness

Functional Form

First, we investigate the sensitivity of the baseline results (**Figure 2**) with respect to the functional form of EQ. The parameter estimates of the baseline model with the dummy indicating individuals with high EQ scores are presented in Row II of **Table 2**. The dummy for high EQ level is constructed by assigning a value of 1 for above-median EQ levels, EQ $>$ 47, and zero for other levels. The signs and significance of the estimates are highly in line with those of the baseline. Next, we estimate a model with standardized values of EQ. In this specification, EQ enters the baseline specification (4) linearly and leads to highly similar results (Row III).

Estimators

The model specification in Equation (4) is also estimated with alternative estimators. First is the ordinary least squares (OLS) estimator, where the dependent variable is redefined as the midpoints, e.g., $(0 + 0.25)/2$ for the first interval and so on, of each marginal positionality interval. The parameter estimates presented in Row IV are highly similar to those from the baseline specification (Row I). However, unlike the baseline interval regressions, OLS produces statistically significant estimates for all goods and their combinations. Second, the dependent variable is redefined as a dummy variable indicating the positional choice (Society B) in any choice situation for each good. The model specification is then a binary choice model and is estimated with the probit model. The results presented in Row V indicate highly similar with more precise parameter estimates[11]. Third, an ordered probit model is estimated by assigning ordinal values for the marginal positionality intervals as $\tilde{\theta}_i^g = 0, 1, 2, 3$ for each individual i and good g. This model specification is only slightly different from the baseline interval regression. It assumes that the cut-off points for the marginal positionality intervals are unknown constants and they are simultaneously estimated within the same estimation process. The parameter estimates are presented in Row VI. They are all statistically significant and have the same signs and significance levels of those found in the baseline (Row I).

[11]We present the parameter estimates instead of marginal effects as we are mainly interested in comparing the signs and significance of these estimators with those of the baseline. The marginal effects can be reported upon request.

Further Omitted Variables

To deal with bias due to endogeneity generated by omitted variables, we experiment with further proxies that might be correlated with EQ and error terms. Two key variables that we focus on are prosocial behavior (e.g., helping behavior, altruism, or cooperation) and degree of competitivity. Recent literature identifies an important positive relationship between empathy and prosocial behavior, while there is an opposite relationship between empathy and competitivity (e.g., Klimecki et al., 2016). To identify the degree of prosocial behavior, we elicit a detailed measure for the helping or volunteering behavior of respondents, which might also be a measure of their degree of altruistic behavior. The respondents were asked whether they had taken part in any volunteer activities in the past year (see **Appendix C.2** for the full set of volunteer activities). The measure is created by simply summing up the binary responses to all volunteering items. Implementing the measure in our baseline interval regression hardly changes any estimation results (Row VII of **Table 2**).

Then, we elicited a proxy for the degree of competitivity using three questions (see **Appendix C.3** for the full set of questions). The questions aim to elicit the desire of respondents living in "*egalitarian-competitive*," "*welfare state-individualistic*,"

TABLE 2 | Robustness: functional form, estimators, and omitted variables.

		Pleasure and utility			Pain and disutility		
		Income (TRY/month)	Market value of a car (TRY)	I and II	Working hours (hours/week)	Poverty rate (% of people)	III and IV
Model specification		I	II	A	III	IV	B
Baseline (Figure 2)							
I.	Log EQ	0.205**	0.150	0.178**	−0.181*	−0.288***	−0.226***
		(0.097)	(0.097)	(0.071)	(0.094)	(0.082)	(0.065)
	#Observations	224	214	438	231	231	462
Functional forms							
II.	High EQ dummy	0.129***	0.070	0.102***	−0.074*	−0.093**	−0.081**
		(0.046)	(0.045)	(0.033)	(0.042)	(0.046)	(0.032)
III.	Linear (standardized) EQ	0.050**	0.031	0.041**	−0.043*	−0.068***	−0.054***
		(0.024)	(0.024)	(0.018)	(0.024)	(0.021)	(0.017)
Estimators							
IV.	Linear model with OLS	0.228**	0.178*	0.202***	−0.186*	−0.272***	−0.197***
		(0.107)	(0.106)	(0.074)	(0.108)	(0.091)	(0.072)
V.	Probit	0.814***	0.659**	0.725***	−0.809***	−1.250***	−0.909***
		(0.240)	(0.259)	(0.175)	(0.248)	(0.243)	(0.171)
VI.	Ordered Probit	0.740*	0.753*	0.707**	−0.695*	−1.221***	−0.887***
		(0.378)	(0.424)	(0.280)	(0.402)	(0.381)	(0.278)
Further proxies for omitted variables							
VII	Prosocial behavior	0.195**	0.144	0.170**	−0.186**	−0.281***	−0.222***
		(0.096)	(0.097)	(0.071)	(0.094)	(0.083)	(0.066)
VIII.	Competitivity	0.209**	0.149	0.182***	−0.182*	−0.285***	−0.225***
		(0.095)	(0.096)	(0.070)	(0.094)	(0.082)	(0.065)
	#Observations	672	642	1,314	693	693	1,386

Author's own calculations from the experimental data.
*The models allow for the full set of control variables (see **Figure 2**).*
(A) combines the income and car experiments while (B) combines the working hours and poverty rates experiments.
Robust standard errors are presented in the parentheses.
, **, and * indicate significance level at 10, 5, and 1% levels of significance, respectively.*

and "*regulated-deregulated societies*." Each question is responded from 1 to 5 as 1 "*closer to first*," 2 "*somewhat closer to first*," 3 "*can't say which*," 4 "*somewhat closer to second*," and 5 "*closer to second*." To determine the proxy for the degree of competitiveness, we sum the answers to the three questions. The proxy is then controlled for in the baseline regression and the results are presented in Row VIII of **Table 2**. The parameter estimates are highly similar to those obtained from the baseline[12].

[12]Among the unreported results, we also allow our regressions for "dispositional envy" and "self-esteem" in separate regressions. Envy is often considered an emotion underlying positional behavior. To measure envy, we use the Dispositional Envy Scale developed by Smith et al. (1999). Introducing dispositional envy only slightly increases the magnitude of estimates for the "goods," while there is practically no effect on the parameter estimates for "bads." Finally, we use the Rosenberg (1985) inventory for "self-esteem." The literature suggests that self-esteem is related to both empathy and positional behavior for several goods including physical appearance or career success (e.g., Vrabel et al., 2018). Adding the self-esteem measure in the baseline slightly increased the estimates. Importantly, in the specification with self-esteem, the EQ on positional concern is statistically significant for all consumption items including the market value of a luxury car.

EVIDENCE FROM SUBJECTIVE WELL-BEING DATA

Another approach to investigate positional concern is based on SWB regressions (Ferrer-i-Carbonell, 2005; Luttmer, 2005; Senik, 2005; Clark et al., 2008; Akay and Martinsson, 2011). In these regressions, SWB, e.g., life satisfaction or happiness, is used as a proxy for (experienced) utility (Kahneman and Sugden, 2006)[13]. Then SWB regressions are estimated on own level of consumption of a good and on a reference (or comparison) level of consumption by others, i.e., a reference group. The literature aiming to identify positional concerns using SWB datasets has grown rapidly in recent years (e.g., see Clark et al., 2008 for a comprehensive review). The literature reports that SWB is negatively affected by income comparisons in developed countries (Ferrer-i-Carbonell, 2005; Luttmer, 2005),

[13]Several studies have validated SWB measures as a measure of well-being (Krueger and Schkade, 2008). Today there is a consensus that these simple subjective questions can indeed capture levels of individual welfare (e.g., Oswald and Wu, 2010).

but positively affected or not significantly affected in transition (Senik, 2004) and developing countries (Akay and Martinsson, 2011). In this section, we present complementary evidence based on a large survey that includes data on, e.g., SWB, degree of empathic capacity, absolute and reference per capita after-tax income/month, and working hours/week.

Data

The dataset at use is the General Social Survey (GSS), which is a large and nationally representative cross-sectional dataset collected since 1978[14]. It is very rich with respect to socio-demographic and -economic characteristics and includes a wealth of subjective opinion questions, e.g., attitudes to empathy and a large list of proxies for prosocial behavior. Our sample selection is straightforward. In our analysis, we use people older than 17 and younger than 75 years of age. The empathy information is available in the 2002 and 2004 waves in the National Altruism Study Module which is a part of the GSS dataset. Having deleted the missing values in all variables used in our analysis leaves a sample size of 2,237 individuals. The SWB measure is based on "happiness" information about individuals obtained by means of the following question: "*Taken all together, how would you say things are these days – would you say that you are very happy, pretty happy, or not too happy*?" The variable is observed on 3-point ordinal scale that aims to capture the respondent's subjective welfare experience. In our SWB regressions, we allow for a large set of individual socio-demographic and -economic characteristics that are often used in well-being regressions (see, e.g., Dolan et al., 2008 for a comprehensive review).

Measures

Measure of Empathy

The dataset allows us to calculate (Davis, 1980, 1983) interpersonal reactivity index (IRI). This measure is based on responses to seven expressions/statements, e.g., "*I often have tender, concerned feelings for people less fortunate than me*" and "*I am often quite touched by things that I see happen*" (see **Appendix D.1** for the full set of statements) on a 5-point scale, where 1 = "*completely disagree*" and 5 = "*completely agree*" for items (1), (3), (6), and (7) and the opposite for items (2), (4), and (5). Then we simply calculate the average score for the seven items. In line with the EQ measure of empathy, a higher IRI indicates a higher degree of dispositional or trait empathy. The mean IRI is 3.94 (std. 1.24). The Cronbach's alpha for the seven-items of IRI inventory and for all respondents in the GSS data is 0.73, which indicates a relatively high internal consistency.

Consumption Goods and Their Absolute and Relative Levels

To sustain comparability with the experimental results, we investigate two consumption items that are highly in line with those used in our experiments: per capita after-tax income/month as a "good" and working hour/week as a "bad." After-tax income is the total after-tax family income from all sources in a year divided by 12. To obtain the *per capita* after-tax income/month, we use weights of the standard OECD equivalence scale (1 for the individual, 0.7 for each adult, and 0.5 for each child in the household). To obtain average weekly working hours, we use the average hours spent on the primary job for each individual. We simply use zero working hours for those who were unemployed in the previous survey year.

To measure relative levels of per capita after-tax income/month and working hours/week, the reference groups with which individuals compare their income or working hours should be defined. As in the bulk of the SWB literature, our approach is based on defining reference groups using some criteria, e.g., age, gender, and region (e.g., Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005). Recent studies also show that defining reference groups with *ad-hoc* criteria and directly asking individuals about their reference group produce highly similar results (Clark and Senik, 2010). The reference groups that we use are based on age, gender, health status, marital status, and region of residence. We use combinations of these criteria for each reference group used in our estimations. Our baseline reference group definition suggests that "*the individuals compare their per capita after-tax household income (working hours/week) with the average per capita after-tax household income (working hours/week) of all people who live in the same region (nine regions), who are in the same age group (four quartiles of age distribution), and who are of the same gender (male or female).*" The number of reference groups with this definition is 72, each consisting of about 30 individuals. We then use the average per capita after-tax family income/month or average working hours/week of the reference group as the reference income or reference working hours with which the individuals compare their own income or own hours of work. Next, we add marital status (married = 1) and health status (very good health = 1) in the definition to check the robustness of the results.

Econometric Approach and Results

Model Specification

To investigate how positional concerns are heterogeneous with respect to the degree of empathic capacity, we are going to estimate a series of well-being equations. SWB is measured on a 3-point ordinal scale and the appropriate model is an ordinal choice model. The baseline model specification, in which we estimate the absolute and reference consumption levels on SWB for a good, is as follows:

$$SWB_i^* = \lambda_A ln\left(Y_i^A\right) + \lambda_R ln\left(Y_r^R\right) + \mathbf{X}'\beta + s_k + \tau_t + \epsilon_i. \quad (5)$$

In Equation (5), SWB_i is the happiness measure and takes the values of $J = 1, 2, 3$, and i indicates the individual. Y_i^A is the own level of per capita after-tax income or own working hours/week. Y_r^R is the reference level of per capita after-tax income/month or working hours/week and is calculated as $Y_r^R = (1/N_{r-1}) \sum_{m=1}^{N_{r-1}} Y_m^R$, which is the "average" level of per capita after-tax income/month or working hours/week in

[14]The data are collected by the National Opinion Research Center at the University of Chicago. The dataset is obtained from http://gss.norc.org/get-the-data. Please visit the website for further information on the sampling frame and measures.

individual i's reference group r. N_r is the number of people in the reference group[15].

λ_A is the parameter of own consumption while λ_R is the parameter for the reference consumption, which is a measure of the positional concerns as it indicates the strength of the relationship between the consumption level of people in the reference group and individuals' well-being. The sign of λ_A is expected to be positive for after-tax income/month as a higher level of resources implies a higher level of well-being. The literature suggests that time spent on working is associated with disutility, implying a negative relationship between own working hours and well-being (Knabe and Rätzel, 2010; Rätzel, 2012). Yet longer working hours also implies a higher level of resources, which might correlate positively with well-being. Thus, the sign of the relationship between own working hours on well-being is a priori unknown. λ_R is expected to be *negative* for per capita after-tax income/month and *positive* for working hours. While a higher level of income of others implies a lower income position, a higher level of working hours among others implies a higher level of indirect benefits for the individual.

The main aim of this section is to investigate how λ_R varies with respect to the degree of empathic capacity, IRI. To this end, interaction models are used. λ_R in the model specification (5) is replaced with $\lambda_R = \lambda_R^{LIRI} D_i + \lambda_R^{HIRI}(1 - D_i)$, where D_i is a dummy variable indicating individuals with high IRI levels. We define high levels of empathic capacity using the median IRI = 4 as threshold. The hypothesis we test is whether λ_R^{LIRI} is equal to λ_R^{HIRI} for per capita after-tax income/month and working hours/week in separate regressions.

Specifications

The model specification allows for a large set of individual and household characteristics, **X**, including age, gender, health status (in four dummies from "very poor" to "very good"), years of education, marital status (dummies for married, single, widowed, and divorced), number of children at home (dummies for kids 1–5, 6–11, and 12–17 years old), total household size, race (dummies for white, black, and other), labor market status (dummies for working full-time, working part-time, temporarily not working, retired, and in school). β is a vector of parameters corresponding to the control variables in matrix X. The model also allows for nine region[16] dummies s_k. The model specification pools data from two waves and τ_t is the dummy for the 2004 wave. ϵ_i is the usual error term.

An appropriate model specification for Equation (5) is an ordered probit, which exploits the ordinal nature of the dependent variable. Yet, recent research shows that there is basically no difference between a linear model and ordered probit specification (Ferrer-i-Carbonell and Frijters, 2004). To exploit the simplicity of linear models, we prefer ordinary least squares as our baseline model specification. However, we also estimate models with the ordered probit model specification and compare the results.

Results

Main Results

We estimate the well-being regression in (5) with and without the interaction terms for two alternative goods, i.e., per capita after-tax income/month and working hours/week. The results are summarized in **Table 3**[17]. First, we estimate the baseline model specification (5), where we allow only for absolute and reference income without interaction terms (Column I). In line with the expectations, the absolute level of income is positively related to happiness while the reference income is negatively associated. These results are also highly in line with the literature (Ferrer-i-Carbonell, 2005; Luttmer, 2005). The significant relationship between reference income and happiness is an indicator of a degree of positional concern. Our main aim is to test whether the relationship between reference income and happiness is heterogeneous with respect to the degree of empathic capacity measured by IRI. The results from the baseline interaction model are given in Column II of **Table 3**. There is substantial heterogeneity in estimated reference income (Rows A and B). The reference income on SWB is negative and statistically significant only among high-IRI people. The difference between parameter estimates for low and high degree of empathic capacity is statistically significant at the conventional levels of significance ($p = 0.068$). That is, a higher level of empathic capacity is associated with a stronger negative effect of positional concerns regarding per capita after-tax income/month on happiness. This result is highly consistent with the results from our survey experiment above.

Next, we turn our attention to positional concerns regarding working hours/week and conduct a similar analysis as for per capita after-tax income/month. The results from the baseline model (5) without the interaction terms are presented in Column V of **Table 3**. The absolute working hour/week on SWB is statistically insignificant while the reference working hours/week on happiness is positive and statistically significant, which is also in line with the expectations. We estimate the baseline model with interaction terms and present the results in Column VI. The results are strikingly consistent with those from the survey experiment. A higher level of empathic capacity leads to a weaker and statistically insignificant relationship between reference working hours/week and SWB, implying a degree of other-regarding feelings or behavior. The parameter estimate of reference working hours is large, positive, and statistically significant among people with a lower level of empathy. The difference between the parameter estimates of reference working

[15] As in the bulk of the literature investigating positional concerns, we also use the parameter estimates of the reference income as a measure of the degree of positional concerns (e.g., Ferrer-i-Carbonell, 2005). Another strategy to identify positional concerns is to use the $log(Y_i^A/Y_r^R)$, which is practically the same as the specification in (5).

[16] The dataset does not include information on the federal states where the individuals reside. Instead, we use a regional classification based on nine groups of federal states: New England, middle Atlantic, south Atlantic, east and west north central, east and west south central, mountain, and Pacific states.

[17] The full estimation results of the well-being regressions are not reported here due to space limitations. However, they are highly similar to those in the literature. Age and happiness have a U-shaped relationship while health and employment status are positively related to happiness. All estimation results are available upon request from the authors (see Dolan et al., 2008).

TABLE 3 | Results from subjective well-being approach.

	Real family income per capita					Average weekly working hours				
	Baselines		Robustness			Baselines		Robustness		
		Interaction model	RG-1	RG-2	Prosocial behavior		Interaction model	RG-1	RG-2	Prosocial behavior
	I	II	III	IV	V	VI	VII	VIII	IX	X
IRI measure of empathy	0.020					0.020				
	(0.020)					(0.020)				
Absolute level	0.045***	0.044***	0.045***	0.045***	0.044***	0.030	0.026	0.026	0.020	0.031
	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)	(0.058)	(0.058)	(0.061)	(0.052)	(0.058)
Relative level	−0.201***					0.064*				
	(0.076)					(0.037)				
High IRI (=1 if greater than median = 4)		−2.045*	−1.255*	−1.372**	−1.710*		−0.141*	−0.136*	−0.137*	−0.171*
		(1.110)	(0.747)	(0.683)	(0.979)		(0.082)	(0.076)	(0.077)	(0.098)
A. Relative Level * Low IRI		−0.118	−0.129	0.001	−0.099		0.096*	0.092**	0.097**	0.110*
		(0.108)	(0.082)	(0.069)	(0.100)		(0.053)	(0.046)	(0.048)	(0.057)
B. Relative Level * High IRI		−0.324***	−0.259***	−0.140***	−0.274***		0.017	0.015	0.020	0.033
		(0.082)	(0.081)	(0.061)	(0.083)		(0.048)	(0.045)	(0.045)	(0.050)
P-value (H0: A = B)		0.0675	0.084	0.041	0.0772		0.0188	0.013	0.018	0.0462
R-Squared	0.149	0.166	0.151	0.15	0.151	0.15	0.152	0.152	0.151	0.166
#Observations	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237	2,237

Authors' own calculations from GSS (2002 and 2004).
The dependent variable is the happiness which is measured in 3-point scale. The models are estimated with ordinary least squares. The control variables include age, gender, health status (in four dummies from "very poor" to "very good"), years of education, marital status (dummies for married, single, widowed and divorced), number of children at home (dummies for kids 1–5, 6–11, and 12–18 years old), total household size, race (dummies for white, black, and other), labor market status (dummies for working full-time, working part-time, temporary not working, retired, and in school). The model also allows for nine regional dummies.
To calculate per capita household income, the standard OECD scale is used.
The standard errors are clustered at the reference groups level.
List of measures for prosocial behavior is in ***Appendix D.2****.*
, **, and * indicate significance at 10, 5, and 1%, respectively.*

hours/week by low and high empathy is also statistically significant ($p = 0.019$).

Robustness

We extensively investigate the robustness of the baseline results and summarize our findings in **Table 3**. Our robustness testing presented here mainly targets the definition of reference groups and potential omitted variables, which are the key threats to the estimation results. Two additional criteria are added in the baseline definition of the reference groups. First, a dummy for married individuals (married = 1) is used together with age (four quartiles of the age distribution), gender, and regions (nine regions) in RG-1[18]. The results from RG-1 are given in Columns III and VIII for per capita after-tax income/month and working hours/week, respectively. Adding marital status into the reference group definition does not substantially affect the parameter estimates and test results. In RG-2 (Columns IV and IX), we add health status into the baseline definition of the reference group. The health status is defined using a dummy variable indicating individuals with "good" and "very good" health. The size of the reference income estimates with RG-2 is somehow reduced for the per-capita after-tax income/month. Yet the differences across the low and high levels of IRI are still statistically significant ($p = 0.041$). The results for working hours/week are highly similar to those of the baseline (Column VI).

Finally, we investigate the robustness with respect to potential omitted variables. As our dataset is cross-sectional, we are not able to allow for unobserved individual effects (e.g., typically considered to be personality dispositions or genetic factors). If these characteristics are correlated with IRI, the results presented in **Table 3** might be biased. As in the case of our survey experiment, we control Equation (5) for some proxy variables that may be correlated with EQ and error terms. The dataset includes a rich set of variables that can be used for this purpose. In line with the previous analysis, we mainly focus on the prosocial behavior measured using attitudes to altruism (e.g., volunteering and helping behavior). The measures are obtained using the set of 15 questions in the National Altruism Study Module of GSS

[18]Note that the precision of reference income is highly related to the size of reference groups. Thus, adding more criteria substantially reduces both the sample size and the reference income and working hours estimates.

dataset supplied for the years 2002 and 2004. The full set of questions in this module is given in **Appendix D.2** (see also Einolf, 2008, for further discussions).

Our modeling strategy is to include these 15 proxies for altruistic attitudes and helping behavior in our baseline interaction model specification and check whether the previous results stay the same. These results are presented in Columns V and X of **Table 3**. Adding these variables have only a marginal influence on the parameter estimates and the test results. The differences in the parameter estimates of reference per capita after-tax income/month and working hour/week on SWB for low and high IRI are still statistically significant. Among the unreported results, we conducted several further sensitivity checks. First, we experimented by creating alternative proxies by summing or averaging all items in **Appendix D.2**. The results are practically the same. Second, we estimated our interaction models with an alternative set of control variables and estimators. We estimated the baseline interaction model using a stepwise estimation strategy and also with the ordered probit model specification. The results presented in **Table 3** hardly changed.

CONCLUDING DISCUSSIONS

Empathic capacity measured using both the empathy quotient (Baron-Cohen and Wheelwright, 2004) and the interpersonal reactivity index (Davis, 1983) is significantly associated with positional concerns identified using survey experiments and the subjective well-being (SWB) approach. The experiments were conducted for an alternative set of goods associated with individual pleasure and suffering to investigate how people's levels of empathy relate their positional concerns with regard to a number of consumption "goods" and "bads." The SWB approach investigates how the utility impact of others' consumption is heterogenous with respect to the level of empathic capacity. Our main conclusion is that positional concerns substantially vary with the levels of empathic capacity. The degree of heterogeneity in positional concerns differ across types of goods in a predictable pattern. The results are very robust and suggest that people with a higher level of empathic capacity are more concerned about their relative consumption position (or their utility is affected more) when the object of their comparisons is a consumption item associated with pleasure and utility while they are less positional (or their utility is affected less) when it is a consumption item associated with pain and disutility. Extensive robustness analysis suggests that the results are insensitive with respect to functional forms, estimators, empathy measure used, and potential omitted variables (e.g., prosocial behavior) that may bias the results.

Our results are highly intuitive and suggest that positional concerns vary with empathic capacity. One obvious practical implication of this finding for economics is that the models aiming to relate optimal taxation, labor supply, and consumption decisions with positional concerns should also consider the heterogeneity in positional concerns due to dispositional empathy differences across individuals. However, caution should be taken. In conceptual terms, we rely on the definition of a trait-like empathy, i.e., dispositional empathic capacity. Thus, the results in this paper can be interpreted as part of a recently developing literature aiming to investigate how non-cognitive skills relate to economic outcomes of individuals (e.g., Borghans et al., 2008). However, empathy can also change temporally depending on contextual factors, and the utility implications of these temporal changes might depend on another set of factors, e.g., the speed of adaptation to temporal shocks. Our first suggestion for future research is to extend the research presented here to experiments where temporal empathy is measured (see, e.g., Klimecki et al., 2016). Two important limitations of this study are that the experiment uses student respondents and assumes a fixed composition of individuals in the reference groups. Second suggestion for the future research is to use more representative sample of individuals where potential life-cycle changes in personality characteristics are identified. As the psychology literature suggests, people's empathic reflection process may also differ depending on the socio-cultural or genetic proximity to the people in their reference groups (Brandstätter, 2000). In our paper, we assumed that individuals' reference groups are exogenously given and formed by "strangers." Thus, our final suggestion for future research is to investigate how the characteristics of people in the reference group interfere with the relationship between empathy and positional concerns.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

According to the Turkish law, the experiment did not require an ethical committee approval and also there was no institutional review board for the social sciences in the Istanbul University by the time of our experiment, 2014. Therefore, written informed consent was not obtained from participants. Students are recruited. The paper includes detailed information on the recruitment process.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02226/full#supplementary-material

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Metacognitive Self and Motivation to Seek Diagnostic Information About the Self: A Longitudinal Study

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This longitudinal study was designed to test the hypothesis that the strength of metacognitive self would predict the level of motivation to obtain self-diagnostic information. We begin by defining the construct of metacognitive self as a cognitive-motivational concept that pertains to the individuals' self-awareness of biases. We then discuss the role of acquiring diagnostic information about the self in enhancing self-regulation. We predicted that stronger metacognitive self would be associated with greater motivation for seeking diagnostic information about the self, including both positive and negative feedback. More than 400 undergraduate university students participated in the 2.5-years longitudinal study. Participants were tested 5 times, with 6-months intervals, using measures of metacognitive self (Metacognitive Self Questionnaire; MCSQ-21) and the need for diagnostic information about the self (Self-Diagnostic Motive Scale; SDMS). As expected, participants with high metacognitive self sought diagnostic information about themselves significantly more than those low in metacognitive self. This effect was observed at each of the five measurement points. We conclude that individuals characterized by greater insight into their own biases are more highly motivated to obtain feedback about themselves that can be used for accurate assessment of their strengths and weaknesses and for self-improvement.

Keywords: metacognition, diagnostic information, biases, motivation, longitudinal study

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INTRODUCTION

Metacognitive Self and Its Motivational Function

Metacognition is broadly defined as awareness and understanding of own cognitive processes. In our research, we focused on a specific aspect of metacognition, namely metacognitive self (MCS), which is defined as the insight into own biased thinking. We will briefly introduce the construct, placing it within the context of the metacognition research.

The interest in metacognition goes back at least to the times of Aristotle (Sachs, 2001). However, the term "metacognition," understood as cognition of own cognition, was introduced by developmental and cognitive psychologists in the last century (Flavell, 1979). More recently, metacognition research expanded in scope to fields, such as working memory and consciousness (Schraw and Dennison, 1994; Koriat, 2007), creativity (Scholer and Miele, 2016), judgment, decision-making, and persuasion (See et al., 2008), children's cognitive development (Flavell, 1979), problem solving and memory (Nelson and Narens, 1990), critical thinking processes, attitude change, and bias regulation (Brinol and DeMarree, 2012). The important finding emerging from this large body of research is that metacognition plays a crucial role in the process of human

self-regulation (Baumeister and Vohs, 2004). Schwarz (2015) claimed that acquiring metacognitive pieces of knowledge can fluctuate due to the mental resources' accessibility and the level of difficulty of knowledge to be learned. The level of fluency creates metacognitive experience of the dynamics of one's own information processing. Such experience of ease or difficulty was defined as conceptual fluency (Whittlesea, 1993). Thus, the interpretation of metacognitive experience depends on the complexity and richness of one's cognitive network and accessible lay theories (i.e., naïve psychological theories commonly held by people; Nisbett and Ross, 1980). Moreover, metacognitive experience is context sensitive. Fluent processing increases positive feelings and the likelihood of information acceptance. Once false information or misinformation, such as linking vaccination and autism, has been accepted, it is very difficult to correct (Schwarz, 2015). The ability to question one's own beliefs seems to be rooted in individuals' epistemic needs (Kruglanski, 1989) and intrinsic motivation for self-knowledge (Higgins and Kruglanski, 2000).

It can be assumed that people differ in their level of intrinsic motivation and epistemic need to ask themselves about reasons why their way of thinking or behavior might be wrong (e.g., Kross and Ayduk, 2017). Some individuals can be expected to be more strongly motivated to recognize their biases than others. Based on these findings, we reasoned that the metacognitive experience, connected with metacognitive feelings, and the level of intrinsic epistemic motivation shape the individual's awareness of biases.

As we conceptualized metacognitive self as self-awareness of biases, it is important to review current understanding of biases. Biases are deviations from the common rationality, also referred to as the psychological regularities (Larrik, 2004). For example, people tend to overestimate their future success (Koriat et al., 1980; Weiner, 2014) and underestimate the time needed to accomplish a task and achieve a goal (Buchler et al., 1994). This discrepancy arises because people tend to ignore potential distractors and are focused on what might expedite success (teleological approach). Biases and shortcuts might also be anchored in heuristics (Weiner, 1972; Kahneman and Tversky, 1973). Insight into one's own biases is what we refer to as metacognitive self. Individuals with high level of MCS successfully identify biases in their own actions, reasoning, and judgment, while those low in MCS fail to acknowledge that they fall victim to common biases.

As pointed out earlier, accurate insight into the biases one holds (i.e., strong MCS) requires motivation and cognitive capacity to search for reasons why one might be wrong. Note that such self-questioning attitude implicitly assumes that an individual possesses the perceptual ability to recognize own inaccurate behavior or cognition. It may be then argued that lack of a need to question one's own biases implies low metacognitive self and low need for accurate self-knowledge. Conversely, strong desire to gain insight into one's own biases may be seen as a necessary (although not sufficient) condition for high metacognitive self. The metacognitive experience that accompanies active and self-initiated reflection about one's self may then lead to greater self-understanding and knowledge of the self in general.

Emphasizing the cognitive-motivational basis of MCS, we posit that the strength of MCS is associated with stronger motivation to search for self-diagnostic information.

Motivation to Search for Self-Diagnostic Information

Self-diagnostic information is a particular type of self-knowledge. Tversky (1977) postulated the diagnosticity principle, which identifies features that are used to cluster objects into subgroups in human mind (context dependent effect). This principle assumes that while perceived similarity between objects enclosed in one cluster increases, the analogs similarity between objects composing a different cluster decreases. The diagnosticity principle is also referred to as the law of the human mind structuring. Usually, researchers create the indexes of diagnosticity (e.g., posterior probability, information gain, based on Bayesian algorithms). Regardless of the method of measuring diagnosticity, social psychology refers the concept to the capability of the retrieved cues to form a solution for the judgment task at hand (Simmons et al., 1993). The objective of diagnosticity is to acquire and comprehend information about social objects, especially the self, as the clusters are formed about the social objects: self and others.

Properties or features of the self may be less or more diagnostic. Ling et al. (2012) discuss how people reach conclusions when self-diagnosing their health conditions. The authors claim that "self-diagnosis is contingent upon an individual's ability to combine memory-based information about past behavior and experiences with symptoms with information available in the context (…) to assess whether or not he or she is at risk and (…) to seek treatment" (p. 2112). It is also highlighted that self-diagnosis serves pro-health behaviors and self-regulatory functions. The self-diagnosis (concerning not only health, but also social relations or self-description) is based on motivation to search for self-diagnostic (i.e., salient, meaningful, systematically reflected) information. Bassok and Trope (1984) showed that people quite often use diagnostic strategies to clearly distinguish between the hypothesis and its alternative (here, the hypothesis about self).

Other researchers showed overwhelming drive in human beings to search for positive information about the self (i.e., self-enhancement motive). Sedikides and Strube (1997) distinguished four motives of human knowledge acquisition about the self: self-enhancement, self-verification, self-assessment, and self-improvement. The authors' model, which integrates different research theories in self-motives tradition, is referred to as the Self-Concept Enhancing Tactician Model (SCENT). In accordance with the SCENT model, the self-motives can be sometimes activated simultaneously and interact with each other. For example, the self-assessment motive and the self-improvement motive function as an interactive set of motives connected with the process of gaining knowledge about oneself. The first one aims at obtaining information about what is the present characteristics of an individual, while the second focuses on searching for indications of how such characteristics can be improved in the future (Sedikides and Skowronski,

2000, 2009). At the same time, individuals may possess the desire for continuous self-improvement in order to truly get to know themselves and their limits. Although self-assessment and self-improvement are likely to be related, the two can be distinguished conceptually. As pointed out by Taylor et al. (1995), if individuals have models on which they can base their behavior, they may not be motivated to increase self-knowledge to improve themselves.

Trope and Neter (1994), among others, focused on the role of positive experience in searching for diagnostic information. In their study, the participants were given either positive or negative feedback on a task, or were led to experience either positive or negative mood, and were then asked to choose the type of feedback they preferred in a different feedback situation. The results showed that individuals who received feedback about their failures in the initial task or were in a negative mood preferred self-enhancing information in the subsequent task, while participants who were informed about their successes or were in a positive mood subsequently preferred feedback that focused on their liabilities. Such feedback was unpleasant but informative and could serve as a basis for self-improvement. The findings suggest that the relative importance of esteem- and accuracy-related needs may depend on one's resources to cope with the immediate emotional costs of negative feedback. However, as pointed out by Trope and Neter (1994), "when the informational value of the feedback is high, individuals may make intentional efforts to control their decision. They may see acquisition of the feedback as rational and may actively resist temptations to avoid it" (p. 647). Of importance, previous studies have demonstrated that high MCS can serve as a buffer against ego depletion (Brycz et al., 2014).

Furthermore, using a diagnostic strategy in information search involves asking highly diagnostic questions, for example, why one was wrong, and preferring highly diagnostic tasks. Moreover, a diagnostic orientation is characterized by the same interest in both favorable and unfavorable information that concerns the self (Landau et al., 2010). Yet, as most research results demonstrate, individuals show strong preference for information, which is at the same time diagnostic and positive (Morrison and Cummings, 1992).

It has been shown via experimental studies that individuals with strong MCS seek any type of feedback more often than those with weak MCS. Furthermore, compared to those low in MCS, those high in MCS participants are more interested in acquiring self-knowledge through negative feedback (e.g., Brycz et al., 2018). This suggests that individuals high in MCS are more apt to engage in self-diagnosis than those with low MCS. Consistent with findings that people with high MCS seek diagnostic information more than those with low MCS, we expected the self-evaluation of those with high MCS to be more influenced by self-diagnostic motives, especially by self-assessment and self-improvement, than by self-enhancement need.

In summary, our predictions were as follows:

- We expected a weak to moderate effect of metacognitive self (MCS) as a predictor for motivation to seek self-diagnostic information (SDMS) as measured 6 months later (Hypothesis 1). This approach allowed us to assess the prospective impact of MCS on SDMS.
- We further expected a moderate to strong relation between MCS and SDMS, each measured at the same measurement point (Hypothesis 2).
- Of the three types of feedback people may seek, namely own results information (ORI), self-improvement information (SII), and comparison information (CI), we expected moderate to strong concurrent relations of MCS with SII and ORI subscales. This would indicate that the pure self-improvement motive (SII) and self-assessment based on the evaluation of one's performance (ORI) are both related to MCS. As CI combines self-enhancement and self-improvement motives, we expected its relation to MCS to be less evident (Hypothesis 3).

MATERIALS AND METHODS

To examine whether metacognitive self (MCS) predicts seeking self-diagnostic information (SDMS), a multi-year longitudinal study has been designed. Both MCS and SDMS were assessed at five time-points. This allowed us to test MCS as a concurrent and 6-months prospective predictor of SDMS.

Participants

Participants in the study were all recruited randomly among undergraduate university students at University of Gdansk. We chose to focus on the student population because they face many challenging tasks and life-direction determining decisions (e.g., the task of exploring and forming a coherent sense of identity) as well as because they are likely to receive frequent feedback concerning themselves in both academic and social spheres (e.g., Taylor et al., 1995; Arnett, 2000). Hence, this population of emerging adults can be seen to be in particular need of self-evaluation, possibly greater than younger or older individuals.

Five assessments were performed every 6 months during a period of 2.5 years. Some students from the initial recruitment were further excluded because of their extended absence from the University due to participation in an Erasmus exchange programme, leave of absence, or failure to meet academic requirements. Due to this dropout, additional students were recruited at further stages of the study. A total of $N = 406$ students (369 females and 37 males) participated in the first wave of the study (during the summer semester of the first year of university study; March–April 2014). The second wave (winter semester; November–December 2014) involved $N = 382$ students (346 females and 36 males). The third assessment (summer semester; March–April 2015) was completed by $N = 341$ students (310 females and 31 males) and the sample of the fourth assessment (winter semester; November–December 2015) included $N = 339$ students (306 females and 33 males). In the fifth and final wave (summer semester; March–April 2016) $N = 352$ students (321 females and 31 males) were tested. In summary, of the 406 participants who completed the initial assessment, 329 completed all five assessments. Each sample was dominated by females, which is representative of the student population at the Departments of Humanities and Social Sciences

of the University of Gdansk, where most of the recruitment took place.

The average age of the students at the first assessment was 20.10 years ($SD = 2.66$, $Mdn = 20$). Along all five waves of the study, the age range of the participants was from 19 to 23.

Measures

Two questionnaires were used in this study. The first, the Metacognitive Self Questionnaire (MCSQ-21; see Brycz et al., 2019, for validity and reliability data), is a 21-item self-report measure of metacognitive self. Each item is a colloquial behavioral description of a given bias, for example "I tend to judge other people positively rather than negatively" (positivity bias). Participants assessed to what extent they believe each described behavior applies to them, using a 6 point Likert scale from 1 (*definitely disagree*) to 6 (*definitely agree*).

The second questionnaire used was the Self-Diagnostic Motive Scale (SDMS; see Brycz et al., 2018, for details on validity and reliability of the scale). SDMS measures the desire to obtain diagnostic information about the self. It contains 6 items, divided among three subscales: own results information (ORI) measures the extent in which one is interested in feedback on whether the task was performed correctly and whether the task was executed incorrectly; self-improvement information (SII) measures the extent in which one would like to know about ways to improve their performance and about behavioral changes that would help with that; comparison information (CI) measures the extent in which one would like to receive feedback about the extent to which they performed better on the task relative to the others and about the extent to which they performed worse than the others. The three-factor structure of the scale was examined through exploratory factor analysis and later confirmed through confirmatory factor analysis. Conceptually, the first two motives, ORI and SII, focus entirely on the self and reflect, respectively, self-assessment and self-improvement. However, the third motive, namely CI, is more complex, since it includes feedback on both oneself and others and both "downward" and "upward" comparisons. Downward comparison (to those who did worse) fulfill self-enhancement needs, while upward comparisons (to those who did better) may facilitate setting self-improvement goals (Monteil and Michinov, 1996). The SDMS items were presented as questions, for example, "How much would you like to know … to what extent did I complete the task worse than others" (CI). All items were evaluated on a six-point Likert scale from 1 (*definitely not*) to 6 (*definitely yes*).

The reliability of the MCSQ-21 and the SDMS was assessed on the basis of Cronbach's alpha, McDonald's omega, and Guttman's lambda. As can be seen from **Table 1**, the internal consistencies of the MCSQ-21 and the SDMS were satisfactory for each sample at each of the five measurements.

TABLE 1 | Reliability estimates of the MCSQ-21 and the SDMS.

MCSQ-21	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
alpha	0.681	0.733	0.791	0.760	0.797
omega	0.701	0.752	0.806	0.778	0.811
lambda 6	0.709	0.760	0.813	0.788	0.817
SDMS	**Wave 1**	**Wave 2**	**Wave 3**	**Wave 4**	**Wave 5**
alpha	0.857	0.891	0.933	0.925	0.944
omega	0.930	0.964	0.970	0.971	0.981
lambda 6	0.893	0.928	0.948	0.942	0.963

Procedure

The research was approved by the Polish Ethical Committee at the University of Gdansk, Poland (decision 17a/2013). All students enrolled in the study were given written information on the use and confidentiality of their personal data and signed the consent letter. They were informed that they would be asked to attend five assessments over a 3-years period. Data were collected periodically at the end of each academic semester, but before the final exams period. Participants were tested either individually or in groups of up to 30. Students were informed about the scientific goal of the study (i.e., to examine the relation between the way they think about their decisions and the amount of feedback about themselves they prefer to receive). All individuals consented to share their personal information with the researchers and provided their first names, surnames, student identification numbers, e-mail addresses, and agreed to attend for follow-up. A trained research assistant or an investigator administered the sessions. During each evaluation participants were asked to follow the instructions on their questionnaire booklets. After filling in demographic data, participants were given two questionnaires, the MCSQ-21 and the SDMS. At all five waves of the study, the two questionnaires were presented in random order. The effect of tests' randomization was insignificant: $F < 1$. We used paper-and-pencil versions of the scales to ensure the participants' compliance with the study procedure. Hard copies were stored at the University of Gdansk, ensuring the security of personally identifiable information. As each participant turned in their completed questionnaires, they were thanked and asked to schedule the next assessment session. Participants who completed their last assessment, either because their further participation was not possible or because of the end of the study period (i.e., the fifth wave), were fully debriefed. No compensation was offered for participation.

In summary, the cohort was followed for 2.5 years and five measurements were taken. Both metacognitive self and the willingness to search for self-diagnostic information were assessed at each time point, allowing for both the concurrent associations as well as the prospective associations to be examined.

RESULTS

To assess Hypothesis 1 that changes in the drive to seek self-diagnostic information (SDMS) would be due to the level of metacognitive self (MCS), data were first fit using a linear growth model with fixed effects of MCS on the intercept (baseline assessment) and linear (score of the SDMS) terms and random effects of participants on the intercept and slope to model

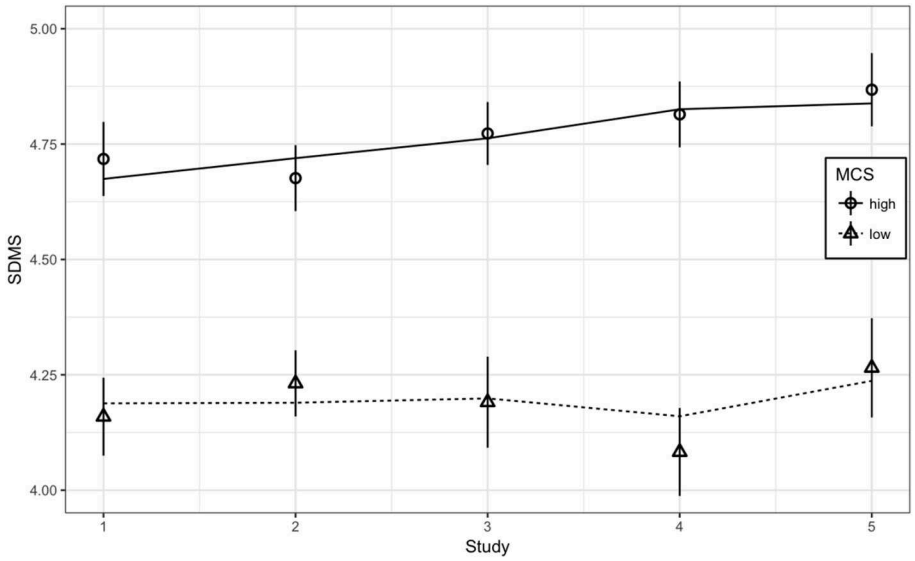

FIGURE 1 | Estimated growth curves of SDMS for individuals with low and high initial scores of MCS.

individual differences in the initial scores and rate of growth (Bates et al., 2015). The fixed effect of MCS on model fit was evaluated using model comparisons. Improvements in model fit were evaluated using −2 times the change in log-likelihood, which is distributed as χ^2 with degrees of freedom equal to the number of parameters added (which was 1 for all comparisons). The analyses were carried out in R version 3.4.3 using the lme4 package (version 1.1-15; R Core Team, 2017).

The data and the model fit are shown in **Figure 1**. The results indicate that there was a significant MCS effect on the intercept, χ^2 (1) = 80.4, $p < 0.001$, and no effect on the slope, χ^2 (1) = 1.46, $p = 0.227$. Thus, the individuals who exhibited high level of MCS had stronger drive to seek self-diagnostic information than participants showing low level of MCS. The initial level of SDMS was 1.61 pts ($SE = 0.48$). The growth of SDMS was assessed on 0.19 pts ($SE = 0.15$) at each wave of the study, and the influence of MCS was assessed on 0.65 pts ($SE = 0.11$).

However, as can be seen on **Figure 1**, the two lines, representing relation between MCS and SDMS, are essentially parallel over the five waves of the study. This parallelism of the curves is evident form insignificant differences in the slopes. Thus, the predictor (i.e., MCS) was treated as continuous variable in the analyses. The discrete grouping was used solely to provide a clearer visual representation of the effects.

Notwithstanding the above, **Figure 1** depicts the growth of the relation between MCS as the prospective predictor and the SDMS total score as the dependent measure. In **Figure 2**, we present the correlations between the MCS level obtained at each measurement point and the SDMS level as measured during the subsequent assessment session. The significant associations ($r = 0.13$–0.30) support our Hypothesis 1, and indicate that MCS, measured ∼6 months earlier, significantly predicted the drive to seek self-diagnostic information. **Table 2** shows intercorrelations between MCS and SDMS at all waves of the study. As indicated in **Table 2**, and in line with our Hypotheses 1 and 2, MCS showed significant prospective and concurrent relations with SDMS.

TABLE 2 | Intercorrelations between SDMS and MCS across all studies.

	SDMS 1	SDMS 2	SDMS 3	SDMS 4	SDMS 5
MCS 1	0.282	0.128	0.142	0.211	0.106
MCS 2	0.203	0.283	0.180	0.231	0.191
MCS 3	–	0.271	0.254	0.301	0.247
MCS 4	–	–	0.296	0.359	0.280
MCS 5	–	–	–	0.284	0.272

All correlations are statistically significant at $p < 0.001$.

TABLE 3 | MCS as a predictor for the SDMS subscales: ORI (information about own results), SII (self-improvement information), and CI (comparison information concerning own and others' results) at all five waves of the study.

Subscales of the SDMS	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
ORI	0.26**	0.26**	0.24**	0.40**	0.30**
SII	0.28**	0.22**	0.25**	0.34**	0.32**
CI	0.16*	0.17*	0.21*	0.29**	0.20*

*$p \leq 0.05$; **$p < 0.01$.*

According to Hypothesis 3, we expected that the associations of MCS with seeking own results information (ORI) and self-improvement information (SII) would be stronger than with seeking information about the self compared to others (CI), as the latter is likely to involve self-enhancement. The results, displayed in **Table 3**, do not confirm our hypothesis. Across all assessments, the correlations of MCS with the SDMS subscales were all positive and ranged from $r = 0.20$ to $r = 0.40$ for ORI and SII and from

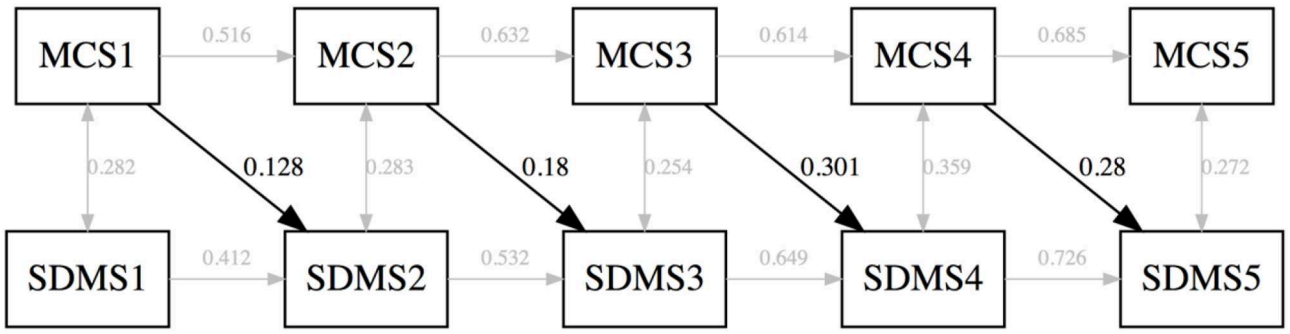

FIGURE 2 | Pearson's correlations (black one headed arrows and gray double headed arrows) and reliability coefficients (test-retest correlation; gray one headed arrows).

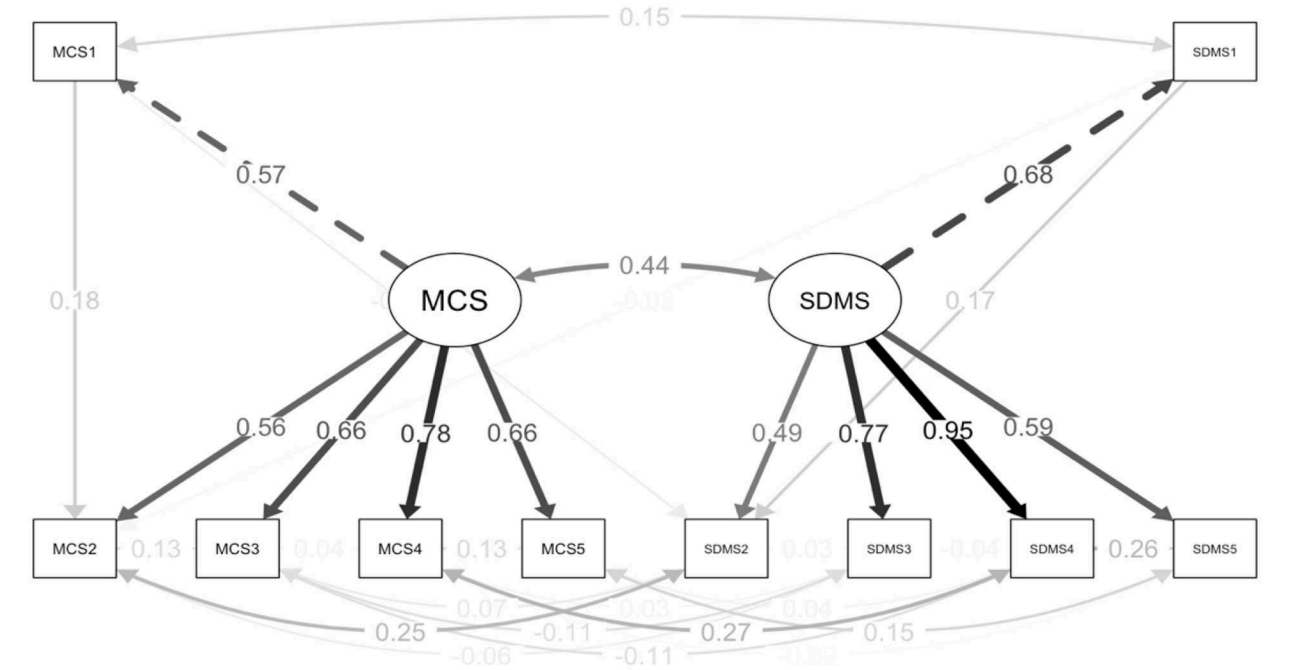

FIGURE 3 | EFA model with standardized estimates. Magnitudes of the estimates are reflected by the intensity of the black color.

$r = 0.16$ to $r = 0.29$ for CI. Although MSC correlated slightly higher with ORI and SII than with CI, it should be noted that all correlations were significant and did not differ significantly from each other. Thus, the stronger the self-awareness of biases, the more participants look for self-diagnostic information, regardless of the type of feedback.

To further test the influence of MCS on SDMS we modeled latent variables for MCS and SDMS, with scores at each of the five waves as indicators. These latent variables reflected stable variances of MCS and SDMS. We separately modeled wave-specific scores on MCS and SDMS to capture within-person variability on these variables. The model specified autoregressions involving within-person deviations from the mean in MCS and SDMS over time as well as predictions from within-person deviations from mean levels of MCS to within-person deviations from the mean of SDMS measured the following wave and from SDMS to MCS measured the following wave. The variables within the measurement wave were allowed to covary. The resulting model, depicted in **Figure 3**, provided a good fit to the data: χ^2 (13) = 7.745, $p = 0.860$, CFI = 1.00, AGFI = 0.977, RMSEA = 0, CI95 [0–0.032]. As indicated in **Figure 3**, the correlation between the latent variables, reflecting stable variances of MCS and SDMS, was $r = 0.44$ and showed that, overall, participants who were high in MCS were more eager to seek self-diagnostic information than those who were low in MCS. However, beyond the stability of MCS and the stability of SDMS, the prospective effect of MCS on SDMS was small.

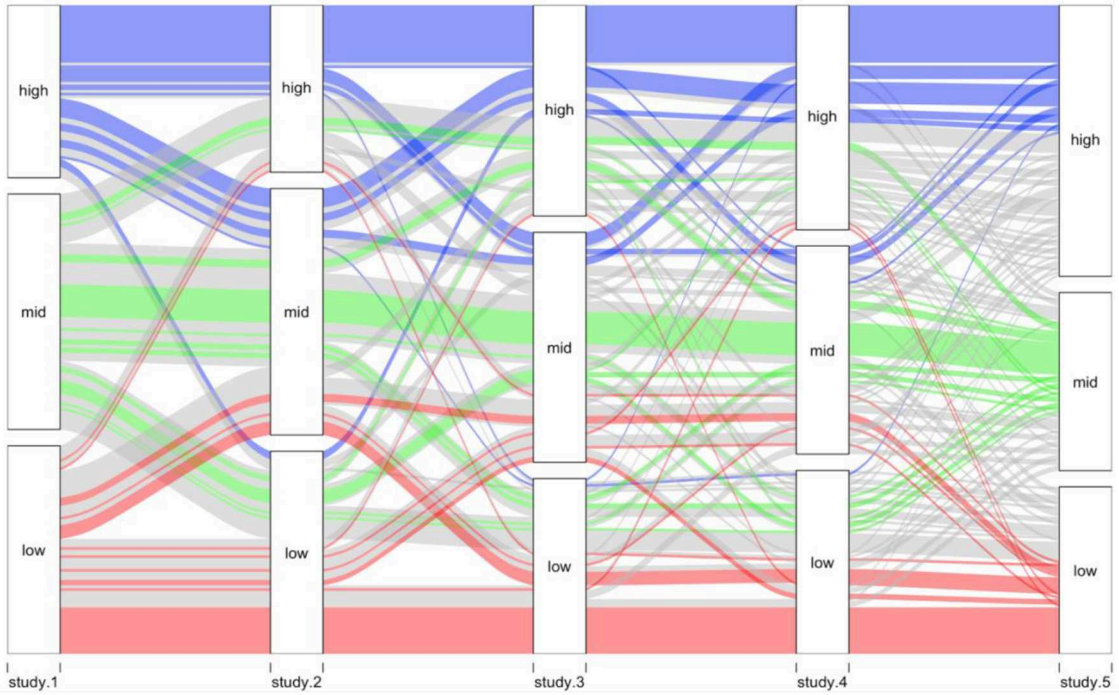

FIGURE 4 | Plot for each participant's level of SDMS over all five measurements. Each line represents each individual's SDMS score; the lines are color-coded with respect to the initial and final level of SDMS: participants low in SDMS (<4) are marked in red, those moderate in SDMS are marked in green (4 < x < 5), and those high in SDMS (>5) are marked in blue.

From the results presented in **Figures 2**, **3**, it can be concluded that MCS is not a strong predictor of SDMS. A possible explanation for this finding is illustrated in **Figure 4**, which shows the fluctuation of each participant's SDMS across the five measurement points. As can be seen, changes in the drive for self-diagnostic information were not linear. It appears that motivation to search for self-diagnostic is a complex phenomenon, and is influenced by other psychological variables in addition to MCS.

DISCUSSION

This study examined the relation between metacognitive self and the desire for self-diagnostic information both concurrently and prospectively. More than 400 emerging adults participated in the 2.5-years project, with five assessment waves, each 6 months apart. The obtained results show that MCS is related significantly and positively to SDMS, both concurrently and prospectively, thus offering support for Hypotheses 1 and 2. The associations of MCS with each of the SDMS subscales did not differ significantly, thus failing to support Hypotheses 3.

Consistent with Hypothesis 1, in the prospective analysis, stronger MCS significantly predicted subsequently greater desire for self-diagnostic information. Moreover, this prospective association of strong MCS with increased SDMS was evident across each interval that the association could be tested. However, as determined by the linear growth model analysis, MCS did not explain interindividual differences in intraindividual change in SDMS. Individuals high in MCS did not differ from those low in MCS in the rate of growth of SDMS. This finding suggests that the effect of MCS on the level of SDMS remains rather constant over time.

In the concurrent analysis, in line with Hypothesis 2, stronger MCS significantly predicted greater SDMS. This positive effect was reproduced at each assessment point. Given the content of the SDMS subscales, we expected that MCS would correlate more strongly with seeking own results information (ORI) and self-improvement information (SII) than with seeking comparison information (CI; Hypothesis 3). Such a pattern of results was expected based on the evidence that social comparisons can also serve self-enhancement functions (e.g., Wills, 1981). The observed correlations indicated, however, that MCS related positively to all of the SDMS subscales to about the same degree. Thus, the data failed to show the expected preference of individuals high in MCS for seeking information on self-improvement and one's own performance. The above results seem compatible with the assertion that there is a strong common factor underlying the desire for various self-diagnostic information (Brycz et al., 2018).

Our findings are consistent with those of previous research on linkage between metacognitive self and the desire for self-diagnostic information (Brycz et al., submitted; Brycz et al., 2018). In the past experimental study MSC was found to be effective in explaining interindividual differences in seeking self-diagnostic information when confronted with a negative

feedback. The current study extends these findings and provides evidence that the two constructs are positively related also at the trait level.

The present study represents the first to examine the longitudinal predictive power of MCS. MCS was shown to be positively predictive of seeking self-diagnostic information both concurrently and across time. Our findings support the reasoning outlined in the introduction and above cited reports of greater interest in feedback among individuals with high MCS. They also align with research on the mechanisms underlying monitoring of own knowledge as well as with research on strategies for learning and remembering (Koriat et al., 2014). For example, on the basis of taking into account self-diagnostic information, judgments of learning are assumed to rely on subjective effort invested in searching diagnostic information on the process in question (Koriat et al., 2014). The motivation to maintain the metacognitive level of thinking is thus intrinsic. Koriat et al. (2009) demonstrated a developmental increase in data-driven regulation, resulting from seeking and considering diagnostic information about the self.

The current results also contribute to the growing body of research on regulatory functions of metacognitive self. Prior studies have shown that individuals high in MCS, compared to those with low MCS, are more persistent in the face of challenges and recognize more uncontrollable events in their environment and themselves. The present results may further suggest that the associations of MCS with persistence and recognition of properties of events may in part be due to the increased need for self-diagnostic information associated with stronger MCS. As Bandura (1991) mentioned, conscious and purposeful self-observation may provide self-diagnostic feedback, which has an important self-motivating function and can modify one's course of action.

Learning crucial information about the self at the metacognitive level and acquiring essential knowledge of how individuals understand the world around them and themselves is of considerable practical and theoretical interest for learners, educators, and researchers (Holland et al., 1989). Of particular importance in this context is the finding of Yang et al. (2017) that testing of previously learnt information enhances learning and retention of new information (i.e., the forward testing effect). This finding could suggest that the drive to search for self-diagnostic information may enhance knowledge of one's own biases and heuristics as well as strengthen self-knowledge in general.

Limitations and Future Directions

Certain limitations of this study need to be highlighted. First, it is important to note that all data were self-reported, which introduces the potential of confounding construct with method variance. Our study's longitudinal design allowed for an examination of the relationship between self-reported MCS measured at one point in time with self-reported SDMS measured at the subsequent time period and thereby reduced the plausibility of common-method-variance explanations for the results. Nevertheless, because cross-sectional data were also collected, we cannot entirely rule out common method variance as a source of bias in the results. Furthermore, the present study did not examine any of the exogenous variables that might determine individuals' tendency to look for self-diagnostic information. Most likely, there are many other self-related, affective, and motivational factors that play a vital role in the self-evaluation process (e.g., self-esteem). Finally, despite the large longitudinal response rate, we cannot exclude the possibility that the loss of participants at follow-up assessments limited the representativeness of the sample and the generalizability of our findings. Further studies should include testing of more complex models using additional measures of constructs relevant to processing information about the self and include both self-ratings and non-self-report assessments.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the manuscript/supplementary files.

ETHICS STATEMENT

The study was reviewed and approved by the Polish Ethical Committee (decision no 17a/2013). Written informed consent was obtained from all participants in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

HB contributed the conception and design of the study. AF organized the database. PK performed the statistical analysis. HB, PK, and AP wrote the sections of the manuscript. HB and AP contributed to the manuscript revision. All authors read and approved the submitted version.

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Methods to Assess Social Comparison Processes Within Persons in Daily Life: A Scoping Review

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Self-evaluations relative to others (i.e., *social comparisons*) have well-established implications for health and well-being, and are typically assessed via global, retrospective self-report. Yet, comparison is inherently a dynamic, within-person process; comparisons occur at different times, on a range of dimensions, with consequences that can vary by context. Global, retrospective assessment forces aggregation across contexts and reduces ecological validity, limiting its utility for informing a nuanced understanding of comparisons in daily life. Research across social and clinical psychology has implemented methods to assess comparisons naturalistically, involving intensive, repeated assessments of comparison occurrence, characteristics, and consequences in everyday life (via ecological momentary assessment or daily diaries). Although promising, this work to date lacks an overarching conceptual framework for guiding decisions about assessment design and implementation. To address this gap, the aims of this scoping review were: (1) to summarize available literature on within-person naturalistic assessment of social comparison, and (2) to provide a set of key considerations to inform future social comparison research using within-person naturalistic assessment. Searches in PubMed, PsycInfo, and CINAHL identified relevant articles published before June 2019. Articles were included if they described at least 3 comparison assessments within each participant, taken in the natural environment, and spaced no more than ∼24 h apart (i.e., repeated momentary or daily assessment). In articles meeting these criteria (33 unique studies across 36 published papers), we summarized aspects of the comparison assessment, including recording methods, direction (e.g., upward, downward), target (e.g., friend, stranger), and dimension (e.g., status, appearance). Most studies assessed appearance comparisons (vs. other comparison dimensions) and collected information in response to signals (rather than initiated by participants). However, there was considerable heterogeneity in the number of assessments, assessment periods, recording modalities, and comparison predictors and outcomes assessed. Findings

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broadly establish heterogeneity in the aspects of comparison considered critical for within-person naturalistic assessment. We describe key decision points for future work to help advance within-person naturalistic assessment methods and improve the utility of such approaches to inform research, theory, and intervention.

Keywords: social comparison, within-person, ecological momentary assessment, daily diary, intensive longitudinal data, ambulatory assessment, social influence

To date, more than six decades of research has demonstrated that self-evaluations relative to others (i.e., *social comparisons*) have important implications for well-being and health (Buunk and Gibbons, 2007; Gerber et al., 2018). For example, a range of research designs and assessment methods has shown that comparisons can influence intrapsychic states such as affect and attitudes (Myers, 1978; Buunk et al., 1990), satisfaction with one's current status (Major and Testa, 1989), and perceptions of risk for negative outcomes (Klein and Weinstein, 1997). Social comparisons also contribute to mental health conditions such as depression (Swallow and Kuiper, 1988) and to physical health outcomes such as smoking (Gerrard et al., 2005), weight loss (Leahey et al., 2011b), and chronic illness self-care (Arigo et al., 2015), and comparison is recognized as a key mechanism underlying health behavior change (Olander et al., 2013). Consequently, there is considerable interest in effectively harnessing comparison processes to promote healthy behavior and self-concept.

To achieve this goal, however, it will be critical to understand for whom, when, and under what circumstances social comparison is most likely to confer benefits. Answering these questions requires applying distinct research methods that capture comparisons at different levels of influence. At the person level, considerable evidence shows that people differ in their tendency to compare themselves with others (e.g., *social comparison orientation* [SCO]; Gibbons and Buunk, 1999; O'Brien et al., 2009), and recognizing this between-person difference has generated useful insights. For example, this work has demonstrated that those who have a stronger (vs. weaker) SCO respond more (vs. less) intensely to comparison opportunities (Vogel et al., 2015). Whether this is beneficial is unclear, however; SCO is positively associated with neuroticism, depression, and negative affect (Gibbons and Buunk, 1999), but also is positively associated with empathy for others (Buunk and Gibbons, 2006) and engagement in physical activity (Luszczynska et al., 2004; Arigo and Butryn, 2019).

How might social comparison processes relate to both positive and negative outcomes? It seems that not all instances of comparison are created equal; their effects depend on a variety of factors such as type of comparison target, comparison dimension and direction, and the comparer's perceived similarly to the comparison target (see **Table 1**). These contextual factors differ between instances of comparison and thus vary within the same person over brief periods of time. In fact, Gibbons and Buunk (1999) note that their measure of SCO has suboptimal temporal stability for a measure of individual differences (i.e., 0.60), in part, because comparison activity is expected to vary with contextual changes. Similarly, Van der Zee et al. (2000) measure of comparison response shows that the same individuals report experiencing both positive and negative affect across instances of comparison, suggesting within-person variability in comparison experiences over time and context.

TABLE 1 | Features of social comparison commonly described in theoretical and empirical literature.

Feature	Definition
Type of comparison target	Category of person or relation to the self—e.g., friend (in real life or on social media), family member, work colleague, stranger, celebrity
Comparison dimension	Aspect of the self or behavior being compared to that of others—e.g., income, professional status, ability, appearance, progress toward a goal
Comparison direction	Perception of the target's status relative to the self on the relevant comparison dimension
Upward comparison	Target is perceived to be better off than the self
Lateral comparison	Target is perceived to be at the same level as the self
Downward comparison	Target is perceived to be worse off than the self
Perceived similarity to the target	During or immediately after a comparison, emphasis on similarities with vs. differences from the target on the relevant comparison dimension
Identification	Emphasis or focus on similarities or closeness between the self and the target
Contrast	Emphasis or focus on differences or distance between the self and the target
Comparison mode	Immediate level of interaction with the comparison target—e.g., in person, over the phone, on social media, on television, in a magazine

People make comparisons to friends, family members, work colleagues, strangers, and celebrities, among other types of *targets*, and some targets may be more important in certain contexts than others (Wheeler and Miyake, 1992; Leahey and Crowther, 2008). The *dimension* of comparison refers to what about the self is being compared—for example, income, professional status, ability in a specific arena (e.g., playing an instrument), appearance, or progress toward a goal—and the value of each dimension may depend on both the person and instance of comparison. The comparison *direction* depends on a person's perception of the target's status (in the dimension under comparison) relative to their own. Comparisons to those perceived as better off on a relevant dimension are *upward comparisons,* comparisons to those perceived as worse off on this dimension are *downward comparisons*, and comparisons to those

perceived to be about the same on this dimension are *lateral comparisons* (Wills, 1981; Wood et al., 1985).

From work on individual differences in social comparison behavior (using self-report methods), some people are more likely to make comparisons with specific types of targets or on specific dimensions than others. For example, young adults make comparisons to friends more often than to family members (Wheeler and Miyake, 1992), women with (vs. without) elevated body dissatisfaction are more likely to make appearance comparisons (Leahey et al., 2011a), and people with (vs. without) depression or anxiety make more upward comparisons (Butzer and Kuiper, 2006). But studies that use selection methods (Wood, 1996)—i.e., assessing participants' choice of target from a set of multiple options—reveal that people show a range of preferences for specific comparison directions and dimensions when given options, and that their preferences may not be consistent over time (Van der Zee et al., 1998b; Arigo et al., 2015). Thus, in addition to the overall frequency of comparison type, the specific features of a given comparison may matter much more than previously thought.

Understanding whether making social comparisons is associated with positive or negative outcomes for a given individual requires even more nuance. With respect to immediate emotional states/affect, Buunk and Ybema (1997) proposed that people who identify with upward targets (by focusing on similarities with the target) tend to feel inspired by someone else's success, as a similar outcome for the self seems possible, whereas people who contrast themselves against upward targets (by focusing on differences between the self and the target) tend to feel disappointed by the distance between their current and desired states. Conversely, people who identify with downward targets tend to feel anxious in response to apparent confirmation that their situation is or may become dire, whereas people who contrast with downward targets (by focusing on differences) tend to feel satisfaction with their own status, as the target shows them that they could be doing worse (see Buunk and Ybema, 1997).

Importantly, however, all of these immediate affective responses to social comparison—inspiration, disappointment, anxiety, or satisfaction—may motivate behavior change (Castonguay et al., 1998). Whether they lead to positive changes depends not only on who makes the comparison, but on a variety of contextual influences; in addition to comparison direction and the degree of similarly vs. difference the comparer perceives, the outcome of a comparison may depend on the time of day or week, pre-comparison mood state, reason for making this comparison, or the comparer's previous progress toward their goals (Wheeler and Miyake, 1992; Aspinwall and Taylor, 1993; Arigo et al., 2018). Our understanding of these contextual factors (which may vary within the same person over short periods of time) and their roles in the comparison process is limited by the use of between-person research methods (i.e., retrospective self-report and group-based experimental designs), which tend to be most common in social comparison research. These methods force aggregation both within an individual across occasions and contexts as well as across individuals.

For example, in reporting their tendency to engage in social comparison, individuals must retrospect over their experiences with social comparison and provide a single (usually numeric) answer. This answer typically is intended to reflect an individual's perception of the frequency with which they make comparisons or their perception of how strongly they value comparison information (or both), and measures that assess this construct often do not specify a time frame. This answer will be differentially influenced by a number of factors, including recent experiences, intense/salient experiences (Do et al., 2008; Schneider et al., 2011; i.e., peak and end effects), social desirability (Furnham, 1986), stereotypes or pre-existing beliefs (Cavanaugh et al., 1998), and related but separate current states (e.g., current level of negative affect; Robinson and Clore, 2002a,b). The role that each of these factors plays in an individual's internally generated summary score likely differs across individuals, providing a differently weighted aggregation of experiences in a single set of responses that is then combined to compare individuals to one another (Hill et al., 2018).

Further, aggregation likely reduces ecological validity, as it dissociates the experience of social comparison from the real-world contexts where it occurs (Sliwinski et al., 2018). Thus, asking individuals to provide a single response about their comparison behavior that is a summation over multiple contexts could remove meaningful variation in comparisons that occur in response to real world situations and events, and removes temporal sequencing regarding predictors and/or outcomes. Similarly, group-based experimental designs that present individuals with a single target for comparison and capture reactions to the comparison (e.g., Stanton et al., 1999; Derlega et al., 2008), although high on internal validity, reduce the extent to which the comparison reflects the type of target that individual would select or respond to in the real world. These designs provide information about how comparisons function in response to a specifically generated target, but not how the individual goes about choosing or responding to targets in their everyday life. To achieve the goal of promoting healthy outcomes, there is need to better understand how comparisons occur and function in people's daily lives, with greater attention to specific experiences with comparison, and how these dynamic processes unfold within an individual.

In response to this need, a subset of research across social and clinical psychology has begun to assess specific experiences of social comparison that occur in the natural environment to understand the dynamics of social comparison processes. This involves ambulatory assessment of self-reported comparisons in daily life, using repeated assessment of the same participants over short time intervals (e.g., hours or days; vs. single-administration, global self-report; Smyth et al., 2017). Assessments can occur after a set amount of time (i.e., interval-contingent recording, such at the end of each day), in response to a prompt from the research team (i.e., signal-contingent recording, usually with technological assistance) or in response to a participant's recognition that they have made a comparison (i.e., event-contingent recording). A range of terms have been used to describe this general approach, including "experience sampling" (Larson and Csikszentmihalyi, 2014) and "daily diaries" (Gunthert and Wenze, 2012). However, the use of multiple assessments per day is more often called "ecological

momentary assessment" (EMA; Smyth and Stone, 2003; Smyth et al., 2017), whereas "daily diary" may refer to recording only once per day. Recording of comparisons and other variables of interest occurs via paper forms, personal digital assistant (PDA), electronic surveys (via links sent by email or text), or standalone smartphone applications.

As comparisons can happen quickly and automatically as well as deliberately (Gilbert et al., 1995), these methods are useful for reducing recall bias and forgetting. Further, these methods can elucidate important *within-person* (i.e., time-sensitive and dynamic) effects that differ from those observed *between-person* (i.e., stable, trait level). For example, consider the relation between exercise and heart rate. At the between-person level, there is a negative relation such that people who exercise more often generally have lower heart rates. But this relation does not hold for the within-person level—when people exercise, their heart rates increase, rather than decrease (cf. Curran and Bauer, 2011). Thus, knowing that people who are high (vs. low) in SCO also exercise more frequently does not mean that we know whether exercise is more or less likely after a comparison happens in the real world. To know the latter, we need intensive assessment of the same person over short time periods to detect within-person, time-sensitive effects.

Intensive assessment approaches to measuring social comparison have been used with the intention to capture the frequency of occurrence, characteristics, and consequences of comparisons, and variability in these aspects of comparison, within an individual at the moment or day levels. Yet, with respect to social comparison, intensive assessment work has moved forward with little coherence across study methods or consensus as to best practices for this approach, and without a framework for guiding decisions about assessment design. Given the nuances of social comparison and the range of methods and parameters that could facilitate intensive assessment, having synthesis of existing studies and specific recommendations for this work could improve the rigor and utility of future studies. In line with these goals, the aims of this scoping review were: (1) to summarize the available literature on intensive assessment of social comparison, regarding the aspects of comparison deemed critical for such assessment (e.g., direction) and specific methods of assessment (e.g., recording method), and (2) to propose a set of key questions to guide decisions about future intensive assessment of social comparison.

METHOD

This review followed the PRISMA Extension for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018). A brief description of the protocol for this review is registered with the Open Science Framework (https://osf.io/mbucg/). The research questions for this review were:

1) In which populations and under what circumstances have researchers assessed social comparison processes in the natural environment?
2) What specific assessment procedures, including the number and timing of assessments per day/week and instructions to participants, have been used to capture social comparisons in the natural environment?
3) What characteristics of self-reported social comparisons have been assessed in the natural environment?
4) How frequently do participants report comparisons in the natural environment?
5) What experiences have been assessed as predictors or outcomes of comparisons in the natural environment?

Article Identification

Inclusion criteria for this review were selected by the first, second, and last authors (DA, JAM, JMS) to focus on intensive, naturalistic assessment of social comparison. Empirical articles were included if they met the following criteria: (1) available in English, (2) available on or before June 30, 2019, (3) ambulatory assessment of naturally occurring social comparison via self-report (i.e., participants use paper and pencil or technological devices to record social comparisons and associated experiences during daily life), (4) at least three assessments of social comparison per participant, and (5) assessments scheduled no more than 24 h apart OR instructions to record each time a comparison occurred.

The authors searched PubMed, PsycInfo, and CINAHL for relevant publications. Search terms were combinations of "social comparison" and "daily diary," "diary," "ecological assessment," "intensive," "repeated measures," "event contingent," or "experience sampling." Resulting titles and abstracts were evaluated with respect to inclusion criteria; database and follow-up hand searches returned 644 individual articles. After removing 23 duplicates (resulting in 621 potential articles), four of the authors (MB, KP, LS, LT) reviewed the remaining titles and abstracts to determine inclusion. These authors were trained to recognize inclusion/exclusion criteria but were unaware of the review's specific research questions at the time of coding. After abstract review, 470 articles were excluded, leaving 151 articles for full text review. The same four authors (MB, KP, LS, LT) examined the full text of these articles to determine inclusion. A further 115 articles were excluded, leaving 36 in the final set of articles included for formal review and data extraction. **Figure 1** shows our PRISMA-ScR flowchart describing the disposition of articles evaluated for inclusion, with a final total of 36. Multiple independent articles described findings from the same datasets in three cases (Fitzsimmons-Craft et al., [4 articles]; Leahey et al. [3 articles]; Thogersen-Ntourmani et al. [2 articles]) and two articles described more than one individually eligible dataset (Locke, 2003, Studies 1–3; Locke, 2007, Studies 1–2). To ensure that each unique set of methods (sample, recording method) counted once, we collapsed multiple papers from the same dataset (9 became 3) and added individual studies from multi-study publications (2 became 5). This resulted in 33 unique studies.

Data Extraction

The final set of 33 included studies (36 published articles) were coded for the following characteristics: author(s), year of publication, the sample enrolled in the study (e.g., college students, older adults), whether assessment of social comparison

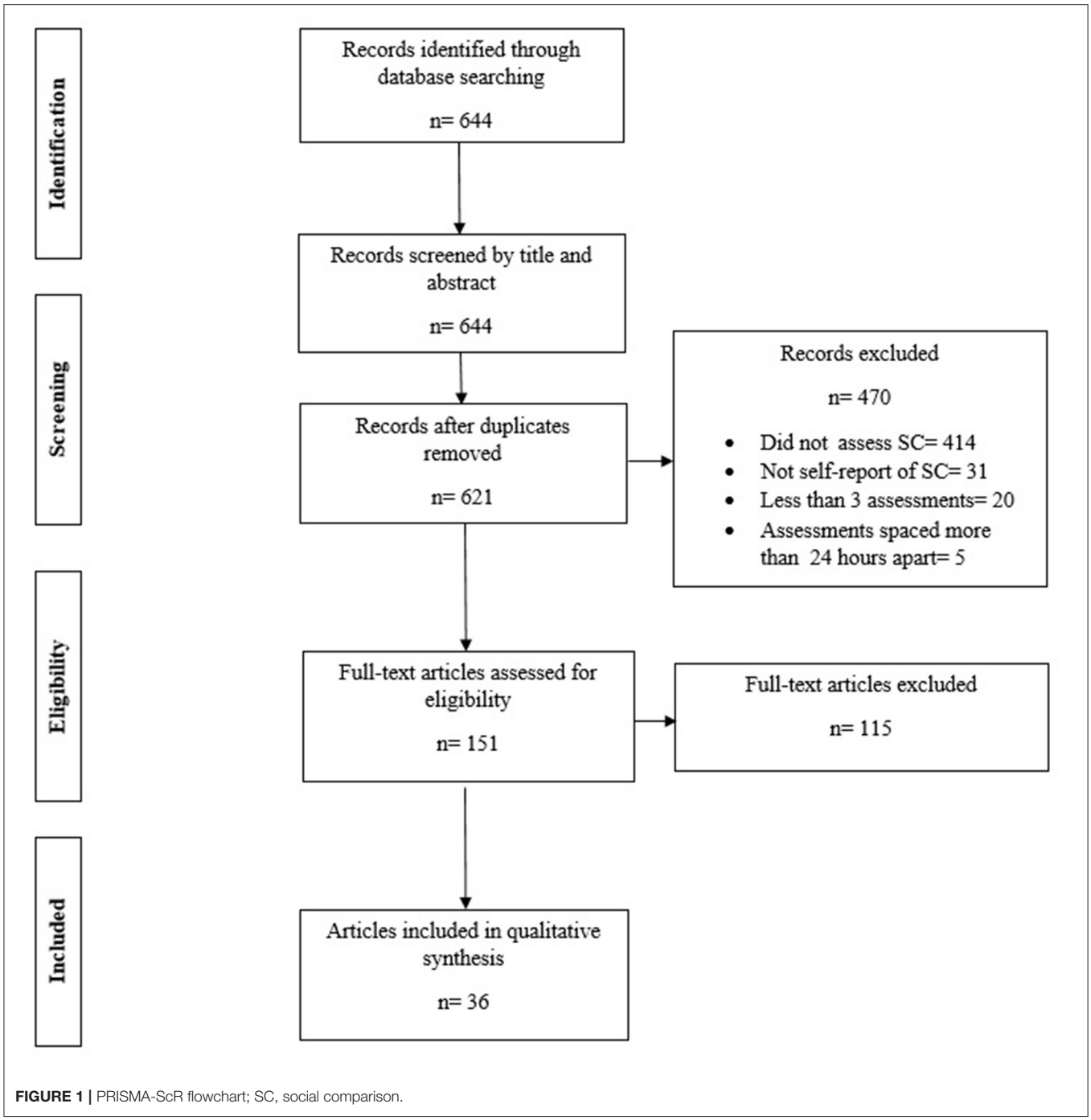

FIGURE 1 | PRISMA-ScR flowchart; SC, social comparison.

as a predictor or outcome was the primary purpose of the study, the study context (e.g., body image, work performance, not specific), assessment design (i.e., daily diary vs. EMA), recording method (i.e., interval- vs. signal- vs. event-contingent assessment, or a combination), the recording modality (e.g., paper and pencil, smartphone), the number of assessments per day that included social comparison items, the aspects of comparison assessed (e.g., dimension, direction, identification), predictors of comparison occurrence or type (e.g., pre-comparison affect), the average number of comparisons recorded per assessment, and outcome variables assessed (e.g., affect, behavior). Four of the authors (MB, KP, LS, LT) each coded 6–7 articles for this information. Authors DA and JAM checked each set for accuracy, and discrepancies (which were minimal) were resolved by consensus. Due to the overlap of the sets of articles noted above, 33 was used as the denominator for all descriptive calculations.

RESULTS

The earliest study identified that used intensive, naturalistic assessment of social comparison was published in the early 1990s (Wheeler and Miyake, 1992). No other studies identified in our search were published until 2000 (Affleck et al., 2000), with the majority of studies appearing in published form between 2007 and 2017 (25). The most recent studies identified were published in early 2019 (Arigo et al., 2019b; Fuller-Tyszkiewicz et al., 2019).

Research Question 1: Study Contexts and Populations of Interest

Social comparison was of primary interest in the vast majority of studies reviewed ($k = 31$; 94%). In the remaining two cases, social comparison was of secondary interest—as an influence on organizational citizenship behaviors (i.e., work activities focused on helping others; Spence et al., 2011) and "fat talk" (i.e., negative comments about weight; Mills and Fuller-Tyszkiewicz, 2018). Three studies enrolled wide subsets of the general population, including full-time employees (Spence et al., 2011), romantic partners (Pinkus et al., 2008), and adolescents (Lennarz et al., 2017; see **Table 2**). Specific populations of interest were women with fibromyalgia (Affleck et al., 2000) and ethnic minority students (non-Caucasian; Leach and Smith, 2006). The majority of studies enrolled college students, however ($k = 19$; 58%). Several of these studies enrolled only women (7) and assessed only appearance-related comparisons (5). Seven additional studies focused on appearance comparisons enrolled older women, with a total of 12 studies assessing appearance comparisons among women (36% of studies reviewed). Only one study focused on appearance comparisons enrolled both men and women (Pila et al., 2016), and no studies enrolled only men for this purpose. Further, one study of appearance comparison asked only about those toward upward targets (Pila et al., 2016). Across populations, one study focused exclusively on instances of being the target of someone else's upward comparisons (Koch and Metcalfe, 2011, Study 1), one assessed only downward comparisons (Affleck et al., 2000), and one assessed only experiences of negative-outcome comparisons (i.e., those that resulted in negative affect or self-views; Kashdan et al., 2014).

Research Question 2: Methodological Factors

Recording Structures Across Studies

The most frequently used method for collecting data on naturally occurring social comparisons was through signal-contingent recording (i.e., prompting participants to record recent comparisons, with multiple prompts within a day; $k = 15$; 46%), followed by event-contingent recording (i.e., participants recording each time they recognize that they have made a comparison; $k = 11$; 33%). The remaining studies used interval-contingent recording (i.e., recording after a set amount of time), at the end of the day ($k = 7$; 21%; see **Table 2** and **Figure 2**). There was wide variety in the number of times per day participants were asked to respond in the signal-contingent protocols ranging from 3 times per day (4 studies) to 10 times per day (1 study). The most common frequency was 6 times per day (5 studies). One study varied the number based on day of the week, using 9 prompts on weekends and 4 prompts on weekdays (Lennarz et al., 2017). The number of recording days for signal-contingent studies ranged from 4 (1 study) to 14 (3 studies), with a mode of 7 (7 studies). The total number of assessments per person per signal-contingent study ranged from 21 to 98. Interval-contingent studies tended to ask participants to record their experiences once per day for longer durations. The number of assessment days per person was 7 (3 studies) to 30 days (1 study), with 14 days as the most common duration (4 studies). Event-contingent recording designs were more variable between studies, in that some studies specified a set number of days for each participant (e.g., 7 days; 3 studies) whereas others used the number of reported events to conclude the data collection (e.g., 10 events of comparison; Locke, 2005). In the latter cases, the duration of the study varied across participants.

Recording Method

All of the studies that used event-contingent recording were conducted using paper-based surveys, whereas studies using signal-contingent or interval-contingent recording were conducted via smartphones, personal computers (laptop/desktop), or palmtop computers (personal digital assistants, or PDAs). Three interval-contingent studies used a combination of paper and electronic reporting. Signal-contingent designs tended to use palmtop computers (12), though one study used paper reports (Leach and Smith, 2006) and another used online surveys (Fardouly et al., 2017), allowing participants to record from any internet-connected device. Consistent with recommendations for signal-based assessments (Smyth and Stone, 2003), several studies used "since the last" signal as the reporting time frame (12), whereas interval-contingent assessments used the "current day." For studies employing event-contingent responding, the reporting interval was "right now."

Recording Instructions, Item Wording, and Response Scales

Instructions and items used to assess social comparison varied across the methods of reporting. Studies using event-contingent methods were fairly consistent in response options, as the majority (7 out of 11) used the original or a modified version of the Rochester Social Comparison Record (RSCR; Wheeler and Miyake, 1992). This measure is completed each time a participant notices that they've made a comparison, and records are counted to determine the number of comparisons over a given time period. In addition to the date of the event, the RSCR asks participants to report on various features of each comparison (e.g., type of target, direction; described below). In contrast, event-contingent studies differed in their specific instructions to participants, with respect to the definition of a recordable comparison. Wheeler and Miyake (1992) and Patrick et al. (2004) stipulated that participants should only record instances of comparison to which they have a noticeable "psychological reaction." All other researchers who used event-contingent methods used a broader definition, such that participants should record any instance of "similarities and/or differences between

TABLE 2 | Descriptive information for each article included in the present review ($k = 36$).

Author (Year)	Sample	Study context	Recording method	Recall period	Number of reports per day	Number of assessment days	Recording modality
Affleck et al. (2000)	89 women with fibromyalgia	Chronic pain/pain intensity	Interval	Current day	1	30	Paper and PDAs
Arigo et al. (2019b)	80 college women	Not specific	Interval	Current day	1	7	Any device that had internet access
Bogart et al. (2004)	98 college students	Not specific	Event	Most recent	N/A	3	Paper
Drutschinin et al. (2018)	161 women	Appearance	Signal	Since last prompt	6	7	iPhone
Fardouly et al. (2017)	146 college women	Appearance comparisons	Signal	Since last prompt	5	5	Any device that had internet access
Fitzsimmons-Craft (2017)	232 college women	Appearance-related comparisons; body, eating and exercise comparisons	Signal	Since last prompt	3	14	Personal electronic devices
Fitzsimmons-Craft et al. (2015)	232 college women	Body, eating, and exercise related social comparison	Signal	Since last prompt	3	14	Personal electronic devices
Fitzsimmons-Craft et al. (2016a)	232 college women	Appearance related; body, eating, and exercise social comparisons	Signal	Since last prompt	3	14	Personal electronic devices
Fitzsimmons-Craft et al. (2016b)	232 college women	Appearance related; body, eating, and exercise social comparisons	Signal	Since last prompt	3	14	Personal electronic devices
Fuller-Tyszkiewicz et al. (2019)	84 women aged 18-40	Appearance comparisons	Signal	Since last prompt	10	7	Phone
Kashdan et al. (2014)	172 college students	Daily negative social comparisons	Interval	Current day	1	21	Not specified
Koch and Metcalfe (2011), Study 1	49 participants	Upward social comparison	Event	Right now	N/A	14	Website (computer) & blank-pocket sized notebooks
Leach and Smith (2006)	32 ethnic minority students	"Ethnic minority students' comparisons to other ethnic minorities or to members of a high-status ethnic majority"	Signal	Most recent	3	7	Booklet (paper)
Leahey and Crowther (2008)	105 women	Appearance comparisons	Signal	Since last prompt	6	5	PDA
Leahey et al. (2011a)	160 women	Appearance comparisons	Signal	Since last prompt	6	5	Paper and pencil
Leahey et al. (2007)	153 women	Body-focused comparisons	Signal	Since last prompt	4	7	Not specified
Lennarz et al. (2017)	68 adolescents	Not specific	Signal	Right now	4 Friday & 9 on Saturday and Sunday	6	Phone
Locke and Nekich (2000)	157 college students	All	Event	Right now	N/A	7	Paper
Locke (2003), Study 1	106 college students	All	Event	Right now	N/A	N/A	Paper
Locke (2003), Study 2	109 college students	All	Event	Right now	N/A	N/A	Paper
Locke (2003), Study 3	191 college students	Not specific	Event	Right now	N/A	7	Paper
Locke (2005)	229 college students	Not specific	Event	Right now	N/A	N/A	Paper
Locke (2007), Study 1	130 college students	Not specific	Event	Right now,	N/A	7	Paper
Locke (2007), Study 2	132 college students	Not specific	Event	Right now	N/A	N/A	Paper

(Continued)

TABLE 2 | Continued

Author (Year)	Sample	Study context	Recording method	Recall period	Number of reports per day	Number of assessment days	Recording modality
Mills and Fuller-Tyszkiewicz (2018)	135 women aged 18–40	Appearance comparisons	Signal	Since last prompt	6	7	Phone app
Myers et al. (2012)	91 college women	Appearance comparisons	Signal	Since last prompt	5	5	PDA
Patrick et al. (2004), Study 2	88 college women	Not specific	Event	Right now	N/A	10	Paper
Pila et al. (2016)	87 adults	Upward social comparisons (any and body-related)	Interval	Current day	N/A	7	Online survey
Pinkus et al. (2008), Study 1	95 couples 190 individuals)	Not specific	Signal	Since last prompt	6	14	PDA
Rancourt et al. (2015)	46 college women	Weight-related comparison	Signal	Since last prompt	6	5	PDA
Ridolfi et al. (2011)	93 college women	Appearance comparisons	Signal	Since last prompt	5	5	PDA
Rogers et al. (2017)	161 women	Appearance comparisons	Signal	Since last prompt	6	7	Phone app
Spence et al. (2011)	99 men and women	Coworker comparisons at work	Interval	Current day	1	14	Email
Steers et al. (2014), Study 2	154 college students	Not specific	Interval	Current day	1	14	Online if had access, others used paper
Summerville and Roese (2008)	34 adults	Not specific	Signal	Right now	7	14	PDA
Thøgersen-Ntoumani et al. (2017)	126 women	Appearance	Signal	Since waking up/last prompt	3	4	Phone
Thøgersen-Ntoumani et al. (2018)	126 women	Appearance	Signal	Since last report	3	7	Phone
Wheeler and Miyake (1992)	94 college students	Not specific	Event	Right now	N/A	14	Paper
Zuckerman and O'Loughlin (2006)	176 college students	Not specific	Interval	Current day	1	14	Online

PDA, personal digital assistant (palmtop computer).

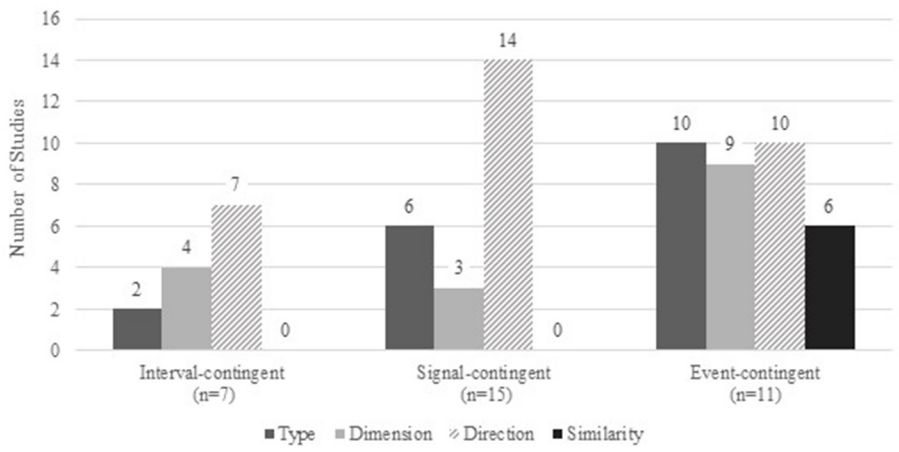

FIGURE 2 | Summary of social comparison features assessed by study method.

yourself and another person" (e.g., Koch and Metcalfe, 2011, Study 1; Locke, 2003, Studies 1-3; Locke and Nekich, 2000). In only one study were participants encouraged to consider comparisons with "imaginary" others, as well as those to real individuals (Patrick et al., 2004).

A small subset of studies using interval- or signal-contingent recording ($k = 8$; 24%) indicated that they provided participants with specific guidance in how to identify or define a comparison; these studies did not indicate that only comparisons with accompanying psychological reactions would count. All of these studies included items assessing the occurrence and/or frequency of comparisons, as well as a range of follow-up questions. One study using interval-contingent methods asked participants to estimate the total number of comparisons they made that day and record an integer of their estimate (Pila et al., 2016); 4 interval-contingent studies used rating scales to capture frequency [1–10 (Spence et al., 2011; Kashdan et al., 2014), 1–9 (Steers et al., 2014, Study 2), and 1–7 (Zuckerman and O'Loughlin, 2006)], and 1 study asked participants to indicate whether they had made any comparisons that day (yes/no; Arigo et al., 2019b). Studies using signal-contingent methods tended to begin each prompt by asking whether participants had made a social comparison (yes/no; 15) before asking follow-up questions about specific comparisons, with certain studies limiting the question to certain types of comparisons (e.g., appearance comparisons).

Across methods, the majority of included studies ($k = 25$; 76%) asked a number of follow-up questions regarding the "most recent" comparison to assess a range of features (described below). In 4 cases, study procedures described such follow-up questions but did not specify which comparison was assessed (Leahey et al., 2007; Myers et al., 2012; Mills and Fuller-Tyszkiewicz, 2018; Thøgersen-Ntoumani et al., 2018). A subset of signal-contingent studies used rating scales to capture the intensity or frequency with which participants had made comparisons (e.g., "Please slide the bar to indicate the level of [body] comparison behavior you have engaged in since the last time you were signaled, where 0 = No [body] comparisons and 100 = Constantly making [body] comparisons;" Fitzsimmons-Craft et al., 2015, 2016a,b) and did not appear to request additional information about a particular comparison.

Research Question 3: Comparison Features

As expected, comparison target type, dimension, and direction were assessed in large subsets of studies reviewed (see **Table 3** and **Figure 2**). Thirteen studies (39%) asked participants to report their relationship to the target (friend, family member, celebrity) to describe the target type. Two studies (6%) assessed only comparisons to a certain type of target: romantic partners (Pinkus et al., 2008, Study 1) and "the average college student of the same age and gender" as the participant (Zuckerman and O'Loughlin, 2006). Of note, only two studies (6%) asked participants to report the gender of their target (Koch and Metcalfe, 2011, Study 1; Wheeler and Miyake, 1992).

Dimension was assessed in 17 studies (52%), using checklists or open-ended responses. Checklist options most often included academic performance, appearance, wealth, personality, abilities, and opinions. Of the remaining 16 studies, 13 asked about appearance comparisons exclusively. These were specified as "appearance comparisons" (broad), "body comparisons," and "weight/shape comparisons;" only one study allowed participants to select the specific appearance dimension (e.g., weight, shape, muscularity/level of tone, physical abilities; Fitzsimmons-Craft, 2017). Two studies asked specifically about comparisons of health behaviors, which might also relate to appearance. The first offered a category called "health habits (e.g., physical activity, eating behavior)" (Arigo et al., 2019b), and the second asked about eating and exercise comparisons with unique items (described in Fitzsimmons-Craft et al., 2015). Although the RSCR does not offer "eating" as a comparison category, Wheeler and Miyake's (1992) initial study using this measure indicated their ability to assess eating comparisons. It is likely that these were coded from free responses to an "other" category, although the procedure does not explicitly state this.

The most prevalent comparison feature was direction, however. This feature was assessed in 30 studies (91%); the majority of these studies (23) allowed researchers to capture upward, downward, and lateral comparisons, whereas a smaller subset assessed only upward and downward comparisons (7). Importantly, response options for direction were most often offered on a continuous scale (e.g., *I am much worse than the target* to *I am much better than the target*; 15 studies), with the scale midpoint representing lateral comparisons. In some cases, these continuous responses were recoded to form upward, downward, and lateral categories, and these were used in statistical analyses (e.g., Leahey and Crowther, 2008). As noted, additional studies assessed only upward comparisons (Pila et al., 2016) or only downward comparisons (Affleck et al., 2000).

"Similarity" was assessed in a small subset of studies ($k = 6$; 18%), typically framed as whether the participant perceived similarity or dissimilarity between the self and the target (e.g., similar, dissimilar, or neither; Locke and Nekich, 2000). Of note, this language also was used to frame perceptions of direction, with the response options specifying the intent of the item (i.e., similarity with respect to how much better or worse off the respondent is than the target; Wheeler and Miyake, 1992). Similarly, a subset (8 studies) assessed the mode or setting of comparison (e.g., face-to-face interaction, exposure via media), with 5 studies explicitly assessing comparisons via social media platforms (Patrick et al., 2004; Leahey and Crowther, 2008; Fardouly et al., 2017, Study 2; Ridolfi et al., 2011; Steers et al., 2014; Rancourt et al., 2015, Study 2). Other comparison features assessed included target's ethnicity (Leach and Smith, 2006), the participant's location and the "density" of people present at the time of comparison (Fitzsimmons-Craft, 2017), the importance or desirability of the comparison dimension to the participant (Koch and Metcalfe, 2011, Study 1; Locke, 2003, Study 1), how helpful the participant perceived the comparison to be (Locke, 2003, Study 2), whether the participant had compared to the target in the past or expected to in the future (Locke, 2007, Study 1), the participant's main concern during the comparison (Locke, 2007, Study 2; Locke and Nekich, 2000), the participant's reason for making the comparison (Patrick et al., 2004), and whether the comparison was made deliberately or automatically (Locke, 2005).

TABLE 3 | Main features assessed in each article included in the present review ($k = 36$).

Author (Year)	Features
Affleck et al. (2000)	Downward comparisons of pain intensity only
Arigo et al. (2019b)	Target type
	Dimension
	Direction
Bogart et al. (2004)	Target type
	Dimension
	Direction
	Mode
Drutschinin et al. (2018)	Appearance comparisons only
	Direction
Fardouly et al. (2017)	Appearance comparisons only
	Direction
	Mode
Fitzsimmons-Craft (2017)	Target type
	Dimension
	Direction
Fitzsimmons-Craft et al. (2015)	Dimension (separate items for body, exercise, and eating)
Fitzsimmons-Craft et al. (2016a)	Dimension (separate items for body, exercise, and eating)
Fitzsimmons-Craft et al. (2016b)	Dimension (separate items for body, exercise, and eating)
Fuller-Tyszkiewicz et al. (2019)	Body comparisons only
	Direction
Kashdan et al. (2014)	Direction
Koch and Metcalfe (2011), Study 1	Self-used as upward target only
	Target type
	Target gender
	Dimension
Leach and Smith (2006)	Dimension
Leahey and Crowther (2008)	Body shape/weight comparisons only
	Target type
	Direction
Leahey et al. (2011a)	Body shape/weight comparisons only
	Direction
Leahey et al. (2007)	Body shape/weight comparisons only
	Direction
Lennarz et al. (2017)	Direction
Locke and Nekich (2000)	Target type
	Dimension
	Mode (1)
	Direction
	Similarity
Locke (2003), Study 1	Target type
	Dimension
	Direction
	Similarity
Locke (2003), Study 2	Target type
	Dimension
	Direction
	Mode
	Similarity
Locke (2003), Study 3	Target type
	Direction
	Mode
	Similarity
Locke (2005)	Target type
	Direction
	Similarity
Locke (2007), Study 1	Target type
	Direction
	Mode (1)
Locke (2007), Study 2	Target type
	Direction
	Similarity
Mills and Fuller-Tyszkiewicz (2018)	Appearance comparisons only
	Direction
Myers et al. (2012)	Appearance comparisons only
	Direction
Patrick et al. (2004), Study 2	Target type
	Dimension
	Direction
	Mode
Pila et al. (2016)	Upward comparisons only
	Dimension (body vs. other)
Pinkus et al. (2008), Study 1	Comparisons to significant other only
	Target gender
	Dimension
	Direction
Rancourt et al. (2015)	Body weight/shape comparisons only
	Target type
	Direction
Ridolfi et al. (2011)	Body weight/shape comparisons only
	Target type
	Direction
Rogers et al. (2017)	Body comparisons only
	Direction
Spence et al. (2011)	Dimension (work-related only)
	Direction
Steers et al. (2014), Study 2	Dimension
	Direction
Summerville and Roese (2008)	Direction
Thøgersen-Ntoumani et al. (2017)	Appearance comparisons only
	Direction
Thøgersen-Ntoumani et al. (2018)	Appearance comparisons only
	Direction
Wheeler and Miyake (1992)	Target type
	Target gender
	Dimension
	Direction
	Mode
Zuckerman and O'Loughlin (2006)	Comparison to the average college student of same age and gender only
	Dimension
	Direction

Research Question 4: Comparison Frequency

A goal of this review was to describe the frequency (or range of frequencies) with which participants in intensive assessment studies reported making comparisons. As noted, however, studies varied in their approach to assessing comparison frequency; some asked only whether a comparison had occurred over a given time frame (yes/no), whereas others requested an estimate of the number of comparisons made in a specific time frame. Four studies reported the average number of comparisons per recording period (with corresponding standard errors/deviations; 12%) and two (6%) reported the overall average per person (with corresponding standard errors/deviations). An additional 12 studies (45%) appeared to provide enough information to estimate an average number of comparisons recorded per day, although the variability in day-to-day reporting would be more difficult to estimate. For example, 4 studies indicated the average number of days it took participants to reach a pre-identified number of assessments, in some event-contingent studies (e.g., Locke, 2003, Study 1), and a subset of these provided averages for subgroups only, rather than the full sample (e.g., Leahey et al., 2007).

In most cases, however, it was not clear whether averages or variability estimates (e.g., standard deviations) were between- or within-person, which reflect distinct aspects of comparison. These represent the amount of variability between participants (i.e., stable throughout assessments) vs. within participants (changing within the same participant over time), and thus, could provide important insight into questions about within-person change (e.g., in affective response to comparison). Only a small number of studies explicitly described testing for comparison variability at the between vs. within-person levels (e.g., intraclass correlation coefficients; Locke and Nekich, 2000; Spence et al., 2011; Steers et al., 2014; Pila et al., 2016, Study 2). These studies documented within-person variability in comparison frequency, ranging from 50 to 95% of total variability (We note that these estimates also include error variance.). As their assessments used different time scales, however, it is not possible to draw strong conclusions about variability in frequency across studies (see Podsakoff et al., 2019). Finally, a subset of studies reported on the absolute or relative frequencies of recorded comparisons with specific features, such as the most common target types (e.g., Wheeler and Miyake, 1992; Patrick et al., 2004; Fardouly et al., 2017), dimension(s) (e.g., Wheeler and Miyake, 1992; Patrick et al., 2004; Fitzsimmons-Craft, 2017) or direction (e.g., Locke, 2003, Study 3; Locke and Nekich, 2000; Pinkus et al., 2008, Study 1; Wheeler and Miyake, 1992; Spence et al., 2011).

Research Question 5: Predictors and Outcomes of Comparison

Predictors of Comparison Occurrence or Frequency

Seventeen studies (32%) evaluated between or within-person predictors of comparison reports (occurrence, frequency, or type). Between-person predictors included gender (9 studies), self-esteem (3 studies), body dissatisfaction (2 studies), age (2 studies). Tendency toward jealousy, body mass index, narcissistic personality traits, feminist beliefs, and agency were included as predictors in one study each. As noted, however, our primary interest for this research question was in within-person relations, which describe when (or under what circumstances) comparisons are most likely to occur, and cannot be inferred from between-person relations. A subset of studies described findings related to within-person predictors of comparison occurrence, though these predictors were idiosyncratic. At the day level, these included time spent on Facebook (Steers et al., 2014, Study 2), engaging in sexual activity with one's partner and feelings of connectedness (Kashdan et al., 2014), and pain intensity and positive and negative affect (Affleck et al., 2000). At the moment or event levels, predictors of interest were positive and negative affect (Wheeler and Miyake, 1992; Thøgersen-Ntoumani et al., 2018), comparison setting (i.e., during social interactions vs. alone—Locke, 2003, Study 3; Locke and Nekich, 2000; who was present—Lennarz et al., 2017), and state body dissatisfaction (Rogers et al., 2017).

Consequences of Making Social Comparisons

Similarly, our aim was to describe the within-person consequences of comparison that have been assessed in the natural environment (i.e., what happens when a person makes a comparison, or makes a certain type of comparison?). Within-person effects describe temporal relations between comparison outcomes that also cannot be inferred from between-person findings. The relevant outcomes assessed in the articles reviewed included self-reports of affect, internal experiences (e.g., thoughts, motivation), and behaviors, as well as objectively assessed behavioral engagement. Among studies focused on appearance comparisons, primary outcomes included body/appearance (dis)satisfaction (8 studies), reported engagement in disordered eating behaviors or physical activity (7 studies), thoughts about disordered eating behaviors (e.g., binge eating, restriction) or exercise (5 studies), affect (4 studies), guilt (3 studies), and social physique anxiety and drive for thinness (1 study). Outside of the context of appearance comparisons, 12 studies assessed post-comparison affect, two of which also captured pre-comparison affect and were able to control for this variable in subsequent tests (Wheeler and Miyake, 1992; Leach and Smith, 2006). Additional internal experiences of interest were self-esteem/confidence (5 studies), subjective well-being, depressive symptoms, jealousy, and feeling connected to others (1 study each). Two studies captured self-reports of engaging in specific behaviors: organizational citizenship behaviors (Spence et al., 2011) and physical activity/exercise (Pila et al., 2016). Only one study assessed behavior objectively, using a wristworn sensor to measure engagement in physical activity (Arigo et al., 2019b).

DISCUSSION

Many decades of research and theory on social comparison have revealed considerable nuance and complexity in this process, particularly in natural settings and over brief periods of time. Methods that provide intensive, within-person assessments in the natural environment may capture data that help clarify some of these important issues. This would be informative for both a

basic understanding of human social and cognitive experiences and for designing tailored environments or interventions to promote positive outcomes. Yet, the extent to which this type of assessment is useful depends on the specific research design; a single study can assess only so many unique characteristics, predictors, and outcomes of comparisons (without placing undue burden on participants), under the constraints of the selected signal or recording timeframe. Decisions made about the design could shape a study's outcome(s), and should be considered carefully in the context of the specific research questions at hand. Here, we summarize findings from our review of extant studies and offer recommendations for key points to consider in planning future research with intensive assessment of social comparisons in the natural environment. We summarize our recommendations in **Table 4**.

Whom Are We Studying, and for What Reasons?

Intensive assessment has been applied in both broad and narrow samples. The rationales for focusing on specific groups such as adolescents, adults with full-time employment, and women with fibromyalgia naturally related to the specific outcomes of interest, such as jealousy, work behaviors, and pain experiences, respectively. Indeed, published work demonstrates that social comparisons are common in these populations and may be associated with key health, well-being, and performance outcomes. As each of these populations and outcomes have been studied using intensive assessment only once, replication and extension of the reported findings would be informative. As is common in psychological science, however, the majority of existing studies focused on convenience samples of college students. Given that young adults tend to report stronger tendencies toward comparison than older adults (Callan et al., 2015), future attempts to draw conclusions about the likelihood, frequency, or consequences of comparisons in non-college samples may be skewed by this overrepresentation.

Similarly, large subsets of existing work on intensive assessment have focused only on comparisons of appearance, and only one study of appearance comparisons has enrolled men to study this process. Although these also are limitations of the appearance comparison literature more broadly, their presence in intensive assessment work presents unique challenges. For example, the overall social comparison literature suggests a discrepancy between the effects of appearance comparisons and comparisons in other domains. Upward appearance comparisons almost universally lead to negative outcomes (e.g., increased negative affect or body dissatisfaction), while downward appearance comparisons do not seem to have a "symmetrical" positive effect (Lin and Kulik, 2002). In contrast, with respect to many non-appearance dimensions (e.g., chronic illness prognosis, work performance, positive and negative affect more broadly), both upward and downward comparisons show positive *and* negative effects, of varying intensities (Buunk et al., 1990; Van der Zee et al., 2000; Arigo et al., 2015). The broader literature has not yet been able to determine the features or contexts of comparison that determine positive vs. negative affect, and focusing on within-person processes using intensive assessment could be useful toward this end. Yet, overemphasis on naturally occurring appearance comparisons using these methods, rather than on other types of comparisons, may skew conclusions toward appearance-related patterns (e.g., upward comparisons lead to negative affect). This could mask broader, and important, within-person variability in affective response and other outcomes of interest.

Further, a focus on women in the appearance domain reflects the historical view that body dissatisfaction and disordered eating behaviors are more common among (or exclusive to) women. Although these experiences remain slightly more common among women than men, recent work has demonstrated that they increasingly occur among men (Turel et al., 2018) and trans/non-binary individuals (Sequeira et al., 2018). Little is known about how men and trans/non- binary individuals make and respond to comparisons—appearance-based or otherwise—in their natural environments, limiting the potential for understanding the range of comparison responses and for tailored intervention in these groups.

Additional populations that warrant increased attention using intensive assessment of social comparison include individuals with chronic illnesses and those attempting to change their behaviors. People with illnesses such as cancer, type 2 diabetes, and cardiovascular disease experience ongoing threats to their health that can increase the utility of social comparison, as comparisons can provide comfort, inspiration, and guidance for self-care (Kulik et al., 1993; Van der Zee et al., 1998a; Stanton et al., 1999). Research using between-person methods, such as randomized experiments, behavioral selection, and retrospective self-report, show between-person variability in comparison target preference and affective response (Arigo et al., 2014). The present review identified only one intensive assessment study of adults with a chronic illness (fibromyalgia; Affleck et al., 2000), and the sample was restricted to women. Thus, the extent of within-person variability in comparison among individuals with chronic illnesses is not yet clear, and this variability could provide insight into a critical component of health in these at-risk groups.

In addition, people interested in modifying their behaviors may use a range of others as role models and information sources, particularly if they join group programs or use digital support tools with social networking features (Direito et al., 2014). Social comparison has been identified as an important and potentially effective behavior change technique for a range of outcomes (Abraham and Michie, 2008; Olander et al., 2013). Different individuals may need different types of comparisons to motivate change (cf. Schokker et al., 2010), however, and people also may need different types of comparisons at different times (Arigo and Suls, 2018). Increased use of intensive assessment, both prior to and during focused behavior change efforts, would be useful for further understanding within-person variability in change processes and for optimizing social comparison features of intervention programs. As described further below, it would be extremely helpful for future work in this area to provide additional information about within-person variability in comparison frequency and outcomes.

TABLE 4 | Summary of recommendations for future research using intensive assessment methods to study social comparison.

Category	Considerations	Recommendations	Where is additional work needed
Conceptual definition of social comparison	How will social comparison be defined? - Will comparisons "count" if they are not subjectively associated with a psychological response?	Defining social comparison more broadly (vs. associated with psychological responses); however, this depends on the research question	To determine the extent to which different definitions of comparison lead to different reporting patterns
	How will participants be taught to recognize comparisons in their daily lives?	Interactive instruction in how to recognize comparisons may reduce heterogeneity in identification and reporting; normalizing comparison may reduce hesitation to report	To determine whether giving instructions in a group setting affects reporting
	Will instructions be given individually or in a group?	- The instruction process should be described in detail in published reports	
Sample characteristics	What is the rationale for studying social comparison in a given population, and how narrowly should the population be defined?	Rationale should be clear from the outset and should be described in published reports	To understand comparisons other than those based on appearance among young women and all types of social comparison in more diverse samples
	What type(s) of comparison will be assessed and why?		Specifically, to understand social comparison (across dimensions) in the following groups: - Adults over the age of 25 - Men and trans/non-binary individuals (particularly regarding appearance comparison) - Individuals with chronic illness/health conditions - Those interested in behavior change (to elucidate how comparisons function in the behavior change process)
Recording and data collection parameters	What type of recording method will be used (signal-, interval-, or event-contingent)? What is the recording modality (paper, smartphone app, web link)?	Base these on: - What is known and/or proposed about the likely frequency of the type(s) of comparison of interest (evidence and theory) - Maximizing reach, ease, and accuracy while minimizing participant burden - Pilot work with the population of interest	To determine whether different types and frequencies of recording lead to differing response patterns
	How many total days of recording? Are the days consecutive or does the period include breaks? How many times per day will participant record (signal- and interval-contingent)? Will the number of times per day be consistent across days, or will it change?	Specific to the population of interest, select the recording frequency that would maximize accuracy and power for planned analyses while minimizing aggregation/recall bias *and* participant burden; rationale should be described in published reports - If possible, build in assessment of reactivity	To determine the extent of reactivity to recording social comparisons and related experiences (e.g., consequent affect)
Features assessed	Which features are critical to answering the research question?	Assess target gender and relation to participant	To investigate the influence of: - Mode (particularly social media) - Reason for making a comparison or selecting a particular target - Perceived utility of a comparison - Real vs. imaginary targets - Deliberate vs. automatic comparison - Identification/contrast processes
	Which features are likely to moderate or place boundaries on the primary effects in question?	Assess perceived direction and degree of similarity separately	
		Assess identification and contrast directly (rather than inferring from affective response)—additional work is needed here	
		Unless the research question is specific to a particular dimension, allow for a wide range and assess with high granularity (e.g., "appearance" could mean weight, shape, overall fitness/physique, facial attractiveness, etc.)	

(Continued)

TABLE 4 | Continued

Category	Considerations	Recommendations	Where is additional work needed
Predictors and outcomes of social comparison	Is the research question(s) about the comparison process or the effect of comparisons on another variable (or both)?	Base this on a broad understanding of social comparison processes, rather than knowledge of comparison in a single domain Most commonly assessed predictors are between-person (e.g., self-esteem, body satisfaction, gender) Most commonly assessed outcomes are affective response, body satisfaction, thoughts about or reports of eating/dieting/exercising (within-person) Report on variability at the between- and within-person levels and specify which is being reported	To examine: - Within-person variability in the frequency of comparison - Temporal patterns of comparison occurrence - Effect of comparisons on objectively assessed behavior

How Are We Designing Intensive Assessment Studies?

As evidenced by the number of logistical approaches described in this review, intensive assessment of social comparison has occurred using a range of data collection parameters. Specifics such as the number of assessment days, the frequency of assessments (i.e., how many per day, consecutive vs. nonconsecutive days, consistent number of assessments per day vs. changing), the recording modality (i.e., paper vs. technological device), and the recording or prompt method (i.e., event- vs. signal vs. interval-contingent) have varied widely across studies. In studies published to date, the most popular methods were signal-contingent recording using electronic services (e.g., PDA, smartphone, email), 6 signals per day, and 7 consecutive days of assessment. The rationale for the specific number of days or assessments was not always clear, however, and deserves more careful consideration, as the most common methods may not be appropriate for all research questions.

Conceptual decisions about what is considered a social comparison and what dimensions of social comparison are critical to the aims of the study should guide methodological decisions about timing of assessments, how recording will be carried out, and obtaining quality data from participants (cf. Stone and Shiffman, 2002). Researchers must identify the specific type of design that best fits their research question (i.e., interval-, signal-, or event-contingent) and then select the recording method that can limit participant burden and maximize reporting compliance. For researchers interested in assessing the frequency of the occurrence of social comparisons, it is critical to build this question effectively into protocols. All recording methods (i.e., interval-, signal-, or event-contingent) could capture this information, although the questions should be framed slightly differently for each method. For example, with event-contingent recording, the number of records completed is intended to capture the natural frequency of salient comparisons. With interval- and signal-contingent methods, researchers should use self-report items that align with their frequency-related research questions (e.g., number of comparisons in a time frame vs. occurrence or not).

The decision between interval- and signal-contingent recording will vary based on a given researcher's predictions how often the comparisons of primary interest are likely to occur. Researchers examining more frequently occurring comparisons may prefer the shorter retrospection periods of signal-contingent recording, whereas those examining less frequently occurring comparisons could leverage the reduced burden of interval-contingent recording. Similarly, researchers interested in the behavioral and emotional consequences of comparisons should consider briefer response windows, such as those in signal-contingent recording, to ensure timely assessment of consequences. Repeated assessments within a shorter window of time also provide opportunities to examine immediate (i.e., same report) consequences, as well as consequences later in the study window that could imply a delayed response to the comparison (e.g., lagged effects; Larson and Almeida, 1999; Schuurman et al., 2016).

Recording Modality

Previous work demonstrates the unreliability of paper-based reporting methods (Stone et al., 2002, 2003), and the present review indicates that paper-based recording of social comparison in the natural environment decreased since initial studies in the 1990s and early 2000s. Technologies such as PDAs and smartphones have the advantage of providing time stamps to verify when the record was completed (and may be more efficient for recording comparisons than paper), although some participants may be less inclined to type (vs. write) open-ended responses. Of available technologies, allowing participants to use their personal smartphones may seem optimal, as it limits the new resources necessary to conduct the study and generally is perceived as convenient (Kuntsche and Labhart, 2013). This method also offers a range of distribution options, such as by sending survey links via text message or email, or recording responses in a downloadable app, but has clear disadvantages. For example, these methods often require participants to use their own (potentially limited) data plans to access internet services and require additional attention to privacy and security. Further, smartphone ownership may not be prevalent in all populations

of interest, and reliance on personal devices in these situations will result in meaningful selection bias if alternatives are not provided. Here, knowledge of the population and pilot work can inform decisions.

Reporting Heterogeneity

As noted, we encountered difficulty describing the frequency of comparisons due to discrepancies in results reporting, which was unexpected. Many published papers do not provide basic descriptive statistics (and/or do not clearly specify the level for descriptives that are reported) which preclude strong conclusions about frequency of naturalistic comparisons, day-to-day or moment-to-moment variability in comparison occurrence, or responses to specific types of comparisons. This information could be critical to mapping the comparison process accurately and to translating this information to applied contexts. The limited information we could glean from existing studies appears to support the presence of considerable within-person variability in comparison frequency. It is not yet possible to draw strong conclusions about this variability across studies, or to speak to within-person variability in related aspects of comparison (e.g., types of targets, affective response). In future work, we recommend that researchers consider the unit(s) of analysis (i.e., person, day, and/or moment) and provide descriptive information that matches the lowest unit of analysis.

As an example, consider a signal-contingent design with 4 assessments per day across 1 week, with a question about the frequency of social comparisons. Indicating that participants reported an average of 2 comparisons at each momentary assessment would provide researchers with an estimate of the average number of responses per person per day (∼8), as well as the total number per person for the week of assessments (∼56). Additionally, reporting that there was a standard deviation of 1 comparison at the momentary level further extends the information that can be extrapolated. We could then learn that, for this hypothetical study, most participants reported a range of 1–3 comparisons at each momentary assessment for a range of 4–12 comparisons per day and a range of 28–84 comparisons across the study duration of 1 week. Further, reporting such descriptives for identification/contrast and comparison outcomes, as well as for raw occurrence, would be useful information for researchers planning similar studies or clinicians attempting to identify the role of social comparisons in their intervention protocol. Providing descriptive details for individual types of comparisons and for specific subgroups of interest within the study design can further inform the literature on social comparisons.

Features of Interest

Consistent with the broader literature on social comparison, features of comparison often captured in intensive assessment of social comparison were target type, direction, and dimension. Less than half of the studies reviewed assessed target type. As existing evidence suggests that a person's relationship or perceived closeness to the target is associated with comparison response (and thereby, the utility of a comparison for achieving a particular purpose; Zell and Alicke, 2010), it is possible that this piece of potentially important information is missing from intensive assessment studies. In contrast, the popularity of assessing direction may reflect a widespread notion that direction is key to understanding the effect of comparisons on key outcomes. Although Festinger (1954) described a "unidirectional drive upward" in the group settings that were the focus of his original theory, subsequent work has demonstrated that (1) comparison is an intrapsychic process that does not require the presence of a group (Schachter, 1959), (2) the potential utility and disadvantages of both downward and lateral comparison (Wills, 1981; Mahler et al., 1995; Alicke, 2000), and (3) that direction may reflect not only a categorical perception but also one of scale (Wheeler et al., 1969; Wood, 1989). Existing work using intensive assessment has incorporated these insights to varying degrees, though the rationales for doing so (e.g., why using continuous vs. categorical responses for direction were most appropriate for the specific research question) were not entirely clear.

More recent work also has shown that people make comparisons on dimensions of the self beyond abilities and opinions, on which Festinger focused (Suls, 1986; Heidrich and Ryff, 1993; Arigo et al., 2014), and that individuals differ in their preferences and reactions to comparisons on distinct dimensions (Bennenbroek et al., 2002; Derlega et al., 2008). Further, a given domain of the self or behavior may actually encompass several specific dimensions, which do not all have the same value to a particular person. For example, exercise comparisons may be made on the total number of steps per day or exercise sessions per week, as well as on overall physical fitness or progress toward a goal (Harrison et al., 2015). Similarly, "appearance" comparisons may be made on overall level of body weight or shape, clothing size, general level of attractiveness, or muscularity; "eating" comparisons may be made on quantity, quality, or frequency of eating behavior; and "personality" comparisons may be made on a host of different traits or behavioral demonstrations of such traits. Although dimension commonly was captured in intensive assessment studies, very few provided participants or readers with these levels of specificity. This omission may reflect an effort to limit participant reporting burden, as increasing the number of options can amplify cognitive load (Yan and Tourangeau, 2008). In order to advance the current understanding of naturally occurring comparisons, however, it may be important to improve the granularity of response options with respect to dimension—even in studies that focus on a particular comparison domain (e.g., appearance).

Additional features of interest in existing intensive assessment studies were mode, similarity, and a range of characteristics unique to one or two studies (e.g., how helpful the participant perceived the comparison to be; Locke, 2003, Study 2). Capturing variability in mode reflects that people do not have to encounter targets face to face; targets can appear at a greater distance, such as over the telephone, and many of today's comparisons happen via social media. Since 2011, as the popularity of social media has increased, the frequency of explicit reference to social media in intensive assessment studies also has increased. Comparisons on these platforms have been shown to impact physical activity, self-esteem, and overall well-being (Dibb, 2019; Divine et al., 2019; Schmuck et al., 2019), although

such comparisons may be missed (particularly by those who spend less time on social media) if not explicitly referenced in study training materials or assessment items. In some cases, people may not even have to encounter their comparison target in any tangible sense. There is some evidence that people create comparison targets to fit the characteristics that suit their goals (e.g., self-enhancement), suggesting that targets can be imaginary, and that comparisons to these targets are associated with some outcomes of interest (e.g., health outcomes; Wood et al., 1985). As only one intensive assessment study reviewed here explicitly indicated that targets could be imaginary (Patrick et al., 2004), such targets represent an additional category that may be missed without specific introduction or assessment. Intensive assessment of comparisons to imaginary targets also would provide insight into their frequency daily life.

Identification and contrast, often described as "perceived similarity" to the target, represent recent developments in social comparison theory (Buunk and Ybema, 1997). Although similarity was of interest in a subset of intensive assessment studies, we did not find evidence that it was used in a way that reflects identification and contrast processes as they were theorized to work (i.e., the comparer's emphasis on similarities and/or differences between the self and the target at the time of comparison). In studies that did assess "similarity," this construct was operationalized in two distinct ways: to describe either the participant's overall perception of similarity (similar, dissimilar, or neither; Locke and Nekich, 2000) or to describe a directional scale (e.g., how much better or worse off the comparer perceives the target to be, which actually captures direction; Wheeler and Miyake, 1992). In some studies, these even were mixed together as multiple-choice options (e.g., Locke, 2003, Study 1), potentially creating additional confusion.

Empirical evidence indicates that identification and contrast are distinct aspects of a single comparison and that they may account for between-person variability in the effects of upward and downward comparisons (Van der Zee et al., 2000; Arigo et al., 2015). Findings from this review suggest that identification and contrast have not yet been included in intensive assessment studies, however. It is possible that identification and contrast represent a missing link that could help to explain why both upward and downward comparisons can have positive and negative affective consequences—people identify and contrast with specific targets to different extents at different times, leading to variability in their affective (and perhaps other) responses. As such, greater attention to this aspect of comparison in intensive assessment studies, using clear definitions and consistent terminology and/or measurement methods, may help to shed light on a critical but understudied aspect of comparison at the within-person level.

Which Predictors and Outcomes Are We Including?

Despite the within-person emphasis of many intensive assessment studies, the majority of predictors of comparison occurrence, frequency, or type were those traditionally considered stable, between-person constructs (e.g., self-esteem, gender). Studies that did use within-person predictors focused on immediate affect (e.g., Wheeler and Miyake, 1992) and experiences specific to the context of the study (e.g., sexual activity; Kashdan et al., 2014). Of note, we did not find evidence of interest in more foundational descriptive questions, such as during which days of week or times of day comparisons were most likely to occur. The majority of existing intensive assessment studies focused on research questions about the outcomes of comparison, with a wider range of constructs assessed. Across research contexts and populations, however, there was a heavy emphasis on affect and other internal experiences (e.g., body satisfaction, thoughts, motivation) as comparison outcomes. Affect can be an indicator of how a person interprets a comparison (i.e., identification and contrast), and often has been the assessment method of choice for this construct (cf. Van der Zee et al., 2000). But immediate affect does not necessarily translate directly to overall well-being or behavior. For example, regularly making upward comparisons that provide momentary anxiety or discouragement—but also provide useful information about how to improve—could lend itself to achieving high life satisfaction, well-being, and goal-directed behavior over time (Wood, 1989; Collins, 1996). Thus, assessing affect as a proxy for other variables should be avoided; it would be preferable to assess the variable of interest directly, as efficiently as possible.

Many existing intensive assessment studies were conducted in the traditions of social psychology, which has typically emphasized behavioral outcomes less often than emotional or motivational outcomes (Baumeister et al., 2007). As such, assessment of behavioral outcomes appeared more often in studies designed for clinical or other applied contexts (e.g., disordered eating, workplace engagement) than in those focused primarily on understanding the comparison process (e.g., Locke, 2005). Across studies that did focus on behavioral outcomes, however, behavior was measured almost exclusively via self-report, and only one study used more objective assessment of behavior (physical activity; Arigo et al., 2019b). Reports of behavioral engagement are an improvement over assessing only motivation or thoughts about behaviors (as in several appearance comparison studies). Yet, given the known gaps between motivation or intentions and actual behaviors (Sheeran and Webb, 2016), and in light of new technologies that make at least some aspects of ambulatory behavioral assessment more affordable and less burdensome, relations between comparisons and objectively assessed behavioral outcomes represents a new and exciting frontier for intensive assessment research.

More broadly, if the primary within-person research question focuses on the consequences of comparison, it is critical that researchers consider the various features of comparison that may moderate its effects in the moment. For example, appearance comparisons may have negative consequences, but typically this is restricted to upward comparisons and is strongest when the target is a model (vs. a peer). In contrast, upward comparisons of athletic ability, particularly if the target is a peer, may have positive consequences. Unless the research question is restricted to (and researchers decide to assess only) a very specific type of

comparison, understanding the "effect" of a comparison in daily life requires assessment of its occurrence, direction, dimension, and target type, among other features hypothesized to play a role. Greater attention to the boundary conditions of comparison effects in intensive assessment studies could help to map more specific temporal patterns at the (sub)group, individual, day, and moment levels.

To select the most appropriate comparison features for intensive assessment, researchers should have a general understanding of social comparison theory and evidence, not only in their population or domain of interest but more broadly. This will ensure that key features are not missed, items and response options are worded appropriately (using a precedent or intentionally deviating from it), and the resulting findings advance our understanding of comparisons and other constructs as intended. Careful consideration here will minimize participant burden while maximizing the potential benefit of new intensive assessment work on social comparison.

Additional Points and Recommendations Emerging From This Review

As is common with scoping reviews, a few important points arose from our review of this literature that did not align precisely with our research questions. First, that studies differed in the extent to which they described providing instructions or guidelines to help participants correctly identify comparisons. As noted, two studies explicitly defined comparisons as those that were associated with psychological reactions, whereas we saw no evidence of this restriction in the remaining 31 studies. Beyond this, however, methods sections occasionally indicated that participants attended initial (baseline) meetings individually or in groups to receive instructions on recording procedures, including definitions of comparison and other constructs. The group setting of such instructions is interesting, as it raises the questions of whether participants in groups made comparisons to each other and whether such comparisons were associated with distinct reporting patterns during ambulatory assessment. These are empirical questions that, to our knowledge, have not been studied in the context of social comparison.

Theory and evidence relevant to the population of interest should guide decisions about the operational definition of social comparison for a particular study and how this information will be communicated to participants. Although the broad concept of social comparison is familiar to many potential participants, we have found in our own work that the nuances generally are not familiar; regardless of the specific definition of comparison, guidance is useful to clarify the researcher's intention and ensure high-quality responses (e.g., Arigo et al., 2019a). Further, some people believe that they do not make comparisons and/or that making comparisons is judgmental and undesirable (Hemphill and Lehman, 1991; Helgeson and Taylor, 1993). Pilot work with the population of interest is particularly helpful for identifying such beliefs, as well as appropriate language and methods for encouraging accurate responses in the natural environment and understanding the potential prevalence of comparison (or other constructs) in the population of interest (Barta et al., 2012). Although some people seem to make comparisons infrequently (Gibbons and Buunk, 1999), it is likely that instances of comparison are missed without an understanding of the range of experiences that might count. This also applies to studies that focus only on certain types of comparisons, such as upward, negative-outcome, or appearance comparisons, and extra care might be necessary to ensure that participants understand the researchers' definition. Regardless of the particular instructions given to participants, these instructions and their delivery method (e.g., in person vs. online) and setting (e.g., individual vs. group) should be clearly explained in published articles (Stone and Shiffman, 2002).

Second, a subset of studies assessed *reactivity* to social comparison recording, to determine whether the frequency of participants' comparison reports changed over the course of the recording period (e.g., Leahey and Crowther, 2008; Fardouly et al., 2017; Mills and Fuller-Tyszkiewicz, 2018). Some researchers propose that reactivity could undermine the validity of subsequent findings, as the primary construct of interest changed due to assessment rather than naturally occurring variations (see Conner and Lehman, 2012). In contrast, however, others argue that reactivity is simply an aspect of participants' learning processes. Individuals overreport many experiences in the first few days of assessment, which decreases as they adjust to the recording procedure (Iida et al., 2012). Building assessment of social comparison reactivity into intensive assessment protocols could help to clarify this process as it relates to reporting on comparison. As previous work has demonstrated that reactivity is most common when participants report on one experience exclusively (Conner and Reid, 2012), an optimal intensive assessment of social comparison might include survey items assessing other experiences in addition to comparison.

Finally, social comparisons are known to occur both effortfully (i.e., intentional seeking or generation of targets) and automatically (i.e., in response to encountering others or information about others in daily life; Gilbert et al., 1995; Suls et al., 2002), and are known to occur for different reasons (Wood, 1989). As such, it is noteworthy that only one study we reviewed assessed participants' perceptions of whether a given comparison was "deliberate or automatic" (Locke, 2005), and only one assessed participants' reason for making each comparison (Patrick et al., 2004). Because these distinctions could have important implications for the effects of comparisons in daily life and could elucidate further nuances in the comparison process, they warrant increased attention in future research.

Strengths, Limitations, and Other Future Directions

This scoping review had several strengths, including its use of preregistered methods, adherence to PRISMA-ScR guidelines, use of a range of search terms and hand searches, and verification of correct data extraction by authors experienced in intensive assessment methods and social comparison

theory. Although it is possible that relevant articles were missed, our systematic search methods make it unlikely that missed articles would meaningfully affect our conclusions or recommendations. Limitations of this review are that we did not include study findings (and as such, cannot draw conclusions about the present body of knowledge concerning specific predictors or outcomes of comparisons) or consider the consistency between conceptual definitions of comparison and items included in intensive assessments. These are valuable endeavors and deserve more attention than we could provide, within our predetermined scope (i.e., summarizing existing methods to assess comparisons within-person in the natural environment).

Consequently, essential next steps for future research are to synthesize findings from studies included in this review (as well as any relevant studies that were overlooked) and examine the overlap between conceptual definitions of social comparison and assessment items. Such syntheses could provide additional insight into relations between definitions, methods (e.g., instructions, item wording, response scales, recording frequency), and outcomes such as comparison occurrence, frequency, and consequences (e.g., for affect or behavior). A more specific focus on comparison outcomes also might facilitate synthesis of effect sizes across studies, as with meta-analysis. Lastly, although a set of concrete guidelines for conducting intensive assessment studies may be preferable to a set of considerations (see **Table 4**), the optimal methods depend on the specific research questions, populations, and resources researchers have at their disposal. This allows for considerable flexibility, which may better meet the needs of future work in this area.

CONCLUSIONS

Capturing the social comparison process using intensive assessment methods has the potential to provide missing (and needed) information about how people vary in their use of and responses to comparison over short periods of time, in their natural environments. As existing work in this area has focused on the experiences of college students and on appearance comparisons among women, there is much room to expand our understanding of these processes; assessing men, older individuals, and specific groups for whom comparisons may be particularly influential (e.g., those with chronic illnesses or who undertake behavior change efforts) would be useful. In addition, given the variety of methodological options for assessing comparisons in the natural environment, there is need for greater attention to the rationales for protocol decisions and to the types of information reported in published articles. This includes descriptive information such as averages and variability estimates (with the level[s] of analysis specified), reactivity indicators, and the training participants receive to prepare them for recognizing comparisons in their daily lives. Comparisons that occur via social media, those made to imaginary targets, or those that happen automatically may be missed with intensive assessment if not specified in training or in the assessment tool itself. Further, many features of a comparison might affect its outcome, and some features that could provide needed insight rarely are assessed (e.g., identification and contrast); new studies that include assessment of these features may be particularly useful for elucidating within-person comparison processes. Finally, objectively assessed behavior represents a new frontier for understanding within-person variability in the effects of social comparison. Future work in these areas could inform both a basic understanding of comparison processes as they unfold in the real world and intervention content that responds to varying comparison needs and preferences.

AUTHOR CONTRIBUTIONS

DA, JM, and JS conceptualized the manuscript. MB, KP, LT, and LS completed initial data extraction. DA and JM reviewed data extraction and resolved discrepancies. All authors contributed to, reviewed, and approved the manuscript text.

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System Justification Among the Disadvantaged: A Triadic Social Stratification Perspective

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The financial downturn in major economies of the world between 2007 and 2008 caused the bailout of several corporations and financial institutions that ostensibly served the economic interests of the wealthy 1% more than it did for the poorer 99%. Although there were pockets of resistance by the 99% (e.g., the occupy Wall Street movement), working- and middle-class people were surprisingly less supportive of economic redistributive policies and in favor of the prevailing economic order that squeezed the prospects of the less affluent more than it did the wealthy (Kuziemko et al., 2014; Jost, 2017; see also García-Sánchez et al., 2019). Elsewhere in the social psychological literature, research has documented a similar orientation amongst society's disadvantaged: the tendency to attribute more positive stereotypes/traits to privileged members of society, and often at the expense of their own group (the so-called "*outgroup favoritism effect*" Cichocka et al., 2015; Hoffarth and Jost, 2017; Samson, 2018).

Research that has tried to make sense of this paradoxical *system-justifying* outgroup favoritism has suggested that such an effect may be more pronounced when status differences between the disadvantaged and the advantaged are seen as legitimately achieved, and when the system is perceived to be inescapable and durable/stable (Friesen et al., 2019). Indeed, the outgroup favoritism phenomenon is described as "system-justifying" because such tendencies have the potential to entrench social inequality, especially when these attitudes are held by people who are disadvantaged in the prevailing order. This evidence of system-justifying attitudes among disadvantaged appears puzzling because these are people who incur several psychological costs (such as reduced collective self-esteem and entitlement, and increased psychological maladjustment see Major, 1994; Jetten et al., 2017) by virtue of their poorer outcomes within existing societal arrangements. That is, one would have expected (e.g., from a rational choice perspective, Coleman, 1990) for the less privileged in society to be more supportive of systems and policies than serve their interest, rather than those that ostensibly strip them away (Riker and Ordeshook, 1968; Feddersen, 2004).

Different theoretical formulations have largely focused on *when* the puzzling occurrence of system-justifying attitudes is most likely (Friesen et al., 2019), especially amongst society's disadvantaged (Jost, 2017, 2019). However, the unfolding debate around the phenomenon now centers on *why* the disadvantaged would hold such attitudes in the first place. In this opinion

paper, we consider the dominant perspective put forward by the system justification theory (Jost and Banaji, 1994), and then contrast its explanation with alternative propositions, including the newer triadic social stratification theory (Caricati, 2018).

EXPLAINING THE SYSTEM JUSTIFICATION EFFECT VIA THE SYSTEM JUSTIFICATION THEORY

The system justification theory (SJT; Jost and Banaji, 1994) recognizes—as do other perspectives like social identity theory (Tajfel and Turner, 1979)—that people are motivated to support their self (ego) and group interests. However, SJT goes further to propose the existence of an autonomous motivation that supports the existing social arrangement, called the *system justification motivation*. According to SJT, people are driven by a conscious or unconscious system-oriented need "to defend, bolster, and justify existing social, economic, and political institutions and arrangements" (Jost and Kay, 2010, p. 1,148) and this represents a further type of human motivation because it functions to support the status quo alone (Jost and Banaji, 1994, p. 10). According to the original formulation of SJT (Jost and Banaji, 1994) and its subsequent refinements (e.g., Jost et al., 2004), this system-oriented motivation is ostensibly rooted in epistemic needs (e.g., to avoid uncertainty), existential needs (e.g., to reduce distress and threat), and relational needs (e.g., to embrace shared realities; Jost et al., 2008), which manifests most strongly when people's yearnings for predictability and/or certainty within a system that they depend on, is strong (Jost, 2017). Given that the stability and predictability of existing systems guarantees the benefits (or interests) of the privileged, it is cognitively straightforward for society's advantaged to support societal systems that ensures their privileged position. However, supporting unequal societal systems may not be as straightforward for society's disadvantaged (i.e., the 99%) as it might be for their advantaged counterparts. According to SJT, this is because, for the disadvantaged, satisfying their inner yearning for predictability (and control) via support for existing arrangements may come at the expense of relinquishing their struggle for equity/equality (i.e., group interests), and these competing demands are likely to cause cognitive dissonance (Festinger, 1957)—a psychological dilemma that people are often motivated to eliminate/avoid.

Hence, SJT contends that acquiescing to the status-quo may be a much easier strategy for the disadvantaged to resolve their cognitive dilemma, than to adopt the potentially uphill task of changing (legitimate and stable) realities that people have become accustomed to Jost et al. (2012). According to SJT, this scenario creates the potential for the disadvantaged to be even more likely than their privileged counterparts to justify disadvantageous realities because, such rationalization can help to soothe the pain associated with their discomforting internal struggle (Jost and Hunyday, 2002; Osborne and Sibley, 2013; c.f. Owuamalam et al., 2017). In short, according to SJT, the disadvantaged support societal systems/tradition because a system justification motive that operates in the opposite direction to people's interests causes them to do so.

HOW STRONG IS THE EVIDENTIAL BASIS FOR SJT'S DISSONANCE-INSPIRED EXPLANATION FOR THE SYSTEM JUSTIFICATION EFFECT?

Consistent with SJT, pockets of nationally representative cross-sectional surveys (e.g., Jost et al., 2003; Henry and Saul, 2006; Sengupta et al., 2015), and experimental studies (e.g., van der Toorn et al., 2015) have shown that the disadvantaged may support societal systems more strongly than their privileged counterparts do, especially when they are dependent on such systems. However, an even greater number of similar nationally representative surveys (Caricati and Lorenzi-Cioldi, 2012; Brandt, 2013; Caricati, 2017; Vargas-Salfate et al., 2018; see Yang et al., 2019 for a review) have reported unsupportive evidence for the dissonance-inspired version of the system justification thesis, showing that system justification increases as social advantage increases. The unsurportive evidence for SJT's dissonance-inspired explanation is not limited to cross-sectional studies. Experimental studies also report contradictory evidence (e.g., Trump and White, 2018; Owuamalam and Spears, 2020), even when a sense of poverty (vs. affluence) is experimentally induced: people tend to show a greater inclination toward challenging unequal systems by, for example, a fair allocation of rewards to the relevant parties (Bratanova et al., 2016). Other indirect evidence corroborate the foregoing trends, showing that the disadvantage (e.g., African Americans) are more likely to endorse the conspiratorial belief that the system is rigged against African Americans (Crocker et al., 1999), when a standard reading of SJT would suggest otherwise.

CRITICISMS AND OTHER EXPLANATIONS FOR THE SYSTEM JUSTIFICATION EFFECT

In the face of the foregoing empirical discrepancies (see also Li et al., 2020), Owuamalam et al. (2018, 2019a,b) have queried the necessity of SJT's system motive explanation and proposed instead that the system justification effect can be more parsimoniously explained with the traditional interest-based perspectives via their social identity model of system attitudes (SIMSA). Rooted in the social identity tradition, SIMSA assumes that the system justification effect can be driven by the need for accuracy and a positive social identity, and advances three explanations in these regards. The first explanation is that, when positions within an existing order are legitimate and stable, system-justifying attitudes can occur amongst the disadvantaged because accuracy motives constraint their ability to objectively contest the superiority of a clearly superior outgroup competitor. The second explanation is that, when the system is unstable in the long run, system justifying attitudes can represent an expression of hope that

the system will one day provide the opportunity for the upward advancement of one's disadvantaged ingroup. The third explanation is that, when an inclusive social identity is salient, system justification effect can result from ingroup bias at this superordinate level of self-categorization, such that system support is nothing more than an expression of common-ingroup favoritism.

Although SIMSA as a theoretical framework for understanding the system justification effect is in its nascent stages, available evidence corroborates some of its key assumptions. For example, some studies have shown a positive correlation between system justification and hope for both the future advancement of the ingroup (Owuamalam et al., 2016; Sollami and Caricati, 2018; see also Vasilopoulos and Brouard, 2019) and individual mobility (Li et al., 2019). Others have shown that members of a religious minority group who emphasized their inclusive (common-ingroup) identity (e.g., their nation) reported stronger system-justifying attitudes (Jaśko and Kossowska, 2013). In short, consistent with SIMSA's explanations, there is evidence that the system justification effect might be the disadvantaged's attempt to defend, protect and bolster their social identity.

THE TRIADIC SOCIAL STRATIFICATION EXPLANATION FOR THE SYSTEM JUSTIFICATION EFFECT

The triadic social stratification theory (TSST; Caricati, 2018) agrees with SIMSA in proposing that the system justification effect can be rooted in social identity needs. However, unlike SIMSA (or SJT for that matter), TSST focuses on processes of intergroup comparison that can help to explain the system justification effect amongst disadvantaged groups within a triadic (even multiple) hierarchical system. The key assumption here is that, in several social hierarchies, groups are neither inherently high in status (e.g., the 1%) or low in status (e.g., the 99%), and that disadvantage (vs. advantage) often depend on the existence of one or more status outgroups to which one's group compares on some material, psychological or social outcome. Because people are motivated to achieve a positive social identity, there is often the tendency to engage in intergroup comparisons that maximize people's chances of achieving this goal. Members of intermediately positioned disadvantaged groups might compare their outcomes to those who are worse-off than they are (i.e., downward comparison)

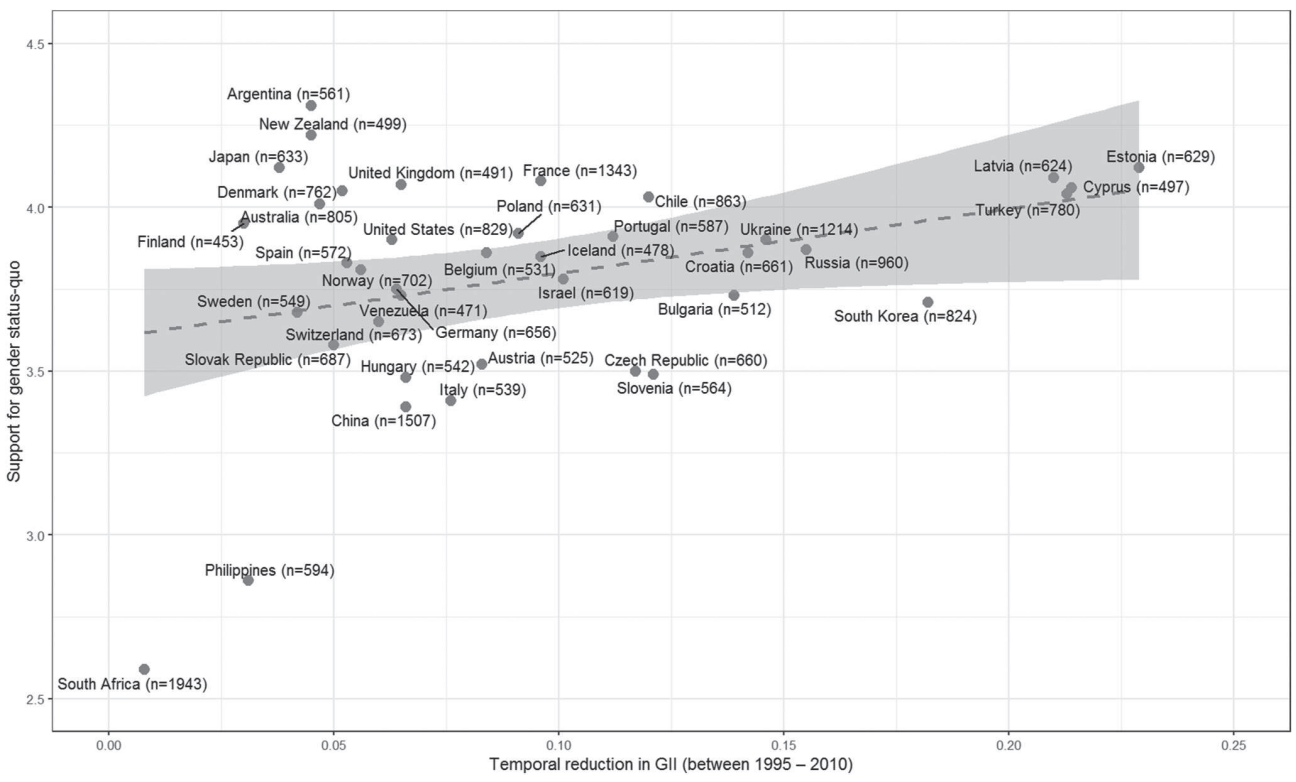

FIGURE 1 | Degree of reduction in gender inequality between 1995 and 2010 predicts tacit support for the gender status-quo in 2009 amongst 27,970 women in 39 nations, $r = 0.33$ ($N = 39$, $p = 0.04$) (ISSP Research Group, 2017) (source: ISSP Research Group, 2017). Gender inequality index (GII; United Nations Development Programme, 2019) measures the inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labor market. Support for gender status-quo was measured with the item "Getting ahead: How important is being born a man or a woman?" (1 = *essential,* 5 =*Not important at all);* because accepting that gender does not matter in getting ahead represents satisfaction with the gender status-quo. This item is also conceptually similar to other items on the gender system justification measure [e.g., "everyone (male or female) has a fair shot and wealth and happiness"—Jost and Kay, 2005]. Gender is conceived here, not as a binary category, but as a multi- layered social stratification that includes men, women, and then transgendered people.

rather than better-off than they are (i.e., upward comparison), and this type of contrast can enable a sense of positive identity (and satisfaction) needed to accept the way things are (Dunham et al., 2014).

But, intermediately placed groups are still lower in status to group(s) that are higher-up in the social stratification, and it is possible that both downward (favorable) and upward (unfavorable) comparisons may be simultaneously active sometimes (e.g., Caricati, 2012), and how system justification is navigated under such circumstance becomes important. Of course the system justification effect is unlikely to emerge when upward (unfavorable) comparison trumps downward (favorable) comparison, and this provision helps to explain a range of radical and non-radical demonstrations of discontent that are seen amongst the disadvantaged (Wright, 2009; Teixeira et al., 2019). Our point, however, is that so long as downward (favorable) comparisons overwhelm the potential for unfavorable comparisons, system justification should be a likely outcome amongst the disadvantaged. In short, the flexibility in the choice of intergroup comparison amongst intermediately placed disadvantaged groups, can provide the incentive for supporting the status quo because, at some level, the existing reality isn't as bad for them as it is for other groups that are lower down the "food chain" (Becker, 2012). That is, if disadvantaged groups can achieve a positive identity via downward comparison(s), they may be motivated to support a system in order to protect the interests that are already satisfied by an arrangement that affords them more opportunities than others. Supportive evidence for this argument comes from Caricati and Sollami (2018), showing that nurses were more likely to justify the hierarchically sorted healthcare professional system when they could compare their outcomes to those of their lower status counterparts (i.e., healthcare assistants) relative to when this favorable downward comparison was not possible.

COMPARISONS ACROSS TIME

The foregoing comparison-based explanation relates to a single time point (i.e., the justification of an *existing* social arrangement). It is also possible to conceive of situations in which comparisons can be made across different time points, such as when people compare their present with their past (e.g., Zagefka and Brown, 2005; Guimond and de la Sablonnière, 2015), their future (Owuamalam et al., 2018) or their temporal intergroup outcomes (de la Sablonnière et al., 2009; Bougie et al., 2011). TSST assumes that as long as these temporal comparisons are favorable (in the present or future), system justification should be a likely outcome amongst members of intermediately placed disadvantaged groups because, they are distinctly enabled by their uniquely malleable position to exploit fluctuations within the system. That is, intermediately placed disadvantaged groups might believe that the existing system is fair (and justified) because it has permitted an improvement to their group's position relative to its situation in the past, or because it will permit further improvements to their outcomes in the future (akin to Owuamalam et al., 2018 hope for future ingroup status explanation). Although evidence for this latter proposition is absent in the published literature, other publicly archived data from the International Social Survey Program (ISSP) provide an initial confirmation of these assumptions. As **Figure 1** indicates, women in countries where the gender inequality index (GII) has reduced considerably in 2010 from what it was in the past (down to 1995), tend to be more supportive of the gender status-quo—dismissing the notion that gender is a relevant factor for upward social mobility.

CONCLUDING REMARKS

To be clear, we are neither proposing a general theory of intergroup relations, nor is the goal here to explain all instances of system justification amongst the disadvantaged. Rather, our aim was to use insights from the TSST to offer a new identity-based explanation for the system justification effect among society's disadvantaged. Indeed, the dominant explanation for the system justification effect has been the assumption of a system motive that runs counter to self/group interests. However, both proponents and opponents of this "special system motive" explanation do not neatly account for the effect of intergroup comparisons on system justification. We close this gap by proposing that instances of system justification among the disadvantaged can also be traced back to the favorable comparisons that are possible when disadvantaged groups occupy an intermediate position within a multiple stratified status system. Furthermore, the current analysis extends these insights to temporal comparisons, and suggests that system justification is likely to manifest amongst intermediately placed disadvantaged groups when these (temporal) contrasts are favorable.

Finally, it is tempting to argue, based on SJT, that intergroup comparisons may be part-and-parcel of the dissonance process that causes system-justifying tendencies amongst the disadvantaged because, it potentially involves the *suppression* of an upward comparison that ordinarily enables group-based motives, while at the same time *permitting* a downward comparison that should allow the system motive to thrive. The problem with this argumentation, however, is that it becomes difficult to separate the effects that are tied to the system motive from an interest-based explanation because, in this situation, intermediately positioned disadvantaged group members may be supporting the status quo because they are at least better-off than others. Research is needed to unpack these complexities.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Seeking Positive Strengths in Buffering Athletes' Life Stress–Burnout Relationship: The Moderating Roles of Athletic Mental Energy

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In search of positive strengths that bolster athletes' reaction to stress, the purpose of this study was to examine the moderating effects of athletic mental energy on the athletes' life stress–burnout relationship. This study recruited two samples (Study 1 = 230; Study 2 = 159) and administered the College Student-Athlete's Life Stress Scale (CSALSS; Lu et al., 2012), Athletic Mental Energy Scale (AMES; Lu et al., 2018), and Athlete Burnout Questionnaire (ABQ; Raedeke and Smith, 2001). Two separate hierarchical multiple regression analyses found that the emotional and cognitive components of athletic mental energy moderated the athletes' life stress–burnout relationship across the two studies. Results provided the initial evidence that athletic mental energy can be positive strengths in buffering the stress–burnout relationship. Theoretical implications, limitations, practical applications, and future research directions are discussed.

Keywords: youth athletes, positive psychology, competitive sports, psychological well-being, optimal state of mind

INTRODUCTION

Although sports professionals and physical educators suggest that engaging in competitive sports bring physical, social, and psychological benefits for the youth (Holt et al., 2011), it is reported that engaging in competitive sports is not totally beneficial. On their journey to athletic success, young athletes encounter many stressors that may endanger their physical and psychological well-being. These stressors include sport-specific stress (e.g., coach–athlete relationship, performance demands, training adaptation, and sports injury) and general

life stress (e.g., interpersonal relationship, academic demands, romantic relationship, and family relationship) (Lu et al., 2012). In addition, in organizational sports, many environmental arrangements and operational procedures make competitive sports challenging and demanding. These organizational stressors include team selection, traveling, financial support, facilities adaptation, spectator pressure, rules and regulations, and competition format, which must be well-managed to avoid adverse consequences (Arnold et al., 2013; Fletcher et al., 2006). Furthermore, exacerbating athletes' stress, it is reported that if young athletes want to be successful, they must start their training at a very young age, train all year-round, and sometimes with excessive training (Gustafsson et al., 2011).

Although stress is an inevitable part of life in general and competitive sports specifically, it is well-documented that excessive stress may lead to physical and mental illness/problems. In terms of physical problems, excessive stress may cause gastrointestinal ulcers (Marik et al., 2010), increase hyperglycemia (Bosarge and Kerby, 2013), elevate the possibility of asthma (Theoharides et al., 2012), and increase the risk of heart disease (Steptoe and Kivimaki, 2012). On the mental aspect, excessive stress is related to hopelessness and suicide ideation (Ibrahim et al., 2014), depression (Risch et al., 2009), eating disorders (DiBartolo and Shaffer, 2002), lower well-being (DiBartolo and Shaffer, 2002), decreased performance (Humphrey et al., 2000), and burnout (Gustafsson and Skoog, 2012; Lu et al., 2016).

Burnout is a serious condition that has received much attention by researchers because it could lead to athletes' dropout and lower psychological well-being (Gustafsson et al., 2011). Athletic burnout is a complex psychophysical syndrome characterized by "*. . . feeling physically and psychologically exhausted from the demands of training and competing, perceive a reduced sense of accomplishment, and experience sport devaluation in which they engage*" (Raedeke and Smith, 2001, p. 283). Smith (1986) proposed a cognitive-affective model of athletic burnout in which burnout is a reaction to chronic stress. According to Smith (1986), athletes live in a harsh environment filled with conflicts and demands, such as meeting athletic and academic demands simultaneously or within a short time, team selection that requires high-performance records or high standards of physical fitness/skill tests, or dealing with interpersonal relationships within and outside sports. Under such conditions, Smith (1986) contends that athletes' cognitive appraisals—evaluating the balance between challenges and resources, and potential consequences of not meeting the demands—lead to athletic burnout. Smith (1986) contends that these cognitive appraisals play a central role in the process. Specifically, when athletes perceive that demands surpass personal resources, and consequences will be severe, they have negative physical and psychological responses, such as anxiety, tension, insomnia, and illness. Finally, physiological and psychological responses lead to rigid and inappropriate behavior, decreased performance, and withdrawal from activity.

Past research adopting the Smith (1986) burnout model generally supported the link between stress and athletic burnout (Tabei et al., 2012; Chyi et al., 2017; Chang et al., 2018). It is imperative to understand the moderators/mediators underlying the stress–burnout relationship so that practitioners can use this knowledge to help athletes avoid burnout (Chang et al., 2017). Some researchers have investigated those mediators/moderators. For example, Gustafsson and Skoog (2012) sampled 217 young athletes to examine the mediating role of optimism in the stress and burnout relationship. They found perfectionism, perceived stress, and burnout all correlated, and perceived stress fully mediated the optimism–burnout relationship. Similarly, Chang et al. (2017) sampled 300 college student-athletes and measured life stress, negative thoughts, and burnout. They found life stress and negative thoughts positively correlated with burnout. Additionally, hierarchical regression analyses found that negative thoughts mediated the stress–burnout relationship.

Although examining factors that mediate the stress–burnout relationship is critical, it is even more important to understand factors that can change this stress–burnout relationship, which are moderators (Barron and Kenny, 1986, p.1174). In this line of research, researchers focus on athletes' positive strengths/merits as a salient factor. For example, in a study that examined conjunctive effects of athletes' resilience and social support in moderating the stress–burnout relationship, Lu et al. (2016) sampled 218 student-athletes and measured life stress, resilience, social support, and burnout. A series of one-, two-, and three-way interactions examined disconjunctive and conjunctive moderations. They found under high life stress condition, athletes' resilience and coaches' social support conjunctively moderated the stress–burnout relationship. Specifically, under high life stress conditions, athletes with high resilience and coaches' high tangible social support were less susceptible to burnout than those with high resilience but low coaches' tangible social support. Recently, Chang et al. (2018) used a two-wave, time-lagged survey to examine the moderating effects of psychological flexibility on the athletic identity–burnout relationship. They found that high athletic identity athletes with low psychological flexibility developed emotional exhaustion (one factor of burnout) over time, but high athletic identity with high psychological flexibility was negatively associated with emotional exhaustion over time.

Research on positive strengths/merits that moderate the athletes' life stress–burnout relationship is insightful for the researchers in the sports domain. Specifically, as the world entered a new millennium, psychologists turned their focus away from treating mental illness to building strengths and virtues (Seligman, 2002). Many positive strengths, such as gratitude (e.g., Chang et al., 2018; Gabana et al., 2019), resilience (e.g., Lu et al., 2016; Hill et al., 2018), mindfulness training (Jouper and Gustafsson, 2013), intrinsic motivation (Cresswell and Eklund, 2006; Li et al., 2013), harmonious passion (Gustafsson et al., 2011), forgiveness (e.g., Watson et al., 2017; Akhtar and Barlow, 2018), and altruism (e.g., Feigin et al., 2018) have been examined by researchers in sports as well as in many domains. Therefore, sports researchers should continue to seek positive strengths/merits that may moderate the athletes' stress–burnout relationship.

Recently, Lu et al. (2018) adopted the conceptual framework of mental energy proposed by the International Life Science

Institute (ILSI; O'Connor and Burrowes, 2006, p.2) and developed a sport-specific construct termed "athletic mental energy," which may be related to the athletes' stress–burnout relationship. In mainstream psychology, mental energy is defined as "*. . .an individual's ability to continue long hours of thinking, concentrating attention, and blocking distractions to achieve a given task* (Lykken, 2005)." Lykken (2005) contended that many great scholars, such as Archimedes, Galileo, Newton, and Einstein, create so many astonishing works because they have a strong mental energy. Lu et al. (2018) adopted the ILSI framework of mental energy and followed the guidelines suggested by the Standards for Educational Psychological Testing (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education, 2014) to develop a sport-specific mental energy scale called Athletic Mental Energy Scale (AMES). Across six studies, Lu et al. (2018) found that the six-factor, 18-item AMES had appropriate validity and reliability. In particular, athletic mental energy negatively correlated to athletic burnout and life stress but positively with a positive state of mind (Lu et al., 2018; pp. 7–9).

Thus, we considered that athletic mental energy might play a moderating role between athletes' life stress and burnout for several reasons. First, although Lu et al. (2018) found that athletic mental energy negatively correlates to athletic burnout and athletes' life stress, the role of athletic mental energy in the stress–burnout relationship has never been fully examined. Second, athletic mental energy consists of positive components, which is in line with positive psychology. The emotional components of athletic mental energy, such as vigor and calm, are frequently reported in sports literature. For example, Brandt et al. (2016) found that champion rowers had higher vigor and lower depression and fatigue than those who are not champions. Similarly, Lane et al. (2017) conducted a large-scale Internet experiment (n = 73,568) and found that participants high in depression performed poorly in Internet games. In contrast, those high in vigor and low in depression performed better.

Furthermore, according to Lu et al. (2018), athletic mental energy also includes positive cognitions, such as confidence, motivation, and concentration. In the sports domain, these perceptions are associated with high performance. For example, Abdullah et al. (2016) recruited 26 Malaysian national soccer players to complete the Psychological Skills Inventory for Sports (PSIS; Mahoney et al., 1987) before the Malaysian super cup. Then, 10 experts judged their performance during the games. They found that participants' motivation, self-confidence, anxiety control, preparation, and concentration predicted soccer performance. Similar studies have found that confidence, motivation, and concentration are the key factors associated with athletic success (e.g., Fransen et al., 2015; Lochbaum and Gottardy, 2015).

Based on the above literature, the purpose of this study was to examine the moderating effects of athletic mental energy on the stress–burnout relationship. We hypothesized that athletic mental energy moderates the stress–burnout relationship. We examined these relationships in two studies with two different samples.

MATERIALS AND METHODS

Study 1

Purpose

The purpose of Study 1 was to examine the moderating effects of athletic mental energy on the athletes' life stress–burnout relationship.

Methods

Participants

Participants were 230 college student-athletes (males = 164; females = 66) with a mean age of 19.92 years (SD = ±1.59) from 14 universities in Taiwan. At the time of the data collection, participants were all in their regular training seasons and had been participating in 25 varied individual and team sports, such as gymnastics, track and field, golf, weightlifting, basketball, volleyball, Tae-kwon-do, badminton, and baseball. The average participation years in competitive sports was 6.46 years (SD = ±4.02).

Measurements and Procedures

Prior to data collection, the researchers gained approval from a local institute ethical committee (TSMHIRB-2-R-030-2.1). Then, the first author contacted target teams' coaches through e-mails and phone calls and briefly informed them of the purpose of the research, confidentiality, and anonymity for participation. After agreement, we made an appointment to collect data. A survey package included a demographic questionnaire and psychological scales [i.e., Athlete Burnout Questionnaire (ABQ), Athletic Mental Energy Scale (AMES), and College Student-Athletes' Life Stress Scale (CASLSS)]. To prevent social desirability effects, we informed participants that this was a study to explore college students' life experiences, that there were no right or wrong answers, and that all responses would be confidential. If they agreed, they signed the consent forms and were asked to answer the questions as truthfully as possible. The measures were as follows:

Demographic Questionnaire

The demographic questionnaire collected participants' age, gender, types of sports, and years of athletic experiences.

ABQ

The ABQ (Raedeke and Smith, 2001) is a self-reported inventory that assesses athletes' burnout experiences. The ABQ has three subscales including *reduced sense of athletic accomplishment*-sample question such as "I accomplish nothing from sports," *perceived emotional and physical exhaustion*-sample question such as "I feel so tired from the training that I have trouble finding energy to do anything else," and *devaluation of sports participation*-sample question such as "The effort I spend in sports would be better spent doing other things." The ABQ used a six-point Likert scale from 1 (never) to 6 (always). Higher scores on the ABQ indicate that athletes are high in burnout. In this study, we used the total score of the ABQ for the main analysis, and its Cronbach's α was 0.92.

CSALSS

The 24-item CSALSS (Lu et al., 2012) was used to assess situations that athletes encountered in their daily life and sports and considered as major stressors in their lives. The 24-item CSALSS has eight factors, including (a) sports injury, (b) performance demand, (c) coach relationships, (d) training adaptation, (e) interpersonal relationships, (f) romantic relationships, (g) family relationships, and (h) academic requirements. According to Lu et al. (2012), CSALSS can be categorized into two major components—sport-specific stressors (by adding factors a, b, c, d) and general life stressors (by adding factors e, f, g, h). Sample questions are: "I am annoyed with my coach's bias against me" or "I am annoyed with my injuries." Participants indicated the frequency of such experiences on a six-point Likert scale that ranged from 1 (never) to 6 (always). The Cronbach's α of the two composite factors in this study were 0.85 and 0.86. We used the two composite scores of CSALSS for the main analysis.

AMES

The 18-item AMES (Lu et al., 2018) was used to assess an athlete's perception of his/her existing energy state, which is characterized by the intensity in motivation, confidence, concentration, and mood. There are six factors in the 18-item AMES, each with three items, including (a) vigor (items 1, 2, and 15), (b) confidence (items 3, 9, and 13), (c) motivation (items 4, 8, and 16), (d) tireless (items 7, 11, and 12), (e) concentration (items 5, 6, and 10), and (f) calm (items 14, 17, and 18). When answering AMES, participants have to identify the feeling of each item on a six-point Likert scale that ranged from 1 (not at all) to 6 (completely so). The items and scoring for AMES are in **Appendix A**, which is provided by our correspondence author. The Cronbach's α of the six factors of the AMES in this study ranged from 0.77 to 0.89, and the total score of AMES was 0.93. We used the six factors of AMES and the total score of AMES for the main analysis.

Statistical Analyses

We used Pearson correlation analysis to examine the relationships among the two composite scores of life stress, the six factors of mental energy, and the total burnout score. Furthermore, hierarchical regression analyses were used to examine the moderating effect of athletic mental energy on the stress–burnout relationship. To examine the main effects of life stress and athletic mental energy on burnout, two types of life stress (i.e., sport-specific and general life stress) and athletic mental energy (i.e., six factors of the AMES and the total score of the AMES) were entered in step 1. The interaction analysis was then entered in step 2 (i.e., sport-specific/general life stress × six components of athletic mental energy). The interaction scores were calculated by centering on reducing the collinearity between the independent variable and the interaction term (Aiken and West, 1991). The significance was set at $p < 0.05$. We used SPSS 18.0 statistical software for all analyses. Furthermore, to estimate the interaction effect, we followed Aiken and West's (1991) equation to compute simple slopes when the interaction was significant.

Results

Table 1 indicates that all subscales exhibited good to excellent internal reliability (α = 0.77–0.93). Zero-order correlations show that all subscales of athletic mental energy were negatively correlated with burnout ($r = -0.33 \sim -0.45$, $p < 0.01$), and the two types of life stress were positively correlated with burnout ($r = 0.37$ and 0.39, $p < 0.01$). **Table 2** indicates the moderating effects of athletic mental energy on the sport-specific stress–burnout relationship. Results show that five factors of athletic mental energy, all except concentration, moderated the sport-specific stress–burnout relationship as follows: vigor (β = −0.226, $\Delta R^2 = 0.050$, $p < 0.01$), confidence (β = −0.128, $\Delta R^2 = 0.016$, $p < 0.05$), motivation (β = −0.147, $\Delta R^2 = 0.021$, $p < 0.05$), tireless (β = −0.179, $\Delta R^2 = 0.032$, $p < 0.01$), calm (β = −0.139, $\Delta R^2 = 0.019$, $p < 0.05$), and total score of mental energy (β = −0.187, $\Delta R^2 = 0.034$, $p < 0.01$).

The interaction and simple slopes for the moderating effects of athletic mental energy on the sport-specific life stress–burnout relationship were all similar. All slopes (i.e., vigor, confidence, motivation, tireless, calm, and total mental energy score) show

TABLE 1 | Descriptive statistics and bivariate correlations for all study variables (Study 1).

	1	2	3	4	5	6	7	8	9	10
1. SS										
2. GLS	0.62**									
3. Vigor	−0.49**	−0.49**								
4. Confidence	−0.46**	−0.43**	0.64**							
5. Motivation	−0.33**	−0.34**	0.62**	0.64**						
6. Cconcentration	−0.45**	−0.33**	0.56**	0.60**	0.51**					
7. Tireless	−0.45**	−0.33**	0.52**	0.54**	0.41**	0.46**				
8. Calm	−0.37**	−0.37**	0.45**	0.60**	0.50**	0.63**	0.49**			
9. Mental energy	−0.54**	−0.48**	0.78**	0.84**	0.76**	0.80**	0.74**	0.79**		
10. Brunout	0.37**	0.39**	−0.36**	−0.33**	−0.40**	−0.33**	−0.39**	−0.31**	−0.45**	
Mean	2.45	2.16	4.33	4.01	4.67	4.03	3.49	3.99	4.09	2.72
SD	0.79	0.85	0.81	0.95	0.96	1.10	1.20	1.10	0.80	0.98
α	0.85	0.86	0.77	0.80	0.84	0.87	0.89	0.87	0.93	0.92

*SS, sport-specific stressors; GLS, general life stressors. *p < 0.05, **p < 0.01.*

TABLE 2 | Summary results of the moderating effects (Study 1).

	Step 1: direct effect			Step 2: interaction effects			
	β	*t*-value	R^2	β	*t*-value	R^2	ΔR^2
SS	0.250	3.61**	0.174	0.214	3.15**	0.224	0.050**
Vigor	−0.233	−3.37**		−0.231	−3.44**		
SS × Vigor				−0.226	−3.82**		
SS	0.269	3.95**	0.167	0.256	3.77**	0.183	0.016*
Confidence	−0.207	−3.04**		−0.209	−3.09**		
SS × Confidence				−0.128	−2.12*		
SS	0.261	4.21**	0.220	0.249	4.05**	0.241	0.021*
Motivation	−0.313	−5.04**		−0.291	−4.70**		
SS × Motivation				−0.147	−2.50**		
SS	0.270	3.99**	0.168	0.275	4.07**	0.179	0.011
Concentration	−0.209	−3.09**		−0.189	−2.76**		
SS × Concentration				−0.105	−1.71		
SS	0.237	3.57**	0.199	0.224	3.43**	0.230	0.032**
Tireless	−0.286	−4.31**		−0.292	−4.48**		
SS × Tireless				−0.179	−3.05**		
SS	0.289	4.44**	0.169	0.280	4.34**	0.188	0.019*
Calm	−0.204	−3.14**		−0.204	−3.16*		
SS × Compose				−0.139	−2.31**		
SS	0.172	2.48*	0.224	0.160	2.35*	0.258	0.034**
Mental energy	−0.357	−5.14**		−0.341	−5.00**		
SS × Mental energy				−0.187	−3.24**		

*SS, sport-specific stressors; GLS, general life stressors. *$p < 0.05$, **$p < 0.01$.*

a slow declining pattern. To save space, we show only the figure of the moderating effect of athletic mental energy on the sport-specific life stress–burnout relationship. As **Figure 1** illustrates, there is a moderating effect of athletic mental energy on the sport-specific life stress–burnout relationship, the simple slopes for low athletic mental energy is significant ($B = 0.467$, $p < 0.01$), but high athletic mental energy is not significant ($B = -0.036$, $p = 0.77$).

The simple slopes for the other five factors were similar as follows: (a) for vigor, the high vigor was $B = 0.004$ ($p = 0.98$) and the low vigor was $B = 0.573$ ($p < 0.01$); (b) for confidence, the high confidence was $B = 0.172$ ($p = 0.18$) and the low confidence was $B = 0.518$ ($p < 0.01$); (c) for motivation, the high motivation was $B = 0.144$ ($p = 0.22$) and the low motivation was $B = 0.528$ ($p < 0.01$); (d) for tireless, the high tireless was $B = 0.064$ ($p = 0.60$) and the low tireless was $B = 0.539$ ($p < 0.01$); and (e) for calm, the high calm was $B = 0.180$ ($p = 0.15$) and the low calm was $B = 0.575$ ($p < 0.01$). As earlier stated, the moderating effects of athletic mental energy on the general life stress–burnout relationship were not found in Study 1.

Conclusion

The purpose of Study 1 was to examine the moderating effects of athletic mental energy on the athletes' life stress–burnout relationship. Pearson correlation analyses and hierarchical regression analyses indicated that the five factors of athletic mental energy moderated the sport-specific stress–burnout relationship. Furthermore, the interaction slopes indicated that the moderating patterns for athletic mental energy on the sport-specific life stress–burnout relationship show a slowly declining pattern. The first study provides preliminary evidence that athletic mental energy moderated the sport-specific life stress–burnout relationship.

Study 2

Purpose

The purpose of Study 2 was to replicate Study 1 and provide more evidence on the moderating effects of athletic mental energy on the athletes' stress–burnout relationship.

Methods

Participants

The participants of Study 2 were 159 college soccer players (males = 139; females = 20) with a mean age of 20.2 years (SD = ± 2.04) from 10 universities in Taiwan. On average, participants had 9.92 years (SD = ±3.38) of training and competition experience in soccer.

Measurements and Procedures

The data collection procedure, measurements, and statistical analyses were the same as those in Study 1. In Study 2, the Cronbach's α of ABQ, AMES, and CASLSS were between 0.78 and 0.94 (**Table 3**), which show appropriate internal consistency.

Statistical Analyses

In Study 2, the statistical analysis procedures were similar to those of Study 1.

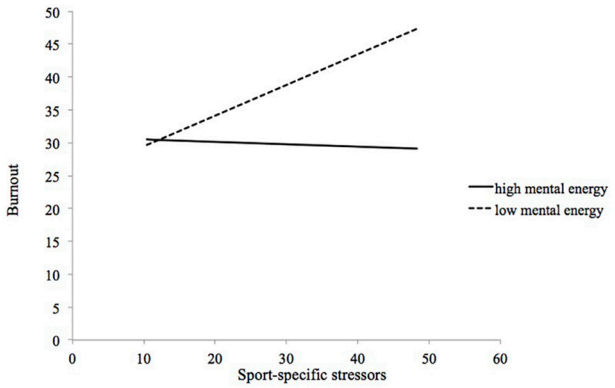

FIGURE 1 | The moderating effects of total mental energy on sport-specific life stress-burnout relationship.

Results

As **Table 3** indicates, zero-order correlations between the two types of life stress and athletic mental energy were significant ($r = -0.17 \sim -0.56$, $p < 0.05$). Also, the two types of life stress were positively correlated with burnout ($r = 0.53$ and 0.47, $p < 0.01$), and athletic mental energy was negatively correlated with burnout ($r = -0.38 \sim -0.54$, $p < 0.01$).

Table 4 shows the main predictive effects of life stress and athletic mental energy on burnout and the moderating effects of athletic mental energy on the life stress–burnout relationship. As **Table 4** indicated, there are four moderating effects of athletic mental energy on the sport-specific life stress–burnout relationship: confidence ($\beta = -0.165$, $\Delta R^2 = 0.027$, $p < 0.05$), concentration ($\beta = -0.143$, $\Delta R^2 = 0.020$, $p < 0.05$), calm ($\beta = -0.206$, $\Delta R^2 = 0.040$, $p < 0.01$), and total mental energy ($\beta = -0.159$, $\Delta R^2 = 0.025$, $p < 0.05$). However, two factors of the athletic mental energy—vigor and motivation—had no significant interaction.

Similar to Study 1, the interaction and simple slopes of the moderating effects of athletic mental energy on the sport-specific life stress–burnout relationship are similar. All figures (i.e., confidence, concentration, calm, and total mental energy score) show a slowly declining pattern. Again, we present only the figure of the moderating effect of the total athletic mental energy on the sport-specific life stress–burnout relationship. As **Figure 2** illustrates, the simple slopes indicate that there is a moderating effect of athletic mental energy on the sport-specific life stress–burnout relationship. The simple slopes for both high ($B = 0.310$, $p < 0.01$) and low ($B = 0.681$, $p < 0.01$) athletic mental energy score are all significant. The simple slopes for the other four factors were similar: (a) for concentration, the high concentration was $B = 0.298$ ($p < 0.05$) and the low concentration was $B = 0.604$ ($p < 0.01$); (b) for confidence, the high confidence was $B = 0.308$ ($p < 0.01$) and the low confidence was $B = 0.650$ ($p < 0.01$); and (c) for calm, the high calm was $B = 0.330$ ($p < 0.01$) and the low calm was $B = 0.767$ ($p < 0.01$).

Unlike Study 1, in Study 2, we found both main predictive effects and moderating effects of the athletic mental energy on the general life stress–burnout relationship. **Table 5** shows the main predictive effects of general life stress and athletic mental energy on burnout and the moderating effects of athletic mental energy on the general life stress–burnout relationship. As step 2 indicated, there are three moderating effects of athletic mental energy on the general life stress–burnout relationship: concentration ($\beta = -0.191$, $\Delta R^2 = 0.036$, $p < 0.01$), tireless ($\beta = -0.210$, $\Delta R^2 = 0.042$, $p < 0.01$), and total mental energy ($\beta = -0.134$, $\Delta R^2 = 0.017$, $p < 0.05$).

The figures of the moderating effects of athletic mental energy on the general life stress–burnout relationship are also similar. All figures (i.e., concentration, tireless, and total mental energy score) show a slowly declining pattern. To save space, we only show the figure of the moderating effect of the total athletic mental energy on the general life stress–burnout relationship. As **Figure 3** illustrates, the simple slopes indicate that there is a moderating effect of athletic mental energy on the general life

TABLE 3 | Descriptive statistics and bivariate correlations for all study variables (Study 2).

	1	2	3	4	5	6	7	8	9	10
1. SS										
2. GLS	0.61**									
3. Vigor	−0.38**	−0.29**								
4.Confidence	−0.45**	−0.38**	0.72**							
5.Motivation	−0.45**	−0.35**	0.74**	0.72**						
6.Concentration	−0.56**	−0.37**	0.63**	0.65**	0.66**					
7.Tireless	−0.40**	−0.17*	0.54**	0.54**	0.48**	0.50**				
8.Calm	−0.33**	−0.28*	0.67**	0.68**	0.62**	0.53**	0.55**			
9.Mental energy	−0.52**	−0.38**	0.87**	0.87**	0.86**	0.81**	0.72**	0.82**		
10.Brunout	0.53**	0.47**	−0.48**	−0.46**	−0.51**	−0.44**	−0.38*	−0.39**	0.54**	
Mean	2.76	2.39	4.27	4.09	4.55	4.11	3.51	4.04	4.10	2.70
SD	0.79	0.81	0.87	0.92	1.06	1.04	0.94	1.00	0.80	0.82
α	0.85	0.87	0.84	0.78	0.88	0.85	0.78	0.87	0.94	0.91

*SS, sport-specific stressors; GLS, general life stressors.*p < 0.05, **p < 0.01.*

TABLE 4 | Moderating effects of athletic mental energy on the sport-specific life stress-burnout relationship (Study 2).

	Step 1: direct effect			Step 2: interaction effects			
	β	*t*-value	R^2	β	*t*-value	R^2	ΔR^2
SS	0.403	5.84**	0.364	0.417	6.03**	0.375	0.011
Vigor	−0.321	−4.66**		−0.318	−4.63**		
SS × Vigor				−0.105	−1.65		
SS	0.400	5.50**	0.340	−0.429	−5.93**	0.366	0.027*
Confidence	−0.282	−3.88**		−0.266	−3.71**		
SS × Confidence				−0.165	−2.55*		
SS	0.368	5.17**	0.371	0.376	5.28**	0.379	0.007
Motivation	−0.346	−4.87**		−0.328	−4.54**		
SS × Motivation				−0.088	−1.36		
SS	0.407	5.06**	0.307	0.404	5.08**	0.327	0.020*
Concentration	−0.212	−2.64**		−0.201	−2.53*		
SS × Concentration				−0.143	−2.16*		
SS	0.443	6.10**	0.311	0.437	6.05**	0.326	0.015
Tireless	−0.204	−2.81**		−0.200	−2.77**		
SS × Tireless				−0.122	−1.85		
SS	0.445	6.39**	0.328	0.491	7.09**	0.368	0.040**
Calm	−0.242	−3.48**		−0.236	−3.48**		
SS × Calm				−0.206	−3.15**		
SS	0.335	4.50**	0.372	0.356	4.83**	0.397	0.025*
Mental energy	−0.363	−4.88**		−0.343	−4.66**		
SS × Mental energy				−0.159	−2.53**		

*SS, sport-specific stressors; Mental energy, total mental energy score.*p < 0.05, **p < 0.01.*

stress–burnout relationship. The slopes for both high ($B = 0.220$, $p < 0.05$) and low ($B = 0.527$, $p < 0.01$) athletic mental energy are all significant. The simple slopes for the other three factors were similar: (a) for concentration, the simple slope for high was $B = 0.195$ ($p > 0.05$) and the low was $B = 0.581$ ($p < 0.01$); (b) for tireless, the high was $B = 0.251$ ($p < 0.05$) and the low was $B = 0.697$ ($p < 0.01$); and (c) for total athletic mental energy, the high was $B = 0.220$ ($p < 0.05$) and the low was $B = 0.527$ ($p < 0.01$).

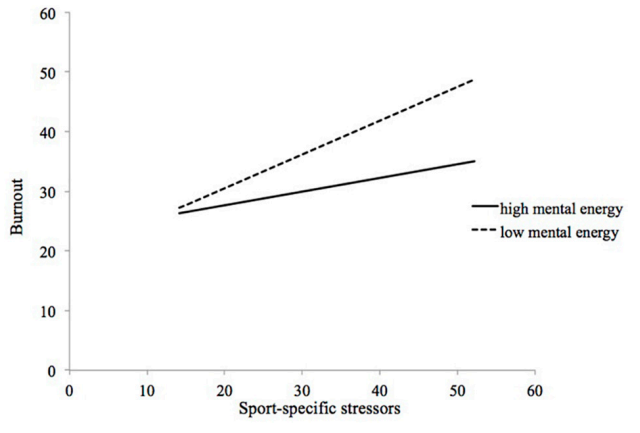

FIGURE 2 | Moderating effect of total athletic mental energy on sport-specific life stress-burnout relationship.

Conclusion

The purpose of Study 2 was to replicate Study 1 to examine the moderating effects of athletic mental energy on the athletes' life stress–burnout relationship. With a different sample, we found that four factors of athletic mental energy moderated the sport-specific stress–burnout relationship, and three factors of athletic mental energy moderated the general life stress–burnout relationship. Furthermore, all of the interaction slopes indicated that the moderating patterns for athletic mental energy on two types of the life stress–burnout relationship show a slowly declining pattern. Thus, Study 2 replicated the results from Study 1, but with added evidence. The theoretical implications, strengths, and limitations of the study and applications and future direction for the research are discussed in the following section.

DISCUSSION

Theoretical Contributions/Implications

In search of positive strengths that moderate the athletes' stress–burnout relationship, we extended Lu et al. (2018) work on athletic mental energy and examined its moderating effects on the athletes' stress–burnout relationship. Across two studies, we consistently found that athletic mental energy moderated the athletes' life stress–burnout relationship. Study 1 found that five factors of athletic mental energy (i.e., vigor, confidence, motivation, tireless, and calm) moderated the athletes' sport-specific life stress–burnout relationship but not the general life stress–burnout relationship. Study 2 found that three factors

TABLE 5 | Moderating effects of athletic mental energy on general life stress-burnout relationship (Study 2).

	Step 1: direct effect			Step 2: interaction effects			
	β	*t*-value	R^2	β	*t*-value	R^2	ΔR^2
GLS	0.368	5.47**	0.350	0.388	5.58**	0.355	0.005
Vigor	−0.369	−5.48**		−0.361	−5.34**		
GLS × Vigor				−0.076	−1.14		
GLS	0.349	4.87**	0.316	0.366	−5.03**	0.323	0.007
Confidence	−0.326	−4.55**		−0.319	−4.44**		
GLS × Confidence				−0.086	−1.27		
GLS	0.334	4.88**	0.361	0.335	4.86**	0.361	0.000
Motivation	−0.395	−5.77**		−0.393	−5.41**		
GLS × Motivation				−0.004	−0.65		
GLS	0.360	5.00**	0.304	0.356	5.06*	0.341	0.036**
Concentration	−0.305	−4.23**		−0.290	−4.12**		
GLS × Concentration				−0.191	−2.92**		
GLS	0.422	6.29**	0.319	0.434	6.66**	0.361	0.042**
Tireless	−0.311	−4.65**		−0.349	−5.27**		
GLS × Tireless				−0.210	−3.20**		
GLS	0.396	5.68**	0.297	0.433	5.86**	0.307	0.010
Calm	−0.280	−4.02**		−0.276	−3.97**		
GLS × Calm				−0.104	−1.47		
GLS	0.317	4.64**	0.376	0.343	4.99**	0.394	0.017*
Mental energy	−0.420	−6.16**		−0.402	−5.91**		
GLS × Mental energy				−0.134	−2.10**		

*GLS, general life stressors; Mental energy, total mental energy score. *p < 0.05, **p < 0.01.*

of athletic mental energy (i.e., confidence, concentration, and calm) moderated the athletes' sport-specific life stress–burnout relationship. Also, in Study 2, we found that two factors of athletic mental energy (i.e., concentration and tireless) moderated the general life stress–burnout relationship. Thus, our study provides initial evidence that athletic mental energy can be a positive strength in protecting athletes' psychological well-being from stress-induced burnout. This is the major contribution of the study. Also, our study provides several theoretical implications for the researchers.

First, like other positive strengths in sport studies, athletic mental energy negatively correlated with burnout. Specifically, the moderating effects of athletic factors on the stress–burnout relationship were consistent over Study 1 and Study 2. Worthy to note is that three emotional components of athletic mental energy (i.e., vigor, tireless, and calm) played important roles in moderation. Vigor is an individual's subjective feeling with heightened arousal. Along with heightening vigor, an individual would maximize his/her efforts in enhancing performance (Lane and Terry, 2000). Research indicates that when individuals encounter adversities/challenges in life, if they can exert more effort to address the problems and overcome obstacles, they can get back to homeostasis physically, socially, and psychologically (Lazarus and Folkman, 1984). Thus, it may be that those athletes with high vigor exert more effort to cope with stressors in sports, and thus they did not experience burnout as much as their counterparts did. Similar explanations can be applied to the moderating effects of tireless on the sport-specific life stress–burnout relationship. In Lu et al. (2018) study, tireless was derived from vigor through factor analyses.

The moderating effects of calm in sport-specific life stress are very insightful. Past research in elite sports found that athletes in peak performance experienced a state of calm such as "no fear of failure" and "physically and mentally relaxed" (Lohr, 1984, p. 67) even when competition environments are very stressful. In medical care settings, it is found that nurses in the intensive care department are very stressed—sometimes they need 24 h or 7 days of work to treat an emergency patient. Facing a stressful working condition, it is found that those nurses remaining calm and confident can adapt and accomplish the

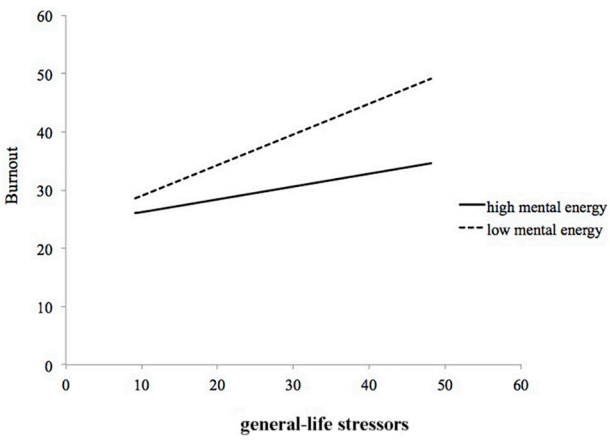

FIGURE 3 | Moderating effect of total athletic mental energy on the general-life stress-burnout relationship.

mission (Ennis et al., 2014). Therefore, it is possible that in a stressful environment, such as sports training and competition, those athletes with the positive emotion of calm might cope well so they do not experience burnout.

There are several positive cognitive components of athletic mental energy in moderating the athletes' life stress–burnout relationship that need further discussion. Specifically, both in Study 1 and Study 2, confidence moderated the sport-specific life stress–burnout relationship. It has been found that athletes high in confidence has lower pre-competition anxiety and performed better (Nicholls et al., 2010). According to Vealey and Chase's (2008) sport–confidence model, high confidence may trigger positive emotions and greater effort to deal with adversities in sports. Thus, the positive element of confidence in athletic mental energy may help athletes cope with sport-specific life stressors (e.g., performance demands, sports injury, training adaptation, and coach–athlete relationship) because they can exert more effort to overcome difficulties.

The other cognitive element of athletic mental energy in moderating the sport-specific life stress–burnout relationship is concentration. Concentration refers to one's cognitive ability to block distractions and focus one's attention to a given task (Weinberg and Gould, 2015). Research has found that athletes who perform better in important games scored high in concentration (Abdullah et al., 2016). Also, research investigating athletes' mental state in the peak performance indicated that "able to focus tasks at hand" and "emerge in the activity that they engage" are major characteristics at this moment (Williams et al., 2013). In contrast, research also found that if an individual cannot concentrate on work during threatening or demanding situations, he/she might have reduced ability to focus, impaired information processing, and decreased working memory (Gaillard, 2018). Thus, athletes low in athletic mental energy, particularly concentration, would be unable to focus their attention on given tasks, such as competition or training. Consequently, they would not be able to handle those sport-specific demands, which in turn, increase stress. Over the long term, those low in concentration would be high in stress and stress-induced burnout.

The moderating effect of motivation on the sport-specific life stress–burnout relationship in Study 1 is unique. Motivation refers to the intensity and direction of behavior and why people behave as they do (Gill and Williams, 2008). Generally, highly motivated individuals tend to persist and strive in their goal-directed behavior. Research has found that high achievers in sports increase efforts and persist in the pursuit of their goals when encountering adversities, such as injury and failure (Sarkar et al., 2015). Furthermore, it was found that those athletes who engage in sports purely for the intrinsic reasons such as fun and enjoyment are working hard during seasons, which subsequently predicted their end-season goal attainments (Smith et al., 2011). Thus, those athletes with the high motivation of athletic mental energy would be able to exert more effort to handle the demands in sports either in training, preventing injury, or maintaining a good coach–athlete relationship. By doing so, they would not experience those stressors derived from sports participation.

There are several differences between the two studies. For example, Study 1 found more moderators that buffered the sport-specific life stress–burnout relationship than Study 2. In contrast, Study 2 found that two factors of athletic mental energy (i.e., concentration and tireless) moderated the general life stress–burnout relationship. The reasons for these differences are complicated because the participants in Study 2 were soccer players. Soccer is a team sport that requires teamwork and cooperation between teammates to achieve the team's goal. Whether the nature of sport causes the differences in our study needs further examination. Study 2's finding that athletic mental energy also moderated the general life stress–burnout relationship can be explained by the transfer effects of life skills in sports to general living conditions. Research suggests that athletes may learn behavioral, cognitive, interpersonal, and intrapersonal skills from sports and transfer to their daily lives (Gould and Carson, 2008). Thus, even in general life condition, athletes' high athletic mental energy is beneficial to handle daily life stressors. However, this is only one possibility. Future studies may examine how athletic mental energy helps athletes handle their adversities in daily life.

Practical Applications

Athletic mental energy is a newly emerging topic in sports and psychology. Research has found that athletic mental energy predicts winning and losing in martial arts (Lu et al., 2018), negatively correlates with life stress and burnout (Lu et al., 2018; and this study), positively correlates with athletes' positive state of mind (Lu et al., 2018), and moderated the athletes' stress–burnout relationship in this study. Thus, sports coaches, sport psychologists, athletes, and sports professionals can apply athletic mental energy in their professional practices. According to Lu et al. (2018), athletic mental energy is influenced by many personal and environmental factors, such as life patterns, nutrition, sleep, interpersonal relationship, and time management, and can be gained from mental and physical training. Therefore, coaches and sport psychologists can schedule psychological skills training (PST) in athletes' daily training to increase athletic mental energy. Also, because athletic mental energy might vary with nutrition or life management, athletes need a healthy diet and a regular life schedule to sleep well at night.

Limitations and Future Suggestions

There are several limitations in our research. First, although we found moderating effects of athletic mental energy on the athletes' stress–burnout relationship, due to the cross-sectional nature, the results do not imply a causal relationship. We suggest that future studies adopt a longitudinal design to investigate athletes' life stress, athletic mental energy, and burnout over time to examine causal effects. Second, the participants in this study were all student-athletes. Therefore, whether the results can be generalized to other athletes such as professional athletes or junior athletes needs to be further examined. Furthermore, the data were collected from Taiwanese student-athletes; whether the results can be generalizable to different cultures needs to be further studied in the future. Moreover, we just sampled soccer

players in Study 2; we suggest that future studies may sample individual sports athletes, such as track and field, gymnastics, and swimming, to examine the possible moderating effects of athletic mental energy on the stress–burnout relationship.

CONCLUSION

In search of positive strengths that may moderate the athletes' stress–burnout relationship, we conducted two studies to examine the moderating effects of athletic mental energy on the athletes' stress–burnout relationship. Results consistently found that athletic mental energy can be positive strengths for athletes in buffering their life stress and stress-induced burnout. We hope that more research will explore the positive effects of athletic mental energy in the sports domain not only for the enhancement of the performance but also for the promotion of the athletes' psychological well-being.

DATA AVAILABILITY STATEMENT

The datasets analyzed in this manuscript are not publicly available. Requests to access the datasets should be directed to frankjlu@gmail.com.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Antai Medical Care Cooperation Antai-Tian-Sheng memorial Hospital Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX A

TABLE A1 | Athletic Mental Energy Scale (AMES).

	Directions: Below are 18 statements that describe **"how do you feel right now"** in sports training/competition. Please circle a number that mostly represents your feeling.	**Completely not**	**Hardly ever**	**A little bit**	**Much**	**Very much**	**Completely so**
1	**I feel spiritual to do everything in sports**	**1**	**2**	**3**	**4**	**5**	**6**
2	I feel there is endless energy coming from my body	1	2	3	4	5	6
3	**I feel I can win all the competitions in the future**	**1**	**2**	**3**	**4**	**5**	**6**
4	I feel excited in future competitions	1	2	3	4	5	6
5	**There's nothing distracting me in competition**	**1**	**2**	**3**	**4**	**5**	**6**
6	There's nothing distracting me in training	1	2	3	4	5	6
7	**No matter how long the training lasts I don't feel tired**	**1**	**2**	**3**	**4**	**5**	**6**
8	I am full of passion to attend my sports	1	2	3	4	5	6
9	**I can have my sports movements and skills automatically executed in sports**	**1**	**2**	**3**	**4**	**5**	**6**
10	I am free of distraction during competition and training	1	2	3	4	5	6
11	**Even the competition is over I still feel I have endless energy to use**	**1**	**2**	**3**	**4**	**5**	**6**
12	Even the training is over I still feel I have endless energy to use	1	2	3	4	5	6
13	**I can control all sports movements and skills**	**1**	**2**	**3**	**4**	**5**	**6**
14	When facing to my opponents I am calm	1	2	3	4	5	6
15	**Either in competition or training, I feel full of energy**	**1**	**2**	**3**	**4**	**5**	**6**
16	I want to show my best to others in sports	1	2	3	4	5	6
17	**Facing coming competitions I don't feel anxious**	**1**	**2**	**3**	**4**	**5**	**6**
18	Even facing a tough opponent I don't feel anxious	1	2	3	4	5	6

#1, AMES is scored as follows: (a) vigor = 1, 2, 15; (b) confidence = 3, 9, 13; (c) motivation = 4, 8, 16; (d) concentration = 5, 6, 10; (e) tireless = 7, 11, 12; and (f) calm = 14, 17, 18. #2, total AMES is scored by summing all subscales.

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BRIEF RESEARCH REPORT
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Profiles of Women With Fibromyalgia and Social Comparison Processes

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Background: Due to uncertainty regarding chronic pain in Fibromyalgia (FM) patients, there has been a growing interest in social comparison and its influence on emotional responses.

Aims: to analyze profiles in FM patients according to pain perception, social comparison strategies and anxiety and depression.

Methods: The sample consisted of 131 FM outpatients (Mean age: 50.15, *SD* = 11.1). Two scales were used: the Social Comparison Illness Scale and the Hospital Anxiety and Depression Scale.

Results: Two profiles were found by cluster analysis (K-means method): one (66%) with a higher level of *pain perception, anxiety* and *depression* and greater use of *upward contrast* and *downward identification* social comparison; and another (34%) with lower levels of *pain perception, anxiety* and *depression* and greater use of *upward identification* and *downward contrast*.

Conclusion: These profiles underline the interest in social comparison strategies and their role in FM.

Keywords: social comparison, fibromyalgia, patient profiles, anxiety, depression

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INTRODUCTION

Fibromyalgia (FM) is a chronic disease that mainly affects women and is characterized by widespread musculoskeletal pain accompanied by various symptoms such as fatigue, stiffness, sleep disruption, physical symptoms (i.e., extreme sensitivity, headaches, irritable bowel syndrome, temporomandibular joint disorders) and high levels of anxiety and depression (Wolfe et al., 2010, 2013). The heterogeneity of these symptoms is one of the reasons why researchers have tried to analyze different patient profiles and their relationship with psychological adaptation. They present a "maladaptive profile" with higher levels of *pain perception*, *anxiety* and *depression,* in contrast to an "adaptive profile" with moderate/low levels of *pain perception*, *anxiety* and *depression* (Kurtze et al., 1998; Giesecke et al., 2003; Shuster et al., 2009; Calandre et al., 2011; Keller et al., 2011; Docampo et al., 2013). *Anxiety* and *Depression* could be important indicators for predicting a patient profile with a worse prognosis, more severe symptoms, pain perception and fewer functional abilities (Bennett, 2002; Thieme et al., 2004; De Souza et al., 2009; Calandre et al., 2011). However,

cognitive processes are seen to have a fundamental role in reducing or dealing with anxiety and depression symptoms in FM (Rodero et al., 2010; Montesó-Curto et al., 2015; Peñacoba-Puente et al., 2015; Cabrera-Perona et al., 2017; Pastor-Mira et al., 2017).

According to the social comparison theory, lack of information and uncertainty can trigger cognitive processes of social comparison (Festinger, 1954). Indeed, chronic patients with higher uncertainty show more anxiety and depression symptoms and interest in social comparison (Butzer and Kuiper, 2006; Terol et al., 2007b, 2012, 2014; Terol-Cantero et al., 2015; Cabrera-Perona et al., 2017). These patients usually compare themselves with "others" or "*referents*" who are considered psychologically close or in a similar situation (e.g., same diagnosis) (Suls et al., 2002; Buunk and Gibbons, 2006; Corcoran et al., 2011). They compare "*contents*" such as symptoms, ways of coping or adjustment to chronic pain or illness (Butzer and Kuiper, 2006; Dibb and Yardley, 2006; Mussweiler et al., 2006; Jauregui-Lobera et al., 2010; Corcoran et al., 2011).

More specifically, the Identification-Contrast Model (Buunk and Ybema, 1997; Buunk and Gibbons, 2007) suggests that social comparison with "*referents*" either focusing on similarities with "others" who are better-off (*upward identification*), or focusing on contrast with "*referents*" who are worse-off (*downward contrast*) would create a positive affect (Buunk et al., 1990; Smith, 2000). However, social comparisons with better-off "others" while focusing on differences (*upward contrast*), or with worse-off "others" while perceiving similarities (*downward identification*) would lead to negative affect (Buunk et al., 1990; Smith, 2000). In chronic illness or pain, social comparison "*strategies*" such as *upward identification* and *downward contrast* have been associated with lower depression and better psychosocial adjustment (Van der Zee et al., 1996, 2000; Terol et al., 2012); and *upward contrast* or *downward identification* have been linked to higher depression and worse adjustment (Neugebauer et al., 2003; Terol et al., 2007b, 2014). In the same way, a few studies on FM have shown that *upward identification* or *downward contrast* strategies are related to lower pain perception and better mood (Affleck et al., 2000; Terol et al., 2014; Cabrera-Perona et al., 2017) and *upward contrast* or *downward identification* are associated with higher levels of anxiety and depression, and worse psychological adjustment (Affleck et al., 2000; Groothof and Scholtes, 2007; Terol et al., 2014; Cabrera-Perona et al., 2017).

In the context of the above, the aim of this study was to analyze the profiles of women with FM who share common characteristics based on a set of assessed variables: *pain perception*, *social comparison* processes (*strategies*, *referents*, and *contents*) and *anxiety* and *depression*.

MATERIALS AND METHODS

Sample

The sample consisted of 131 Spanish female outpatients interviewed at San Vicente del Raspeig Hospital (FM Department). The mean age was 50.15 (*SD* = 11.14). Mean time since diagnosis was 4.32 years (*SD* = 4.99). 68.70% of the participants were married and 31.3% were single, separated-divorced or widows. Educational level was primary and secondary school (77%), higher education (10.7%), and read/write (12.3%). Inclusion criteria were: (1) FM diagnosis re-confirmed by the American College of Rheumatology (ACR) criteria (Wolfe et al., 2010) upon their arrival at the FM Department, (2) aged over 18, (3) no previous psychiatric diagnosis (4) ability to understand questionnaires, (5) informed consent to participate in the study.

Assessments

In addition to collecting information about age, marital status, educational level and time since diagnosis, the following scales were used to assess the variables used in the study:

Pain perception Visual Analog Scale (VAS: Aliaga-Font, 2009) was used to assess: current pain, average pain last week, and maximum pain last week. Patients had to mark their pain perception for each of the three times on the VAS (0 = no pain to 10 = worst imaginable pain).

Social Comparison Process in Illness scale (adapted from Van der Zee et al. (2000) by Terol et al. (2007a, 2014). This scale includes 18-ítems with a Likert response-scale (1 = never; 5 = very often) grouped into three subscales: Social Comparison Strategies, Social Comparison Referents, and Social Comparison Contents. Three items are included in each of the four Social comparison strategies: *upward identification (a = 0.89), upward contrast (a = 0.84), downward identification (a = 0.93), and downward contrast* (*a* = 0.75). The *referents* subscale includes three items ("others" with similar health problems, with different health problems, and with no health problems) and *contents* also includes three items (symptoms, mood, and physical activity). Higher scores show a greater frequency in patients' use of social comparison strategies, referents or contents.

Hospital Anxiety and Depression Scale (HADS: Zigmond and Snaith, 1983; Spanish adaptation by Terol et al., 2007a). This is a 14-item scale consisting of two 7-item subscales: Anxiety and Depression. Responses are given on Likert scales from 0 to 3 with a 0–21 range for each subscale. Higher scores show higher levels of anxiety and/or depression. Internal consistency for this study, HADS – Anxiety $\alpha = 0.80$, HADS – Depression $\alpha = 0.85$.

Procedure

This was a cross-sectional study with a non-probability convenience sample. After the Hospital Ethics Committee's approval of the study, we selected 152 newly admitted outpatients with FM diagnosis. Patients were informed of the study and they signed an informed consent. 13 of these patients refused to participate and eight did not meet the inclusion criteria. Subsequently, 131 outpatients were interviewed by a psychologist in sessions lasting from 20 to 30 min.

Statistical Analysis

The software IBM SPSS v.22 was used for the statistical analysis, and the Kolmogorov–Smirnov test was carried out for distribution of scores (HADS: $D = 0.057$; $p = 0.20$; Social Comparison Processes in Illness Scale: $D = 1.24$; $p = 0.000$). Means and frequencies were used for the *Descriptive Analyses*.

For *Patients' Profiles*, an iterative K-means cluster analysis (non-hierarchical method) was performed to identify subgroups ($K = 2$) and differences were analyzed by ANOVA (F-Fisher with $p < 0.05$ were accepted). Prior to clustering, multicollinearity was assessed (VIFs < 6). Contingency tables and χ^2 statistics were used for the sample distribution "case" / "non-case" according to the HADS and inclusion in either of the profiles. In FM, specific cut-off points for those considered "cases" were recently fixed at +12 for the HADS-Anxiety and HADS-Depression subscales (see Cabrera et al., 2015).

RESULTS

Descriptive Analysis

Table 1 shows means, standard deviations and range scores for all study variables. Frequency in patient's use of Social Comparison strategies referents or contents are presented in **Table 2**.

Pain perception VAS mean scores were above five points. *Anxiety* and *Depression* mean scores were 13.71 (*SD* = 4.00) and 10.73 (*SD* = 4.64), respectively.

For social comparison, 75.6% of patients used *upward contrast strategies* with high frequency, which was the most used strategy (see **Table 2**). In addition, 52.6% of our sample compared themselves with other *referents* with a *similar health problem* (*M* = 3.37; *SD* = 1.35; Range = 1–5) and compared *contents* such as *illness symptoms* with high frequency (85.5%) (*M* = 4.36; *SD* = 0.081; Range = 1–5) (See **Tables 1**, **2**).

TABLE 1 | Descriptive analysis: Means, standard deviations, and range scores for all variables.

	Total sample = 131		
	M	***SD***	**Range**
Pain perception Visual Analog Scale			
Current pain	5.48	1.56	0–10
Last week average pain	6.58	1.56	0–10
Maximum pain last week	7.18	1.44	0–10
Social Comparison Processes in Illness Scale Strategies			
Upward identification	9.31	2.97	3–15
Upward contrast	11.30	3.11	3–15
Downward identification	9.98	3.63	3–15
Downward contrast	9.10	3.01	3–15
Referents			
Similar health problems	3.37	1.35	1–5
Different health problems	2.98	1.24	1–5
No health problems	3.02	1.49	1–5
Contents			
Symptoms	4.36	.81	1–5
Mood	3.89	1.05	1–5
Physical activity	4.02	1.22	1–5
Hospital Anxiety and Depression Scale			
Anxiety	13.71	4	0–21
Depression	10.73	4.64	0–21

M, mean; SD, Standard Deviation.

TABLE 2 | Descriptive analysis: Frequency in patient's use of social comparison strategies referents or contents according to three categories (*).

	Total sample = 131		
	Low frequency	**Medium frequency**	**High frequency**
Social Comparison Strategies			
Upward identification	18.3%	39.7%	42%
Upward contrast	9.9%	14.5%	75.6%
Downward identification	19.1%	24.4%	56.5%
Downward contrast	20.6 %	34.4%	45%
Social Comparison Referents			
Similar health problems	26.2%	22.1%	52.6%
Different health problems	33.6%	31.3%	35.1%
No health problems	37.4%	20.6%	42%
Social Comparison Contents			
Symptoms	2.3%	12.2%	85.5%
Mood	11.5%	22.1%	66.4%
Physical Activity	15.3%	13%	71.7%

**Likert response-scale (1 = never; 5 = very often) grouped into three categories of frequency: Low = 1–2; Medium = 3; and High = 4–5.*

Patient Profiles

As shown in **Table 3**, K-means cluster analysis and differences by ANOVA were performed with the following variables: pain perception, social comparison (strategies, referents and contents), anxiety and depression. The cluster analysis identified two groups of women. Cluster 1 includes 86 patients (65.6%) showing higher *pain perception* ($p < 0.001$), greater use of *upward contrast* and *downward identification strategies* ($p < 0.001$), comparison with *referents* with *different* and *similar health problems* ($p < 0.05$) and *contents* such as *illness symptoms* and *mood* ($p < 0.05$), as well as higher levels of *anxiety* and *depression* ($p < 0.001$). Cluster 2 includes 45 patients (34.3%) showing lower *pain perception* ($p < 0.001$), greater use of *upward identification* ($p < 0.001$), and *downward contrast* ($p < 0.05$), lower frequency of comparison with *referents* or *contents* ($p < 0.05$), as well as lower *anxiety* and *depression* ($p < 0.001$).

Finally, we show the contingency table analysis and chi-square test in order to match patient's profiles (Cluster 1, 2) according cut-off points fixed for the HADS (**Table 4**). Of the sample distribution, 76.9% of anxiety *cases* and 85.2% of depression *cases* were classified according to the HADS cut-off points (HADS – Anxiety and HADS – Depression ≥ +12) for FM in Cluster 1.

DISCUSSION

This study illustrates the role of social comparison processes in FM patients. We found that *upward contrast* and *downward identification* were the strategies most used by patients with FM. They also compare themselves with others (*referents*) on "similar health problems" and on *contents* such as "symptoms."

TABLE 3 | Patient profiles: Cluster analysis and differences by ANOVA.

	Cluster 1 (n = 86) $M \pm SD$	Cluster 2 (n = 45) $M \pm SD$	F	Sig.
Pain Perception Visual Analog Scale				
Current pain	6.06 ± 1.15	4.36 ± 1.64	6.114	**
Last week average pain	7.22 ± 1.25	5.32 ± 1.33	8.046	**
Maximum pain last week	7.78 ± 1.02	6.02 ± 1.42	7.285	**
Social Comparison Processes in Illness Scale Strategies				
Upward identification	8.36 ± 2.64	11.18 ± 2.72	−5.708	**
Upward contrast	12.65 ± 1.97	8.77 ± 3.27	7.226	**
Downward identification	11.01 ± 3.43	8.00 ± 3.23	4.829	**
Downward contrast	8.55 ± 2.66	10.16 ± 3.40	−2.748	*
Referents				
Similar health problems	3.57 ± 1.38	3.00 ± 1.24	2.308	*
Different health problems	3.21 ± 1.26	2.52 ± 1.11	3.063	*
No health problems	3.15 ± 1.52	2.75 ± 1.43	1.450	(ns)
Contents				
Symptoms	4.50 ± 0.75	4.07 ± .87	2.941	*
Mood	4.09 ± 0.99	3.50 ± 1.09	3.124	*
Physical Activity	3.91 ± 1.31	4.23 ± 1.01	−1.545	(ns)
Hospital Anxiety and Depression Scale				
Anxiety	15.30 ± 3.54	10.70 ± 3.13	7.277	**
Depression	12.50 ± 4.04	7.48 ± 3.75	6.875	**

*Pain perception, social comparison (strategies, referents, and contents) and anxiety and depression. M, mean; SD, Standard Deviation; F-Fisher with *p ≤ 05; **: p ≤ 001; (ns), non-significant.*

TABLE 4 | Patient profiles: Contingency table analysis and Chi-Square Test.

	Anxiety− (n = 27)	Anxiety+ (n = 104)	Depression− (n = 70)	Depression+ (n = 61)
Cluster 1. (n = 86)	23.1%	76.9%	50%	85.2%
Cluster 2. (n = 45)	76.9%	23.1%	50%	14.8%
	100%	100%	100%	100%
	χ^2 = 26.934**		χ^2 = 18.710**	

*Cluster 1, 2 according cut-off points for the HADS. Anxiety−: score < 12; Anxiety+: score ≥ 12; Depression−: score < 12; Depression+: score ≥ 12. χ^2: Chi-square; **p ≤ 001.*

These results coincide with another recent study on FM (Terol et al., 2007b, 2012) but differ from findings in other chronic patients (rheumatoid arthritis or cancer patients) who used *upward identification* and/or *downward contrast* more often (Blalock et al., 1990; De Vellis et al., 1990; Dibb and Yardley, 2006; Terol et al., 2007b, 2012). The findings regarding the profiles in FM patients revealed two different subgroups. One of them was a "maladaptive" profile, including women with higher levels of *pain perception*, *anxiety* and *depression* and more frequent "unfavorable" social comparison *strategies* (*upward contrast* and *downward identification*). The other group, or more "adaptive" profile, included women who showed moderate levels of *pain perception*, with a lower level of *anxiety* and *depression* and more frequent "favorable" social comparison *strategies* (*upward identification* and *downward contrast*). These profiles are consistent with other studies that have correlated these variables in the same way (Terol et al., 2012; Cabrera-Perona et al., 2017) or have identified similar groups of patients in FM (Giesecke et al., 2003; De Souza et al., 2009; Calandre et al., 2011; Keller et al., 2011; Docampo et al., 2013). Giesecke et al. (2003) proposed three profiles, one of which shows moderate *anxiety* / *depression* and less *pain*, while another presents a higher level of *anxiety* / *depression* and *pain*. Using the FIQ (FM Impact Questionnaire: Burckhardt et al., 1991) other researchers also report that *pain* and stiffness appeared in all profiles, but psychological stress (*anxiety* and *depression*) was the differentiating feature between these profiles (De Souza et al., 2009; Calandre et al., 2011). According to this, in our sample, 76.9% and 85.2%, classified as "cases" of *anxiety* and *depression*, fitted into the "maladaptive" profile (HADS ≥ +12: Cabrera et al., 2015). This leads us to turn our attention toward FM profiles, but in the context of social comparison processes and their negative emotional consequences (Bair et al., 2003).

Research and Clinical Implications

Our results are consistent with the Identification-Contrast Model (Buunk and Ybema, 1997) applied in FM or chronic illness, where frequency of *upward contrast* and *downward identification* strategies were related to psychological distress (i.e., *anxiety* and *depression*), and poor subjective well-being, quality of life or adjustment (Buunk and Gibbons, 2006; Groothof and Scholtes, 2007; Arigo et al., 2012; Terol et al., 2014; Cabrera-Perona et al., 2017). In particular, this study provides useful information about cognitive processes in women with FM, who use different *social comparison strategies* together with other relevant "comorbidity" symptoms: *perception of pain* and *anxiety* and *depression*. Lastly, this study supports some approaches toward improving more "adaptive" profiles and useful cognitive processes: (a) identifying strategies such as *upward contrast or downward identification* in order to change them, (b) encouraging positive thought thorough the use of "favorable" comparisons strategies (*downward contrast and upward identification*), which would act as a buffer to pathologic emotions and increase a better adjustment to chronic illness (Arigo et al., 2012; Terol et al., 2014; Cabrera-Perona et al., 2017), and (c) motivating the comparison processes with *referents* or "models" that provide adaptive strategies for coping and enhancing their subjective well-being.

Limitations

The first limitation of this study is that all the participants are female. However, FM research is generally focused on women who suffer from this chronic pain. The reason why the sample consists of only women corresponds to the justified prevalence of FM diagnosis in women, as noted: the preponderance of FM in women versus men with an approximate ratio of 9:1 (Wolfe et al., 1995; Mas et al., 2008; Katz et al., 2010). Other limitations are related to the size of the sample and selection by accessibility. Although a larger sample would be beneficial, Jager et al. (2017) consider that homogeneous convenience samples (sociodemographic or clinical factors of the general population)

can be a positive alternative. In this sense, we verified that our sample features were similar to those found in other FM studies.

The cluster analysis is a cross-sectional and exploratory method. Longitudinal studies and regression analysis could further clarify the role of social comparison as an antecedent or consequence of emotional responses (i.e., anxiety and / or depression). Finally, it would be very useful to ascertain the severity of chronic symptoms, uncertainty, anxiety and depression and how they change at different stages of illness and in health settings (primary care level, FM patient associations).

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the San Vicente del Raspeig Hospital Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors have contributed significantly to the article. VC and MT designed the study and protocol. MB and VC carried out the data analysis and results. MM-A, AB, and MT wrote and reviewed the original draft.

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REVIEW
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The Upside to Feeling Worse Than Average (WTA): A Conceptual Framework to Understand When, How, and for Whom WTA Beliefs Have Long-Term Benefits

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Our thoughts, feelings, and behaviors are shaped in critical ways by our beliefs about how we compare to other people. Prior research has predominately focused on the consequences of believing oneself to be *better* than average (BTA). Research on the consequences of worse-than-average (WTA) beliefs has been far more limited, focusing mostly on the downsides of WTA beliefs. In this paper, we argue for the systematic investigation of the possible long-term benefits of WTA beliefs in domains including motivation, task performance, and subjective well-being. We develop a conceptual framework for examining these possible benefits, we explore the usefulness of this framework to generate novel insights in an important psychological domain (skill learning), and we conclude with broader recommendations for research in other domains such as friendship formation, moral, and political decision making.

Keywords: social comparisons, worse than average, better than average, social cognition, self-perception

INTRODUCTION

On the day before your annual performance review, you might have one of two thoughts: you might think that you are *less* skilled than your fellow colleagues or you might think you are *more* skilled. If you are like most people, your thoughts will likely align with the latter option – you will confidently believe that you are more skilled than your peers. Most people believe that they are "better than average" (BTA): more intelligent, interesting, and attractive than other people (Alicke et al., 1995). As it turns out, BTA beliefs are linked to short-term psychological benefits such as positive mood and enhanced self-esteem (Aspinwall and Taylor, 1993). However, what if you believed that you were less skilled than your peers? You might initially feel bad about yourself, but could there also be hidden upsides to feeling "worse than average" (WTA) – such as superior skill learning and long-term professional advancement?

Prior research has predominately documented the downstream consequences of BTA beliefs for motivation, task performance, and subjective well-being (Wills, 1981; Taylor and Brown, 1988; Robins and Beer, 2001). Researchers have provided a balanced account that includes both the positive and negative consequences of BTA beliefs for task performance, well-being, and social connection (e.g., Leventhal, 1976; Moore and Kim, 2003; Gino and Moore, 2007). In contrast to this measured research on BTA beliefs, much less research has focused on WTA beliefs. And, most of the research that has been conducted on WTA beliefs has primarily focused on the negative consequences.

The potential positive consequences of WTA beliefs may have been overlooked in part because WTA beliefs stand in stark opposition to strong cultural ideals in North America. The current zeitgeist in North American culture promotes self-enhancement and high self-regard (Twenge and Campbell, 2010) and scientists are not exempt from culturally-biased thinking (Henrich et al., 2010). In fact, researchers have made omissions about other less culturally-desirable traits. The benefits of introversion and solitude are only recently being systematically documented after delayed investigation (Kahnweiler, 2009; Grant, 2013), and there is a recent upsurge of research examining the benefits of negative affective experiences such as depressed mood (Andrews and Thomson, 2009; Kashdan and Biswas-Diener, 2014) and conversely, the downsides of positive affective experiences such as happiness (Gruber et al., 2011; Mauss et al., 2012).

We propose that a systematic attempt to document the benefits of WTA beliefs is long overdue; thus, our overarching aim is to encourage more research on this potentially rich topic in social cognition. To this end, the current paper develops a conceptual framework to theorize about when and for whom WTA beliefs are likely to have positive downstream consequences for motivation, task performance, and well-being. In contrast to previous theoretical models, which have focused primarily on the causes (Chambers and Windschitl, 2004; Moore and Small, 2007; Guenther and Alicke, 2010) or immediate consequences of social comparison processes (Tesser et al., 1988; Aspinwall and Taylor, 1993), our conceptual framework maps out a sequence of affective and cognitive events that could allow the benefits of WTA beliefs to accrue over time. We also specify how individual differences influence the progression of this sequence. To demonstrate the relevance of this framework, we apply it to the example domain of skill learning, which is a critical determinant of task performance as well as subjective well-being (Reis et al., 2000; Diener and Seligman, 2002). To conclude, we speculate about the usefulness of this framework for other psychological domains ranging from friendship formation to moral and political psychology.

Prior research has pointed to the role of stable personal characteristics in predicting motivation and action tendencies in response to negative feedback and perceived threat – including optimism (Carver and Scheier, 2001), incremental theories (Dweck, 2007), self-efficacy (Deci and Ryan, 2010), and consistent positive role models (Lockwood and Kunda, 1997). Extending this foundational research, we explore a previously-overlooked situational factor. Specifically, we explore how the extent to which the current context incites WTA beliefs predicts motivational tendencies and behavioral remediation. Thus, this paper builds on foundational theories of human motivation to understand the unique role of WTA beliefs in predicting positive long-term changes in motivation and behavior.

WTA/BTA Beliefs in Relation to Other Self-Evaluations

BTA beliefs occur when people think that their standing on some dimension (e.g., a skill, a trait, or their chance of success) is superior to that of the average person or peer. In contrast, WTA beliefs occur when people think that their standing on some dimension is inferior to that of the average person or peer. WTA and BTA beliefs are conceptually related to underconfidence and overconfidence (i.e., when people are unrealistically pessimistic/optimistic about their chance of experiencing positive events (Weinstein, 1980) as well as to self-effacement and self-enhancement (i.e., when people demonstrate a preference to hold unrealistically negative/positive beliefs about themselves; Brown, 1986; Taylor and Brown, 1988, 1994; Colvin and Block, 1994). Given that there is limited research exploring the long-term consequences of BTA and WTA beliefs, we will also review research that is relevant to these and related constructs. However, we observe two important distinctions between WTA beliefs and underconfidence/self-effacement. Underconfidence and self-effacement are predicated on beliefs about the self: believing that you are or are not performing according to your own standards or believing that you are or are not likely to experience certain events. In contrast, WTA beliefs involve a salient social comparison: believing that you are worse than or better than the average person or peer. Thus, we propose that WTA beliefs are particularly likely to trigger *socially-oriented* affective, cognitive, and behavioral outcomes. That is, we propose that WTA beliefs are likely to lead to psychological and behavioral outcomes that rely on seeking out relevant social models or social feedback (Seta, 1982). We also propose that the feeling of not performing as well as one's peers – as opposed to simply feeling dissatisfied with one's performance or abilities – is uniquely motivating (Shore and Tashchian, 2002). We will further expand and contextualize these arguments in the conceptual framework detailed below.

IMMEDIATE CONSEQUENCES OF BTA AND WTA BELIEFS

BTA beliefs are very common: research suggests that individuals typically see themselves as better than their peers on personal characteristics ranging from physical attractiveness to leadership abilities (Taylor and Armor, 1996). The immediate consequences of BTA beliefs include boosts in momentary affect and subjective well-being (Gibbons and Gerrard, 1989; Testa and Major, 1990; Aspinwall and Taylor, 1993; Major et al., 1993) as well as gains in task performance (Ehrlinger and Dunning, 2003). In contrast, WTA beliefs have been linked to negative momentary affect and decrements to subsequent task performance. For example, participants who received feedback that they had performed worse than one of their peers on a personally-relevant task

experienced more arousal and greater negative affect compared to participants who received feedback that they had performed better or equally as one of their peers. These negative affective responses predicted poorer performance on subsequent lab tasks, due to behaviors such as speeding up while completing tasks that required focus and careful attention (Tesser et al., 1988).

In another set of studies, students who believed that they were unskilled at a task also believed that they were taking more time to answer questions and were expending more effort on the task compared to students who believed that they were skilled at the domain in question, regardless of their actual performance (Critcher and Dunning, 2009). Skill-based misperceptions have negative immediate consequences for task performance: for example, negative skill-based misperceptions are associated with reduced performance on spatial, numerical, and verbal tasks (Paunonen and Hong, 2010), poorer public speaking performance (Gilovich and Savitsky, 1999), and worse performance on novel tasks in the lab (Zunick et al., 2015). Overall, when people are put "on the spot" to perform in a domain where they feel WTA, their performance suffers. In a cross-sectional study, people who overestimated the extent to which their peers experienced positive emotions in comparison to themselves reported lower well-being, greater rumination, and more depressive symptoms (Jordan et al., 2011a). These findings provide evidence that WTA beliefs have negative consequences for momentary affect, immediate task performance, and well-being. However, the reliance on cross-sectional designs and lab-based tasks to draw conclusions about the effects of BTA and WTA-related beliefs may be short-sighted. We suggest that longitudinal designs may reveal a markedly different picture of how these beliefs impact thoughts, feelings and behaviors over a different time scale than has typically been considered in research.

CONSEQUENCES OF BTA AND WTA BELIEFS OVER TIME

Why might the relative balance of benefits and drawbacks of BTA and WTA beliefs change over time? Researchers have speculated that self-enhancement related beliefs result in reduced motivation and efforts to improve (Moore and Healy, 2008; Brown, 2012). Cross-sectional data provides evidence that when students are surrounded by other students with lower academic abilities, they experience greater academic self-esteem, yet show worse academic achievement compared to students who are surrounded by others with higher academic abilities (Marsh and Parker, 1984; Altermatt and Pomerantz, 2005).

Researchers have also speculated that holding overly positive beliefs about one's abilities can lead to unrealistic expectations and have detrimental consequences for performance by increasing the likelihood of experiencing frustration and burn-out (Polivy and Herman, 2000). In a qualitative study of teachers recruited from workshops in the US and Israel, teachers who reported a greater discrepancy between idealized expectations of their own performance and actual performance reported greater burn-out and less job satisfaction (Friedman, 2000). Building from this cross-sectional evidence, we propose that the benefits of WTA beliefs have been overlooked in part because they tend to unfold over longer timescales than the benefits of BTA beliefs. Indeed, "sleeper" effects have been documented in other domains, such as in the context of clinical treatments for alcoholism (White et al., 2007) and schizophrenia (Moritz et al., 2014): the treatments that are most difficult for patients to experience and adhere to in the short-term often yield the greatest long-term benefits.

Although direct evidence documenting the longer-term consequences of BTA and WTA beliefs is limited, related research suggests that the short-term consequences of self-enhancement and overconfidence in the domains of academics, well-being, and social activities may come at a long-term cost. In one of the few longitudinal studies in this area, college students who overestimated their abilities felt more disengaged and had lower self-esteem and subjective wellbeing 4 years later; students who did not initially overestimate their academic abilities did not show this pattern of decline (Robins and Beer, 2001). In another longitudinal study, students entering college with overly high expectations about their academic achievement reported greater self-esteem at baseline yet showed decreases in self-esteem during their 4-year college degrees, even after controlling for the grades they received (Chung et al., 2014). Overly high expectations might have detrimental consequences over time because people cannot live up to their own expectations, thus providing evidence that having overly positive beliefs can be a "mixed blessing" (Chung et al., 2014).

Detrimental effects of BTA-related beliefs have also been documented for well-being, physical health, and social relationships. Individuals who scored higher on self-enhancement measures reported greater positive affect and resilience up to several months after being personally involved in a traumatic event (September 11th), however, these individuals were also rated by friends and relatives as less socially adjusted 18 months later (Bonanno et al., 2005). College students who were unrealistically optimistic about how alcohol consumption would impact their lives (i.e., students who reported that would have fewer problems with alcohol use compared to peers) showed increases in negative alcohol-related incidents over a 2-year period (Dillard et al., 2009).

In the social domain, people who overestimate how popular and well-liked they are (as compared to how popular peers rate them) are initially liked better, yet, over time, self-effacers are liked more by others (Paulhus, 1998; Anderson et al., 2006). Students who initially engaged in more status self-enhancement during face-to-face group interactions were liked less over four separate interactions compared to students who were initially accurate about their status or were self-effacing; furthermore, groups with a higher number of status self-enhancers experienced more conflict during an in-lab task (Anderson et al., 2006). Research suggests that individuals holding overly positive beliefs about themselves (compared to ratings made by trained examiners and peers) are liked less by others over time (Colvin et al., 1995), go on to receive lower scores on annual performance reviews (Lönnqvist et al., 2008), and experience decreased satisfaction over the course of their romantic relationships

(McNulty et al., 2008) and when making the transition to parenthood (Ungerer et al., 1997).

In summary, a number of studies suggest that BTA-related beliefs can incur long-term psychological costs. This work also raises the question of whether WTA beliefs might also incur long-term psychological benefits. Much remains unknown about the time frame and sequence of affective and cognitive events through which WTA beliefs reliably promote positive psychological outcomes. Thus, to guide future research in this area, we propose a conceptual framework that generates predictions about when, how, and for whom WTA beliefs might have long-term benefits for motivation, task-performance, and well-being.

CONCEPTUAL FRAMEWORK

We propose that under certain conditions, WTA beliefs trigger a temporally predictable sequence of affective, motivational and behavioral changes events that can promote successful long-term behavioral change (**Figure 1**). Specifically, we propose that WTA beliefs produce long-term positive consequences when they lead to feelings of threat, enhance attention toward appropriate social models, encourage social approach, facilitate social feedback, and lead to improved motivation and task performance. In our model, we do not focus on why people have WTA beliefs or how accurate these beliefs are, given that this theorizing exists elsewhere. For relevant reviews see Larrick et al. (2007), Benoît et al. (2015). Instead, we focus our conceptual model on looking at what happens after WTA beliefs arise. Regardless of whether or not the WTA belief is accurate, WTA beliefs are likely to trigger a cascade of behavioral and motivational consequences – and under certain circumstances – have positive consequences.

Feelings of Threat

Consistent with past theorizing (Roese and Olson, 2007), we posit that there are two initial and necessary conditions for WTA beliefs to yield benefits over time: (1) an individual must feel threatened by, and motivated to reduce, a WTA belief and (2) an individual must feel that his or her own standing in the situation is subject to change. Stated differently, successful "behavioral remediation" – actions taken by people toward improving their situations – depends on choosing to reduce the discrepancy between oneself and others and believing that one can (Roese and Olson, 2007). WTA beliefs signal that one's performance is not adequate, and they are generally perceived as threatening (Taylor and Brown, 1988). In turn, feelings of threat are aversive (Greenwald, 1980; Steele, 1988; Tesser et al., 1988; Wilson et al., 2003), and feelings of threat encourage people to change their behavior (Solomon et al., 1991; Heine et al., 2006; Roese and Olson, 2007).

We propose that WTA beliefs may uniquely motivate behavioral remediation because of a specific desire to feel at least average compared to one's peers. Put differently, people may be more likely to pursue behavioral remediation to get from the 40th to 50th percentile, than they would be to get from the 51st to 61st percentile. Indeed, Festinger's (1954) pioneering theoretical work on social comparison processes postulated that social comparisons lead to a motivation to reduce the discrepancy between oneself and others, beyond more general attempts to simply feel better about one's performance (Hypothesis 1, p. 118). Individuals at the 50th percentile may, in essence, serve as an abstracted average "other" to whom one compares oneself. Consistent with this notion, people experience the greatest motivation to improve after receiving feedback that they are performing worse than average as compared to receiving positive or negative feedback about performance in the absence of normative information (Shore and Tashchian, 2002). Of course, the specific extent to which people are motivated by the average vs. another target could be driven by other factors such as how personally committed someone is to the task. This motivation is also likely to be driven by whether performance is framed as getting closer to a collective goal – in which case, people might be more motivated to perform *better* than their peers versus at the average (e.g., Koo and Fishbach, 2010).

Other individual differences are also likely to play a role in predicting how people respond to threatening situations. For example, personal characteristics such as trait levels of optimism and pessimism (Carver and Scheier, 2001) could also impact whether individuals view certain situations as a threat or as an opportunity. Consistent with prior research (Tesser et al., 1988), WTA beliefs also might not motivate behavior change when (1) people are not personally invested in the domain where WTA beliefs arise and when (2) people do not feel close to or do not identify with the group to which they are comparing themselves. In addition to low group identification, high group identification might also prevent WTA beliefs from triggering the processes necessary for positive behavioral remediation. For example, people who highly identify with a group that they are part of, often start to see others' success as their own (Cialdini et al., 1976). Thus, if a person's group is successful, they feel highly identified with this group, and the group accepts them, they might be unlikely to change their behavior because they see their group's success as their own.

Similarly, different types of threat that are elicited by WTA beliefs could play a role in whether these beliefs have positive or negative or negative consequences. For example, if someone experiences WTA beliefs in a *specific* domain that is less central to their self-worth, they might be less likely to experience anxiety, and more likely to engage in positive behavioral remediation. Yet, if someone experiences WTA beliefs as a *general* threat or in relation to a domain that is central to their self-worth, they might be more likely to experience anxiety and avoid remedying the WTA belief (i.e., engage in avoidance; see Jonas et al., 2014 for a recent theoretical review).

It is also possible that different types of negative emotions could trigger different motivational processes. For example, if people feel shame in response to WTA beliefs, they might disengage from the activity that caused their WTA beliefs. In contrast, if people feel envy or guilt in response to WTA beliefs, they might report greater engagement with the activity and increased improvement in the domain over time (see Schmader and Lickel, 2006). More research is needed to unpack the

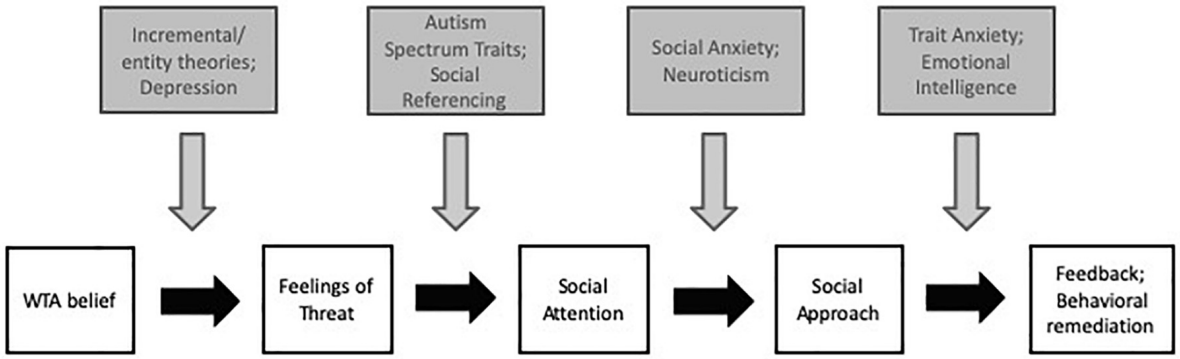

FIGURE 1 | Conceptual framework for a sequence of events that leads to long-term benefits of WTA beliefs. White boxes represent the sequence. Gray boxes represent individual difference factors that can influence how effectively progress is made between steps of the sequence.

role of specific negative emotions in predicting the proposed motivational and behavioral cascade.

Overall, our proposed conceptual model reflects a general pattern of motivational and behavioral responses to WTA beliefs. Numerous boundary conditions such as group identification, social acceptance, and others not mentioned here, will no doubt play a role in the extent to which WTA beliefs result in positive long-term remediation. Future research will be needed to explore the relative importance of these and other conceptually-related moderators.

Social Attention

In the context of WTA beliefs, feelings of threat that arise from inadequate performance are related to how a person is performing in comparison to his or her peer group. Consequently, when feelings of threat are combined with WTA beliefs, a unique situation arises wherein other people are both the cause of (via negative social comparisons), and a potential solution to (as potential models), an individual's negative affective state. Therefore, we hypothesize that feelings of threat that arise from WTA beliefs are unique, relative to related beliefs such as underconfidence and self-effacement, in their tendency to motivate individuals to focus on others in their social environment.

This step of the conceptual framework posits that successful behavioral remediation that follows from feelings of threat hinges on an individual's attention being selectively refocused on social models. While a general negative evaluation of oneself or one's own standing (e.g., underconfidence, self-effacement) could lead to successful behavioral remediation through either social or non-social methods, we propose that WTA beliefs may more directly motivate people to seek out relevant social models[1]. Here, our theorizing is consistent with research suggesting that people are more likely to evaluate their abilities and opinions by comparing their own performance with the abilities and opinions of others, in the absence of objective performance standards (Festinger, 1954). When individuals feel like they are not living up to social standards, they become more motivated to compare themselves with others to learn how to modify their behavior (Gibbons and Buunk, 1999). When people feel uncertain about their performance in a personally-relevant domain, they spend more time comparing themselves to others (Butzer and Kuiper, 2006), such as by spending more time comparing themselves to other people on Facebook (Lee, 2014).

However, for social approach behavior to have adaptive consequences, the social model who is sought out must be appropriate for improving one's own capacities in a specific domain. Empirical evidence suggests that most people are quite effective at seeking out relevant social models to promote learning. Children who are as young as 5 years old seek out accurate (as opposed to simply confident) models in new domains (Brosseau-Liard et al., 2014). This ability to seek out relevant and appropriate social models may have evolved to facilitate skill learning (Boyd et al., 2011; Chudek et al., 2012). Consequently, to the extent that WTA beliefs lead to feelings of threat and heightened social attention, people are likely to seek out relevant social models to learn from and reduce WTA beliefs.

Social Approach

Next, our conceptual framework posits that for most people, enhanced attentional focus on others – resulting from WTA-belief-induced feelings of threat – should lead to social approach. Consistent with this possibility, among psychologically healthy individuals, social threats such as negative social evaluation or social rejection increases social approach motivation (Maner et al., 2007; DeWall et al., 2009), prosocial decision-making (Von Dawans et al., 2012), and feelings of closeness with strangers (Berger et al., 2016). The negative affect generated by social threat also leads people to seek out others' advice (de Hooge et al., 2014). Individuals led to feel anxious were more likely to seek out and take advice that was provided (Gino et al., 2012). We propose that WTA beliefs promote positive long-term behavior

[1] We are not proposing that WTA beliefs preclude the use of non-social methods of improvement, such as spending time alone practicing a novel skill. Instead, we are proposing that in the case of feeling WTA, engaging in socially oriented affective, cognitive, and behavioral changes might be the most direct route to ameliorate the threat elicited by WTA beliefs and to potentiate long-term benefits.

changes when people increase their attention to social models, as well as when people socially approach those models. The extent to people approach, seek out, or take the advice of others after experiencing WTA beliefs is likely to depend on the extent to which other people trust those in their social environment (e.g., Balliet et al., 2014). See section "Social Approach: The Role of Social Anxiety and Neuroticism" for a further discussion of this point.

Indeed, various moderators will predict whether perceived social threats translate into social approach versus avoidance. As we will discuss later on in our framework, people who experience high fear of negative evaluation might not respond as positively to the perception of social threats (Maner et al., 2007). Furthermore, people who feel undervalued by the relevant social group might also be less likely to reach out and form social connections with other people from that same group (Maner et al., 2007). Future research is needed to further explore these and related boundary conditions.

Feedback

Finally, for the benefits of WTA beliefs to accrue over time, individuals need to continuously monitor and modify their behavior in response to social feedback. This proposition is consistent with research suggesting that goal achievement is a dynamic process (Van Yperen and Renkema, 2008). Within our framework, WTA beliefs should dissipate over time as one's actual or perceived performance improves, and reappear when one's performance declines (Carver, 2006; Sedikides and Hepper, 2009). Consequently, several iterations of this hypothesized sequence of events – in which WTA beliefs trigger feelings of threat, enhance social attention, and promote social approach and social feedback, may occur before the maximal benefits of WTA beliefs are realized. The time course over which the benefits of WTA beliefs unfold will vary depending on domain-specific factors, such as how long it takes to learn a skill as well as the level of proficiency an individual hopes to achieve (Carver, 1978). This dynamism speaks to the importance of future research documenting long-term consequences of WTA beliefs.

INDIVIDUAL DIFFERENCES

Thus far, our model has provided an overview of a specific sequence of events through which WTA beliefs should lead to positive consequences: namely, when people feel threatened, turn to social stimuli, learn from relevant social models, and update their behavior in response to social feedback. Yet, our framework also posits that WTA beliefs are not uniformly beneficial; we predict that individual differences influence who will engage in the affective processes, cognitions and behaviors that are likely to promote the positive long-term consequences of WTA beliefs. Although the following list is not intended to be exhaustive, the overarching idea is that these specific individual differences will affect people's reactions at each junction of the model, thereby determining whether and how the benefits of WTA beliefs accrue over time (**Figure 1**).

Feelings of Threat: The Role of Entity/Incremental Theories and Depression

Individual differences related to how people respond to threatening situations likely play a crucial role in predicting the long-term benefits of WTA beliefs. First, people differ in their belief that various personal characteristics, from intelligence to athletic prowess, are fixed and trait-like (entity theory) or malleable and changeable via effort and hard work (incremental theory; Dweck, 2006). These beliefs have implications for how people respond to feedback about their own performance. A person who believes that her poor performance in a specific domain is an indication that she is WTA on an immutable trait may feel helpless to change the situation. She may be unable to transform feelings of threat stemming from a WTA belief into motivation to take remedial action. In contrast, people who believe that their personal characteristics are malleable are more likely to attribute their negative performance to effort, and are more likely to take remedial action (Hong et al., 1999). Thus, entity and incremental beliefs likely moderate the likelihood of people moving beyond feelings of threat to the subsequent steps necessary for successful behavioral change. Similarly, depression is associated with a perceived lack of control over one's own outcomes (Garber et al., 1979; Brown and Siegel, 1988). Consequently, people with depressive symptomology who experience feelings of threat may entirely avoid the domain in which they feel WTA rather than turn their attention toward relevant social models who could otherwise help to improve their performance (Abramson et al., 1978; Peterson et al., 1993).

Social Attention: The Role of Individual Differences in Social Referencing

Social referencing refers to the tendency of a person to look to another person in ambiguous situations to obtain clarifying information. Social referencing behavior appears as early as the first year of life – 10–13 months old infants encountering loud (i.e., potentially exciting but also potentially frightening) mechanical toys will check their caregivers' facial expressions before touching the toy (Walden and Ogan, 1988). Social referencing is an early-developing component of a set of competencies (which also includes theory of mind, the ability to recognize when information is needed and from whom to seek it, and the ability to signal that information is wanted) that is necessary for developing expertise in social information gathering (Baldwin and Moses, 1996). Individual differences have been observed in social referencing behavior (Dickstein et al., 1984) as well as in related competencies including theory of mind (Cutting and Dunn, 1999; Carlson and Moses, 2001) and social signaling (Walden et al., 1997). Children with Autism Spectrum Disorder, for example, typically show reduced attention to faces and people as well as impairments in social orienting and joint attention (Maestro et al., 2002; Dawson et al., 2004; Chawarska et al., 2010). Cross-cultural data further supports the idea of a "broader autism phenotype" in the general population (Wakabayashi et al., 2006), and evidence suggests that the traits associated with such a phenotype are normally distributed

(Hurst et al., 2007). Traits that influence whether an individual will turn his or her attention to social stimuli in an ambiguous or threatening situation could lead to downstream consequences for the ability of an individual to profit from WTA beliefs. It is possible that people with ASD might be less concerned about their relative standing. Yet, to the extent that they are concerned with their social standing or fitting in with their peer group more broadly, due to an inability to seek out adequate social models, this research suggests they should be less likely remedy their social situation.

Social Approach: The Role of Social Anxiety and Neuroticism

Individual differences in social anxiety and neuroticism both influence the tendency to engage in social approach, particularly during the experience of threat. Social anxiety is characterized by a persistent tendency to avoid social situations involving unfamiliar people or possible scrutiny by others (American Psychiatric Association, 2013). In addition to influencing a person's chronic or baseline tendency to engage in social approach behavior, social anxiety's effects seem to be exacerbated by stress. Compared to non-anxious individuals, people with social anxiety disorder react to acute social stress with heightened sensitivity to angry faces and greater social avoidance behavior (Roelofs et al., 2009). These findings suggest that social anxiety might play a critical role in whether an individual engages in social approach (such as seeking feedback) following a threatening WTA belief. Neuroticism, sometimes called emotional instability, is characterized by the tendency to experience negative emotions such as anger, anxiety, and sadness (Costa and MacCrae, 1992). People higher in neuroticism have been found to react to a broad range of stressors with lower levels of problem solving and higher confrontation, avoidance, and self-blame, as well as higher levels of interpersonal withdrawal (O'Brien and DeLongis, 1996; Lee-Baggley et al., 2005). In sum, social anxiety and neuroticism may both be particularly perverse because these traits lead people to withdraw socially and avoid seeking social support at precisely the moments at which such strategies could be the most helpful – such as in the context of a threatening WTA belief.

Feedback: The Role of Trait Anxiety and Emotional Intelligence

The final step in our proposed conceptual framework that links WTA beliefs to positive long-term changes is the use of social feedback to guide behavioral change. Across many domains, people regulate their performance by monitoring how well they are doing: if they fall short of their desired standard, they change their behavior to try to meet the standard, followed by self-monitoring, in a feedback loop that continues until they are satisfied with their performance (Carver and Scheier, 2000). Trait levels of anxiety may play a critical role at this junction, as research suggests that people are willing to accept both the reasonable and unreasonable advice that they are presented with, after being led to feel anxious (Gino et al., 2012). People who are prone to experiencing anxiety across various situations might benefit less from WTA beliefs because they are less able to distinguish between feedback that is or is not likely to lead to successful behavioral remediation.

Emotional intelligence may also affect a person's ability to benefit from WTA beliefs. People who score higher on measures of emotional intelligence are better able to predict how they will react to future situations and regulate their emotional experiences to promote goal attainment (Dunn et al., 2007; Mayer et al., 2008; Brackett et al., 2011). Consequently, emotional intelligence may help people effectively regulate their feelings of threat that initially coincide with WTA beliefs, and to skillfully use WTA beliefs to motivate adaptive and approach-oriented future actions. More generally, the example of emotional intelligence highlights the possibility that some of the individual differences we have discussed may have effects at more than one of the critical junctions linking WTA beliefs to long-term benefits. For example, people who score lower on emotional intelligence often have poorer social skills (Frederickson et al., 2012). Thus, people who score lower on measures of emotional intelligence might be less willing or able to seek out advice from relevant social models, or less able to identify appropriate social models.

The Role of Cultural Context

Culture can influence whether and how individuals initially experience WTA beliefs. In East Asian cultures, self-effacing biases are more common and self-enhancing biases are less common than in Western cultures (Heine and Hamamura, 2007). Because WTA beliefs are also more likely to be the norm in collectivist cultural contexts (Mezulis et al., 2004), WTA beliefs might be less likely to trigger feelings of threat in these contexts or motivate behavioral remediation. Thus, the exact sequence of events proposed in our conceptual framework may also vary across cultures.

APPLYING THE CONCEPTUAL FRAMEWORK

Next, to demonstrate the relevance of our conceptual framework for understanding when, how, and for whom WTA beliefs can have long-term benefits, we will apply our framework to the domain of skill learning. Although we discuss only one example in depth, similar logic could be applied to extend our conceptual framework to a broad range of psychological domains ranging from friendship formation to political and moral psychology.

Skill Learning

Our framework suggests that WTA beliefs can have positive long-term benefits for the ability to learn and master new skills. Skill learning meets the pre-conditions of our framework because skill learning is a domain where people are motivated and can improve their own performance through effort. Individuals are motivated to learn and master new skills in part because it feels good to do so: mastery is a powerful predictor of subjective well-being (McGregor and Little, 1998). People are especially motivated to learn and master new skills when they feel like they are not living up to their own expectations (Ryan and Deci, 2000). In work

settings, when people's performance is below their own aspiration levels, they become more likely to search for new strategies and to change their behaviors to try to improve their performance (even if some risk is incurred; Greve, 2003). Furthermore, people work toward learning and developing their skills by observing and seeking critical feedback from others (Henrich and Gil-White, 2001). For these reasons, when people are learning or developing their skills, such as in educational and work settings, WTA beliefs may be especially likely to yield long-term benefits.

Research suggests that WTA beliefs lead individuals to seek out feedback from other people about how to improve their future performance (Walker and Smither, 1999), which can enhance performance on various lab-based tasks (Badami et al., 2012). In one of the few longitudinal studies in this area, managers who initially received the poorest feedback from their coworkers, and who used this feedback to seek out constructive comments from their peers, demonstrated the greatest performance gains over a 5-year period as compared to managers who did not seek out peer feedback (Walker and Smither, 1999). This research provides indirect evidence that WTA rather than BTA beliefs will facilitate the greatest gains in skill learning over time – especially when individuals seek out peer feedback and are provided with the opportunity to practice and develop their skills.

Indeed, the process of feeling WTA, seeking feedback, and using this feedback to improve one's skills is likely to unfold over time, given that many skills that are relevant to education and employment, such as reading or learning a new computer program, are ongoing processes that take people many years to master. Although some of our theorizing awaits empirical confirmation, research suggests that BTA beliefs may promote idleness and stagnation in one's skills. For example, success in prior endeavors can paradoxically lead people's future performance to decline, an effect that is mediated by the complacency that is promoted by overconfidence (Audia et al., 2000). Recent empirical evidence also suggests that overconfidence can have detrimental longitudinal impacts on leadership abilities because overconfident leaders are unable to see their deficiencies and fail to correct for them (Shipman and Mumford, 2011).

Skill Learning: Feelings of Threat and the Role of Entity/Incremental Theories

People's entity/incremental theories are likely to moderate the benefits of WTA beliefs for skill learning. If skills are seen as fixed, then perceiving oneself as WTA may only incur the downsides of anxiety and reduced self-esteem, since no avenue for remediating one's current skills deficits may appear available. The belief that skills can be grown, on the other hand, may nurture persistence of effort and adaptive change in response to WTA beliefs (Dweck, 1986; Butler, 1987). Across a variety of skills including motor learning (Wulf et al., 2012), exercise efficiency (Stoate et al., 2012), and management abilities (Brown et al., 2016), individuals with a malleable view of their performance show improvements in skill learning compared to individuals with a fixed view of their performance. These gains occur in part because negative feedback does not provide a global threat to self for these individuals, decreasing the need to self-affirm after receiving negative performance feedback, which provides individuals with more time to focus on improving personal performance (Wulf et al., 2012).

In fact, for individuals with a growth mindset, failure can promote learning and superior performance (Mangels et al., 2006). Those with a growth view of their abilities tend to respond to negative performance feedback by searching for new strategies to improve performance (i.e., by examining the strategies of those who outperformed them), whereas individuals with a fixed view of their abilities are more concerned with shoring up their global self-regard after receiving equally negative feedback (i.e., by examining the strategies of those who performed worse than they did; Nussbaum and Dweck, 2008). Thus, in the domain of skill learning, the benefits of WTA beliefs may accrue preferentially to individuals with a growth mindset; for individuals with a fixed mindset, WTA beliefs may cause a loss of interest and disengagement (Bandura and Jourden, 1991), a response that, in many settings, may be even less adaptive than the complacency cultivated by BTA beliefs.

Depression may also preclude individuals from selectively turning their attention toward social models and from seeking out critical skill-relevant feedback following WTA beliefs. People with depression are more likely to give up after experiencing failure on novel tasks and perform more poorly compared to age-matched controls (Holmes and Pizzagalli, 2007). People who report greater depressive symptomology are more likely to seek out more negative feedback from peers after initially receiving performance-relevant negative feedback (Casbon et al., 2005). Thus, depression may lead people to avoid the domain in which they feel WTA, or to look for negative feedback that reinforces their WTA beliefs, rather than to turn their attention toward relevant social models who could facilitate skill-learning.

Self-determination theory (SDT) could be another useful theory to understand when the negative emotions that arise from WTA beliefs translate into adaptive action, such as enhanced skill-learning. SDT predicts that WTA beliefs would be most be most adaptive when people feel autonomous (as if they have control over their behavior in a given domain), competent (like they have skills and are able to improve in a certain domain) and related to others (like they belong or are connected and accepted by others in a certain domain). SDT also illuminates when WTA beliefs are likely to have positive long-term effects for motivation and behavioral remediation. In domains where people are intrinsically motivated, behavior is guided by an internal locus of control, and relevant regulatory processes are based on interest, enjoyment, and personal satisfaction, WTA beliefs are likely to have positive downstream consequences. In contrast, in domains where people are extrinsically motivated, and behavior is guided by an external locus of control, and relevant regulatory processes are driven by rewards and punishments, WTA beliefs might result in reduced motivation or disengagement. Future work should substantiate these theoretically-motivated claims.

Social Attention: The Role of Individual Differences in Social Referencing

Individuals who exhibit less spontaneous social attention and less interest in social interactions should also be less likely than

other people to seek out relevant social models in response to a WTA belief. there is a great deal of related research suggesting that individuals with Autism Spectrum Disorder (ASD) traits are less likely to attend to other people in their social environment, which can impact skill learning and performance over time. People with ASD are less likely to imitate and attend to the actions of their peers – two behaviors that are critical for communication and skill development (Toth et al., 2006). More specifically, these social attention deficits are associated with difficulties maintaining jobs, despite the fact that the majority of individuals with ASD do not experience cognitive deficits (Nesbitt, 2000). Although more research is needed to explore how ASD traits impact skill learning following WTA beliefs, we speculate that individual differences related to social attention and social interest likely moderate the ability to learn and develop new skills following WTA beliefs, as they prevent individuals from attending to relevant and useful models.

Social Approach: The Role of Social Anxiety and Neuroticism

Our framework suggests that people who experience WTA beliefs in combination with social anxiety or neuroticism are less likely to seek out feedback from relevant social models – instead, they might choose to engage in avoidance-related coping strategies. Indeed, people who report higher levels of neuroticism may also be less likely to seek out feedback following WTA beliefs; indeed, individuals who report higher levels of neuroticism report feeling more negative about interacting with another colleague at their workplace whom they believe is performing better than they are (Buunk et al., 2001). Thus, individuals who experience greater social anxiety and neuroticism might be less likely to turn to other successful individuals for skill-related feedback and advice, therefore limiting the ability of WTA beliefs to translate into improved performance and mastery over time.

Feedback: The Role of Trait Anxiety and Emotional Intelligence

More general feelings of anxiety may also limit the benefits of WTA beliefs on skill learning, by negatively impacting an individual's ability to accept and effectively incorporate social feedback into her attempts at behavioral remediation. After receiving critical feedback, individuals with higher self-reported trait anxiety are more likely to feel personally threatened and experience decreases in self-efficacy compared to individuals with lower self-reported trait anxiety (Frey et al., 1986). The decrements in self-efficacy that follow from the receipt of critical feedback are linked to decreased performance, such as lower job-relevant task performance (Randhawa, 2004).

Such performance decrements occur in part because after the receipt of critical feedback socially anxious individuals are less likely to seek out information that might help them to improve their performance. For example, in one study, students were provided with fictitious intelligence feedback that was either negatively or positively discrepant with their self-evaluations (Frey et al., 1986). Students were then provided with the opportunity to read one of several articles that either argued in favor of intelligence testing or derogated intelligence testing. In contrast to students with lower levels of anxiety, who showed no difference in their article choice as a result of the feedback they received about their intelligence, students with higher levels of generalized anxiety were more likely to select articles that criticized intelligence testing after receiving negative information about their intelligence. Although more research is needed to directly illustrate our point that individuals with higher levels of trait anxiety will be less able to make use of WTA feedback to improve their long-term performance, these studies provide suggestive evidence that people who generally experience greater anxiety may be less likely to benefit from WTA beliefs.

In contrast, people who are emotionally intelligent might stand to benefit most from WTA beliefs. Consistent with this possibility, individuals who score higher in emotional intelligence are better able to regulate their emotions in response to experiencing stressful life events, such losing one's job (Troy et al., 2010). In turn, enhanced emotion regulation can buffer against the negative effects of life stressors on mental health outcomes, such as depression (Robinson et al., 2012). More specific to our conceptual model, people with higher emotional intelligence respond more positively in the face of challenging situations. For example, although engaging in a challenging work experience can sometimes lead employees to feel incompetent, individuals who scored higher in emotional intelligence reported greater feelings of challenge, greater positive affect, and lower intentions to quit their jobs compared to individuals who scored lower in emotional intelligence (Dong et al., 2014). These empirical findings suggest that individuals who score higher in emotional intelligence may be better equipped to transform WTA beliefs into long-term psychological and performance benefits.

In sum, the evidence that we have presented in this section supports the idea that WTA beliefs might incur long-term benefits related to motivating and improving skill learning, and it also identifies gaps in the literature where more work would be necessary to substantiate the claims set by our conceptual framework.

DISCUSSION

Social comparison is an inescapable aspect of human psychology – as we navigate our social worlds, it is common and natural for us to wonder how we are doing compared to our peers. Although the belief that one is doing better may be comforting in the short-term, the feeling that one is doing worse than one's peers may have long-term benefits. We have argued that these benefits may have been overlooked by researchers in part because the benefits of WTA beliefs unfold over a longer time scale than can be captured in a typical lab-based study. We have also proposed a conceptual framework to understand when and for whom WTA beliefs are likely to yield long-term benefits. We have proposed that WTA beliefs are most likely to incur long-term benefits when they facilitate adaptive social attention, social approach, incorporation of feedback and behavioral remediation. Finally, we have proposed that WTA beliefs may yield benefits above and beyond other types of negative self-evaluations because the belief that one is performing below

the average level of one's peers is uniquely motivating and promotes socially-focused behavioral remediation. We have applied our conceptual model to explore the potential benefits of WTA beliefs in one specific domain – skill learning. However, empirical research suggests that WTA beliefs occur across diverse domains; thus, the long-term benefits of WTA beliefs should also extend to other domains. As proposed in our conceptual framework, for a WTA belief to incur long-term benefits, an individual must feel threatened and/or motivated to reduce a WTA belief, and an individual must believe that his or her standing in a relevant domain is subject to change. Based on these criteria, another domain whereby WTA beliefs should lead to long-term psychological benefits is friendship formation. The ability to form and maintain friendships is a critical determinant of subjective well-being and physical health (Cacioppo and Patrick, 2008) and forming and establishing social connections is a salient goal for most individuals (Kahneman et al., 2004). Most critically for our model, people can readily influence the quantity and quality of their day-to-day social interactions (Sandstrom and Dunn, 2014). Thus, friendship formation is a domain that meets the pre-conditions of our conceptual framework as a domain where WTA beliefs might potentiate benefits over time.

Indeed, in our own recent research, conducted with nearly 400 first-year university students, participants who believed that they were worse off socially (i.e., had made fewer new friends) than the average first-year student reported lower momentary well-being and belonging (Whillans et al., 2017). Nevertheless, the same students that held WTA beliefs about their social success reported making more close friends 3 months later (controlling for the number of close friends they already had). Thus, our own research – conducted with a large sample of students who were assessed over several months – supports our proposition that WTA beliefs can incur long-term benefits for friendship formation. Additional research is needed to explore the potential moderating conditions proposed by our framework, such as whether individuals who hold entity beliefs about their personality are less likely to reap the social benefits of WTA beliefs (see Howe and Dweck, 2016, for additional discussion).

Another area in which the long-term behavioral and emotional effects of WTA beliefs have been under-investigated is moral standing. A diverse body of social-psychological research has demonstrated that people care deeply about seeing themselves as morally good and that moral self-regard ("Am I a good person?") responds dynamically to situational cues and feedback from the social environment (Monin and Jordan, 2009). Yet little is known about the long-term impact of believing oneself to be less (or more) virtuous than the average person. In lab studies, participants have been shown to resent and put down "moral rebels" who behave in an ethically superior way (e.g., refusing to complete a racist experimental task) when this implicitly indicts the participants' own prior behavior (e.g., completing the task; Monin et al., 2008). Similarly, in other studies, people ascribed negative qualities to moral vegetarians, particularly when thinking about the ways that they imagined the vegetarians might judge their own morality, a phenomenon that was dubbed "do-gooder derogation" (Minson and Monin, 2012). These examples suggest that feeling bad about one's moral standing relative to others – that is, WTA beliefs in the moral domain – may lead to petty takedowns of others, an uncontroversial undesirable consequence. However, participants' behavioral response options for dealing with their (presumed) feelings of moral inferiority were quite constrained in these paradigms (e.g., they did not have the option of demonstrating their own morality or improving their own moral choices). It is possible that as with receiving more general negative performance feedback, short-term harms may give way to longer-term growth after a person comes to see himself or herself as morally WTA in a particular domain.

Indeed, there is some evidence that even in the short term, feeling less than adequate morally may engender positive behavior change, at least when an avenue to moral self-improvement is made available (Merritt et al., 2010). When people were asked to write about a past misdeed, they were subsequently more likely to express prosocial intentions for their future behavior, apparently as a means of repairing their moral self-regard (Jordan et al., 2011b). Similarly, after being assigned to write about themselves in a negative way, people donated more to charity than they did otherwise (Sachdeva et al., 2009). Exposure to other people's moral heroism, which could be assumed to make one feel less confident about his or her own moral standing, has also been shown to inspire feelings of elevation and consequent prosocial behavior in some conditions (Schnall and Roper, 2012). Because all of these studies have looked exclusively at immediate consequences in response to situational manipulations in a lab setting, it is unclear how people's responses to more stable WTA or BTA beliefs about moral standing may affect behavior and emotions as they unfold over time. We argue that at least for people who believe that one's moral goodness (or badness) is not permanently fixed and can instead be changed effortfully (Chiu et al., 1997), WTA beliefs about moral standing are likely to elicit a long-term process of seeking moral self-improvement.

Our conceptual framework focuses on what happens after WTA beliefs arise, regardless of how they arise. However, there are many interesting and potentially generative points of speculation about how the causes of WTA beliefs and/or the characteristics of WTA beliefs could moderate the long-term benefits, such as how accurate the WTA beliefs are, how far away the WTA beliefs are from the perceived social "average" and the extent to which people hold WTA beliefs across multiple personally-relevant domains. For example, the extent to which people's WTA beliefs reflect the reality of their own and others' standing could moderate the long-term benefits. Most people can accurately reflect on whether they have overly positive or overly negative self-perceptions (Bollich et al., 2015). Furthermore, well-adjusted individuals tend to perceive other people's personalities accurately (Human and Biesanz, 2011). Research also suggests that the best performing individuals are most likely to be accurately self-aware regarding their own performance (Kruger and Dunning, 1999). This provides empirical evidence that having perceptions about oneself and others that are based in reality is psychologically adaptive. Similarly, WTA beliefs might be most likely to trigger an adaptive cascade of social and behavioral consequences when WTA beliefs accurately reflect reality.

Research suggests that there are three primary causes of overconfidence: people overestimate their abilities, people

over-place themselves in relation to others, and people are overconfident in their estimates (Larrick et al., 2007). When it comes to task performance, people often over-place themselves because they are not provided with sufficient incentives to accurately answer, and so accurate placement competes with other motivations such as appearing competent, self-confidence, and modest (Benoît et al., 2015). Following from these studies, WTA beliefs might therefore sometimes arise in domains whereby underestimating one's placement is more socially desirable than overestimating one's placement. Although our model does not specifically address how the cause of WTA beliefs predict behavioral remediation, it is possible that WTA beliefs might be more likely to inspire action when they are not accompanied with underconfidence in one's ability – as this could make people less likely to change their behavior or more likely to self-handicap. Future work should further substantiate this claim. Because our theoretical model is agnostic about the origins of the WTA beliefs, additional research is needed to disentangle whether and how the characteristics of the original WTA beliefs themselves – including whether or not these beliefs are accurate – shape the downstream motivational and behavioral consequences.

The distance of an individual's WTA belief from a perceived social average could also moderate the long-term benefits. For example, individuals who believe that they are further from a relevant social "average" might be less likely to believe that they can successfully remedy their own behavior and may be discouraged by a WTA belief. Having a WTA belief that is distant enough from the perceived average to be motivating, but also not so distant that it becomes discouraging, might be the most adaptive for promoting the long-term benefits. Although more research is needed to substantiate this claim, this proposition is consistent with classic research in psychology showing that the most adaptive relationship between a set of variables and an outcome is often non-monotonic (e.g., Yerkes and Dodson, 1908).

Relatedly, WTA beliefs might be most beneficial when they occur in one specific domain (versus across multiple domains). This proposition is consistent with theorizing suggesting that positive psychological traits and virtues, such as courage, justice, and optimism, may have negative consequences when experienced too seldom or too frequently (Grant and Schwartz, 2011). For example, holding WTA beliefs across multiple personally relevant domains at the same time is likely to result in a reduced desire or belief in one's ability to change one's own performance. More specifically, individuals who feel WTA across multiple personally-important domains may experience shame that could prevent them from asking for relevant advice (Tracy and Robins, 2006).

Finally, our conceptual model proposes that individuals, after experiencing a WTA belief, should continue to persist in improving their performance by seeking out relevant social models and social feedback, and by using this feedback to encourage behavioral remediation. However, recent empirical and theoretical research suggests that goal disengagement is a fundamental component of effective self-regulation (see Wrosch et al., 2013 for a review). Consequently, in some cases, the most adaptive response to the experience of a WTA belief could be to select another activity with a greater likelihood of improvement. Following from this proposition, another potentially productive area of research is to examine the boundary conditions for when WTA beliefs can be effectively remedied through subsequent approach-oriented actions such as seeking feedback, versus when they would be more effectively remedied through subsequent avoidance-oriented actions such as task disengagement. Future research should examine the specific components of WTA beliefs that predict whether the long-term benefits will arise – such as accuracy, perceived distance from the average, and the specificity of the WTA belief – to better understand whether an individual is likely to proceed through the steps of our proposed framework.

In the current paper, we focused on the extent to which WTA beliefs can result in social attention, feedback, and subsequent improvement in social domains, such as skill-learning and friendship formation. We focused on socially-relevant approach behaviors due to the fact that such solutions are most likely to potentiate long-term benefits. We also focused on socially-relevant approach behaviors due to the fact that past research in this area has typically focused on social outcomes – such as subsequent friendship formation and time spent soliciting input and feedback from peers and colleagues. However, it is possible that people might respond to WTA beliefs using non-social means of improvement such as self-study. People might be most likely to engage in non-social remediation when WTA beliefs elicit defensive or inhibition-based responses that could lead people to distance themselves socially from others. While our current focus on social remediation was chosen based on the focus of past research, a generative area of future research would be to explore the conditions by which WTA beliefs lead to social vs. non-social remediation.

By outlining a conceptual model and proposing when and for whom the benefits of WTA beliefs are likely to arise, this paper speaks to the critical importance of examining the potential of WTA beliefs to provide a springboard to long-term psychological flourishing. It is our hope that this paper will encourage researchers to question not only why WTA beliefs occur, but when WTA beliefs may play an important role in successfully navigating our social environments.

AUTHOR CONTRIBUTIONS

AW, AJ, and FC developed the conceptual framework. AW and FC drafted the manuscript. AJ provided critical revisions.

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Self-Evaluation Strategies in College Women Trying to Lose Weight: The Relative Use of Objective and Social Comparison Information

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We examined patterns of self-evaluative information use in a sample of college women who were trying to lose weight (N = 306). Participants described their weight loss experiences and answered questions about their self-evaluative activity via an online survey. The analysis strategy examined the relative use of four types of self-evaluative information (objective, upward social comparison, lateral social comparison, and downward social comparison) to meet three basic self-evaluative motives (accurate self-assessment, self-enhancement, and self-improvement). We also examined the role that dissatisfaction, uncertainty, importance, and self-esteem played in the relative use of information and the relationship of these factors on weight loss success. Our findings support previous research showing the primacy of accurate and self-improvement motives in the domain of weight loss and the usefulness of lateral social comparison information for meeting all three motives. Women evaluating their weight reported using upward social comparison information most often, followed by objective information. Lateral and upward social comparison information were rated as more useful than downward social comparison information for meeting accuracy and self-improvement motives. Both lateral and downward social comparison information were reported as especially useful for self-enhancement, with upward social comparison information rated as least useful. Our study utilized an integrative approach for understanding self-evaluative processes in the area of college women's weight loss. We found general support for our hypotheses regarding well-documented patterns of social comparison information usefulness for meeting three self-evaluative motives. Our data also support earlier research arguing that it is important to view information use in the context of multiple self-evaluative motives.

Keywords: self-evaluation standards, self-evaluation motives, social comparison processes, weight loss, college females

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INTRODUCTION

Self-evaluation, the process by which individuals seek information to assess their own performance in a domain, has a rich scientific history (Festinger, 1954; Albert, 1977; Wills, 1981; Wood, 1989; Sedikides and Strube, 1997). Research has focused on the different motives that self-evaluation processes serve, including accurate self-evaluation (i.e., objective accounts of performance, skills,

andtraits that enable individuals to anticipate and control their future behavior; Festinger, 1954; Schachter, 1959; Trope, 1975; Swann, 1983), self-enhancement (i.e., the desire to protect a sense of self-worth in the face of threat; Wills, 1981; Taylor and Brown, 1988; Tesser, 1988), and self-improvement (i.e., extracting information that is useful for bettering one's situation and guiding future behavior; Markus and Nurius, 1986; Taylor and Lobel, 1989). In addition, a great deal of attention has been devoted to the types of information people gather about themselves or others to pursue personal self-evaluation needs such as, objective (Festinger, 1954), social comparison (Festinger, 1954; Suls, 1977; Wills, 1981), or temporal comparison information (Albert, 1977). Other researchers have focused on moderating conditions that may influence the motive or the type of information guiding self-evaluation, such as threat, dissatisfaction, uncertainty, control, and/or the importance of a self-domain. Self-esteem is also an important moderator of information use, with individuals high in self-esteem more able to extract self-enhancing information and avoiding unflattering comparisons (Wayment and Taylor, 1995). It has also been observed that individuals low in self-esteem have less stable self-concepts and may be more influenced by social comparison information (Campbell, 1990). Wills (1981) argued that low self-esteem can make self-enhancement motives more prominent.

All of these dimensions were incorporated into an integrative model of self-evaluation processes (Wayment and Taylor, 1995, see also Helgeson and Mickelson, 1995). Collectively, studies utilizing this model have shown some general preferences for self-evaluative information given the domain under evaluation and self-evaluative motive.

This paper utilized this integrative model to examine the self-evaluative information college women use to assess their weight loss. We chose this domain because of its relevance to college-aged women (Wharton et al., 2008) and the widespread availability of objective information in this domain. Further, objective information is especially important in this domain because of its usefulness for accurate self-evaluation, which is associated with weight loss success (Wharton et al., 2008; Riggs et al., 2017). However, accurate self-evaluations are but one important self-evaluative motive. To date, no studies have simultaneously examined the types of self-evaluative information that are perceived as useful for meeting all three self-evaluative motives in women who are trying to lose weight. For example, well-executed studies of the affective consequences associated with exposure to upward social comparison information (media images, in-person comparisons) support the idea that upward social comparison information is not very useful for self-enhancement (Tiggemann and McGill, 2004; Fardouly et al., 2017). Yet, other information sources have not been examined for their potential usefulness for meeting accuracy and self-improvement motives.

In the following sections, we describe general patterns of results using the integrative model in other domains, describe the relevance of examining self-evaluation patterns in college women seeking to lose weight, and describe our hypotheses (see Halliwell and Dittmar, 2005 regarding the importance of distinguishing between accuracy and self-enhancement motives in domain of body image evaluation).

Self-Evaluation Strategies and Weight Management

Excessive weight contributes to higher risk for diabetes, coronary heart disease, various cancers, and sleep problems, and has even been considered a global epidemic (Calle et al., 1999; Must et al., 1999; Kopelman, 2000). The saliency of weight and weight loss is especially prevalent for college-aged women. For example, female college freshmen gain ˜5.5 lbs. over the first year, and this weight gain relates to lower academic confidence and changes in healthy eating (Economos et al., 2008). Moreover, disproportionate attention is paid to weight in college regardless of whether one's weight is considered objectively healthy or unhealthy (Wharton et al., 2008). It also seems that college-aged women are more concerned with losing weight, as female freshman and sophomores are more likely than their male counterparts to be actively trying to lose weight despite lower overall levels of obesity (Lowry et al., 2000). Finally, given that early college experience is a known risk factor for weight gain (Vella-Zarb and Frank, 2009), it is important to identify constraints (e.g., self-evaluation) on weight management (e.g., weight loss) for college-aged women.

Some research has suggested that self-evaluation strategies may impact weight loss success. For example, social comparison information use has been associated with body dissatisfaction and dieting (Engeln-Maddox, 2005; Myers et al., 2012; Shakya et al., 2015). In one study, those who perceived themselves to be similar to a prototypically overweight person were more likely to diet for weight loss (Dalley and Buunk, 2009, 2011). Relatedly, Lewallen and Behm-Morawitz (2016) demonstrated that upward social comparison may be associated with intentions to engage in extreme weight loss behaviors. Further, naturalistic studies addressing self-evaluation preferences regarding women's body image have shown that women are more likely to make upward social comparisons than lateral or downward social comparisons when comparing their body to others (Myers et al., 2012; Fardouly et al., 2017; Betz et al., 2019). These studies link the specific use of social comparison information with appearance, weight, and dieting outcomes, but do not isolate how specific types of self-evaluative information are useful for meeting all three self-evaluative motives.

Finally, women's perceptions of weight and body image is strongly linked to self-esteem issues and has been implicated in the negative impacts associated with media exposure (Vogel et al., 2014). Low self-esteem has been associated with greater self-evaluation activity (Wayment and Taylor, 1995). In their study of women's disordered eating, Tylka and Sabik (2010) found that women with low self-esteem were more likely to engage in social comparison activity and utilize unrealistic standards for body weight. Thus, in the area of women's weight loss, it is important to consider moderating variables that can influence self-evaluative activity.

Current Study

The research presented here focuses[1] on the relative use of objective standards and social comparison information and their perceived usefulness to meet three self-evaluative motives in the domain of college women's weight loss. Our hypotheses were based on the integrative model of self-evaluation (Wayment and Taylor, 1995)[2]. Given the ubiquity of objective information in the area of weight and weight loss, we first expected that college women would report using objective information most often (H1), and of the three types of social comparison information, we expected a greater use of upward social comparison information (H1a). We had two competing hypotheses regarding the relative use of objective and social comparison information types. Festinger's (1954) original formulation of social comparison theory argued that people prefer objective information, but when unavailable, would turn to social comparison information to meet their self-evaluative needs. Bandura (1982) argued that objective information should increase the use of social comparison information to refine its meaning. Thus, we examined the relative use of objective and social comparison information for evaluating weight loss (R1).

We also ventured several self-evaluation motive-by-information use hypotheses. First, for accurate self-evaluation, objective information was expected to be perceived as most useful, and more useful than all three types of social comparison information (H2). Of the three social comparison information subtypes, lateral social comparison information was hypothesized to be perceived as the most useful for meeting accuracy goals, and more useful than upward or downward social comparisons (H2a). Objective information was also expected to be perceived as most useful to meet the self-improvement motive (H3), followed by upward social comparison information (H3a). Finally, we predicted that objective information would be perceived as useful for self-enhancement (H4) and downward social comparison information would be most useful to meet the self-enhancement motive, and more useful than upward or lateral social comparisons (H4a). We examined two additional research questions. First, how are moderators of information use (*importance* of weight loss, *uncertainty* about weight loss progress, *amount of control* over one's weight loss, *dissatisfaction* with weight loss, self-esteem) related to frequency of information use? (R2). Second, are specific types of self-evaluative information use associated with perceptions of weight loss success? (R3).

MATERIALS AND METHODS

Participant Recruitment and Procedure

The current study recruited Introductory Psychology students who were trying to lose weight. A total of 357 female students completed an online survey and were compensated with partial course credit. To establish the final sample, several participant features were examined for exclusion. Participants were excluded for evidence of "satisficing" ($n = 51$)[2], identified as male ($n = 46$), were age outliers (i.e., > 3 *SD* older than the mean, $n = 2$), or identified as transgender ($n = 1$) or genderqueer ($n = 1$). The final sample ($N = 306$) was entirely female, had an average age of about 18 ($M = 18.38$, $SD = 0.77$), and were predominantly White (68.3%). The racial demographics of the rest of the sample were: Hispanic (17.3%), African American (6.5%), Asian (4.6%), and American Indian (4.6%).

Measures

Demographics

Participants provided their age, gender, level of education, and race.

Weight Loss Goals

Participants were asked open-ended questions regarding their weight loss goals, the reason(s) they were trying to lose weight (via a forced choice question including: fitness, appearance, health, attractivity, and other), and were instructed to write an open-ended response discussing their personal experiences with their "weight loss journey" as if writing on a blog (e.g., Reddit) for others who were also interested in weight loss to see.

Weight Loss Success

A single item assessed participants' perception of their weight loss success (1 = not at all successful; 6 = very successful).

Length of Time Pursuing Weight Loss

Participants indicated how many months they had been trying to lose weight.

Body Size Perceptions

Participants rated their current and ideal body size by marking along a 0–100 point continuum anchored by two graphic images (of a female body) at each endpoint (Gardner et al., 1998). A difference score (i.e., between current and ideal perceptions) was created such that larger values were indicative of greater current-ideal body size discrepancy.

Body Mass Index (BMI)

Participants were asked to provide their height and weight to calculate individual participant BMI scores (Centers for Disease Control and Prevention, 2014). Higher BMI values reflect greater body mass relative to height. For reference, a BMI below 18.5 is considered underweight, between 18.5 and 24.9 is considered

[1]The original Wayment and Taylor (1995) framework also included the use of personal sources of self-evaluative information (personal standards, past positive information, past negative information, ideal future selves, and feared selves).

[2]Fifty-one participants were removed from the sample due to satisficing, defined as participants' tendency to exert minimal effort when participating in a study (Barge and Gehlbach, 2012; Zhang, 2013). Four satisficing metrics were computed: (1) rushing, (2) skipping, (3) straightlining, and (4) early termination. A rushing score was computed by creating a seconds-per-item rate (SPI; the number of seconds participant spent on the survey divided by the number of items completed; Barge and Gehlbach, 2012). A skipping score was computed by dividing the number of questions that were left blank by the total number of questions. The higher the skipping score (i.e., a higher percentage), the more questions skipped. A straightlining score was computed by identifying banks of items that had a standard deviation of 0, indicating no variation across a subset of five or more items (Barge and Gehlbach, 2012). Finally, the number of participants who terminated the survey early were determined. Five respondents were coded positive ("1") for early termination.

normal/healthy weight, between 25.0 and 29.9 is considered overweight, and above 30.0 is considered obese.

Information Use Moderators

Four, one-item questions assessed potential situational correlates of information use: "How *important* is it for you to reach your current weight loss goal?" (1 = not very important; 7 = very important), "How *satisfied* are you with your weight loss progress so far?" (1 = very dissatisfied; 7 = very satisfied), "How much *control* do you feel that you have over reaching your weight loss goal?" (1 = very little control; 7 = a great deal of control), and "How *certain* are you that you will reach your current weight loss goal?" (1 = not at all certain; 7 = very certain). Mean scores for control and certainty were statistically similar (M = 4.50, SD = 1.57; M = 4.58, SD = 1.45, t_{paired} = -0.971, p = 0.33) and were highly correlated (r^2 = 0.62, $p < 0.001$). As such, these two items were reversed and averaged into a single score called uncertainty (M = 2.46, SD = 1.35). The 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965) was used to measure global self-worth and included negative and positive self-related questions (e.g., "On the whole, I am satisfied with myself," "I wish I could have more respect for myself-" *reversed*). Responses were recorded on a 5-point Likert-type scale, ranging from *strongly agree* to *strongly disagree*. Scores were reversed and summed, thus higher scores indicated higher self-esteem. The scale was reliable (α = 0.90) and the mean self-esteem score for this sample was around the midpoint of the scale's range (M = 25.43, SD = 7.06).

Measures of Information Use and Usefulness

Participants answered questions regarding their use of 10 types of information. To align the hypotheses most closely with Festinger (1954), only objective, upward, lateral, and downward social comparison information were included in the analyses presented here. Questions were nearly identical to those used in Wayment's (1992) original study. For each information type, participants were first provided with a definition and a brief example. The description of objective information included "For example, to evaluate one's weight loss, an individual may seek out information about healthy weight from expert sources or weigh themselves on a scale or use other objective measures (body mass index, weight charts, etc.)." The description of upward social comparison information included ". . . may compare their weight with people who are doing better than they are. For example, they compare their weight with someone who weighs less than they do or someone who has been more successful in their weight loss." The description of lateral social comparisons included ". . . may compare their weight with someone who weighs about the same as they do or someone who has had the same level of success/failure in their weight loss." The description of downward social comparisons included ". . .may compare their weight with someone who weighs more than they do or someone who has been less successful in their weight loss."

Following the provided examples, participants were given an opportunity to list examples of the information type in question the use to "evaluate their weight." This open-ended question was followed by a question to assess frequency: "How often do you use [type of information] to assess your weight loss?" (1 = not at all, 7 = very frequently). Next, we asked three questions about the specific usefulness for each information type with respect to meeting self-evaluative motives: accuracy [How useful is (information type) for accurately evaluating your weight loss? (1 = not at all useful, 7 = very useful)], self-enhancement [When you evaluate your weight loss with (information type), how does it make you feel (1 = very bad, 7 = very good)], and self-improvement [How helpful is (information type) for improving your ability to lose weight? (1 = not at all helpful, 7 = very helpful)]. The order in which participants were asked to complete questions for each of the information types were presented randomly.

RESULTS

Preliminary Analyses

Prior to conducting analyses, data were screened for outliers and missing data. A handful of items had missing respondents (<1% of sample) and mean replacement was used (Tabachnick and Fidell, 2013) to complete the data set. There were no violations of normality, as skewness and kurtosis values for all study measures fell within ± 2, indicating no extreme departures (Tabachnick and Fidell, 2013).

Weight and Weight-Related Perceptions

On average, participants weighed about 148 pounds (SD = 31.43), had a weight loss goal of 17.67 pounds (SD = 18.84), and had been trying to lose weight for 4.58 months (SD = 8.72; *Range* = 72 months). Scores on the body size perception scale averaged 45.92 (SD = 22.31), which equated to approximately halfway between the thin and the obese drawings on either scale endpoint. The "ideal" average was 25.53 (SD = 15.83), with the average discrepancy between these two perceptions equaling 20.89 (SD = 13.62) on a 100-point scale. Most BMI scores (65%) were in the "normal" range with respect to Centers for Disease Control and Prevention (2016) standards (M = 24.85, SD = 4.91, *range* = 17.94–50.29). One participant was "underweight" (BMI < 18%), 24.6% were "overweight" (BMI = 25–30%) and 10.5% were in the "obese" range (BMI > 30%). BMI was positively correlated with the body size perception scale (r^2 = 0.69, $p < 0.0001$). Respondents' reasons for wanting to lose weight spanned fitness (75.5%), appearance (79.7%), health (68%), and attractiveness (52%). The average score for weight loss success was 4.14 (SD = 1.19) on a 6-point scale. The distribution of responses on this scale were as follows: 10.2% rated their success as 1 or 2, 42.8% rated their success a 3 or 4, and 47% rated their success as a 5 or 6.

Frequency of Information Use

The first hypothesis was only partially supported. As expected, objective information was reported as used very often, but respondents reported using upward social comparison even more. **Table 1** displays the average frequency ratings for each information type. Upward social comparison information was used most often, followed by objective information, and finally, lateral social comparison information. Downward social

comparison information was used least frequently. More frequent use of objective information was positively associated with more frequent use of lateral social comparison information, modestly correlated with more frequent use of upward social comparison information, and unrelated to the frequency of downward social comparison information use.

Which Types of Information Are Most Useful for Meeting Self-Evaluative Motives?

To test the remaining hypotheses, we computed a two-way (4 × 3) repeated measures analysis of variance with four levels of information use (objective, downward, lateral, and upward) and three levels of self-evaluative motives (accuracy, self-enhancement, and self-improvement). Information usefulness was the dependent variable. A Mauchly's test revealed a violation of the sphericity assumption, therefore the Hyunh-Feldt estimates for F values and degrees of freedom were used in line with Field's (2013) suggestion for sphericity estimates greater than 0.75. Planned contrasts were computed to examine specific predictions. The two-way interaction was significant, $F(4.93, 1502.56) = 52.93$, $p < 0.0001$ and interpreted with respect to the three hypotheses. The marginal means and 95% confidence intervals are presented in **Table 2**. For ease of interpretation, **Figure 1** provides a summary of the perceived usefulness of all four information types for meeting the three self-evaluative motives.

As predicted, objective information was perceived as both the most useful, and significantly more useful than any other type of social comparison information for accurate self-evaluations of weight loss (H2a). Both lateral and upward social comparison information were perceived as more useful for meeting accuracy goals than downward social comparison information (H2b). To meet self-improvement motives, we predicted that objective information would be preferred. This hypothesis (H3a) was strongly supported. Furthermore, we expected that upward social comparison information would be perceived as more useful than lateral or downward social comparisons to meet self-improvement goals (H3b). In partial support of H3b, both lateral and upward social comparison information were more useful than downward social comparison information. Regarding the types of information perceived as useful for self-enhancement, hypotheses were partially supported: objective and lateral social comparison information were perceived as most useful for self-enhancement goals, followed by downward social comparison information. As expected, upward social comparison information was perceived as the least useful information type for self-enhancement. In summary, objective information was rated as most useful for meeting accuracy and self-improvement goals. Upward social comparison information was perceived as useful for meeting self-improvement and accuracy motives. Lateral social comparison information was perceived as useful for all three motives. Downward social comparison information was perceived as most useful for meeting the self-enhancement motive.

Correlations With Information Use

Correlations are reported in **Table 3**. Importance of weight loss was positively and significantly associated with more frequent use of objective, lateral social comparison, and upward social comparison information types. These types of information, as reported earlier, were especially useful for meeting accuracy and self-improvement motives. Dissatisfaction with one's weight loss was associated with more frequent downward social comparison information use, which was noted as being useful for meeting the self-enhancement motive. Uncertainty with one's weight loss progress was positively related to more frequent use of upward social comparison information. Finally, self-esteem was associated with less frequent use of upward social

TABLE 1 | Product moments and correlations among information use frequency (N = 306).

	Mean	*SD*	Skewness	Kurtosis	Downward	Lateral	Upward
Objective	5.04	1.64	−0.664	−0.107	0.101	0.213***	0.130*
Downward	3.58	2.04	0.211	−1.19	–	0.225***	0.243***
Lateral	4.41	2.00	−0.326	−1.01		–	0.290***
Upward	5.28	1.65	−0.913	0.270			–

**Indicates $p < 0.01$, ***indicates $p < 0.001$; Usefulness of each information type was rated on a 7-point scale.*

TABLE 2 | Mean usefulness of each information source compared across motives (N = 306).

	Accuracy			Self-enhancement			Self-improvement		
	Mean	***SE***	**95% CI**	**Mean**	***SE***	**95% CI**	**Mean**	***SE***	**95% CI**
Objective	4.71^{1a}	0.07	[4.56, 4.86]	3.85^{1b}	0.09	[3.67, 4.03]	4.92^{1a}	0.08	[4.74, 5.09]
Downward	2.73^{3b}	0.09	[2.55, 2.91]	3.42^{2a}	0.09	[2.24, 3.61]	2.95^{3b}	0.10	[2.76, 3.15]
Lateral	3.56^{2a}	0.09	[3.37, 3.74]	3.70^{1a}	0.09	[3.37, 3.74]	3.86^{2a}	0.11	[3.65, 4.07]
Upward	3.38^{2b}	0.10	[3.19, 3.56]	2.74^{3c}	0.09	[2.56, 2.91]	3.21^{2a}	0.10	[3.72, 4.12]

*For each information type (i.e., row), self-evaluative motive means not sharing a superscripted letter are significantly different ($p < 0.001$). For each motive (i.e., column), information type means not sharing a superscripted number are significantly different ($p < 0.001$). Please see **Figure 1** for a visual depiction of these results.*

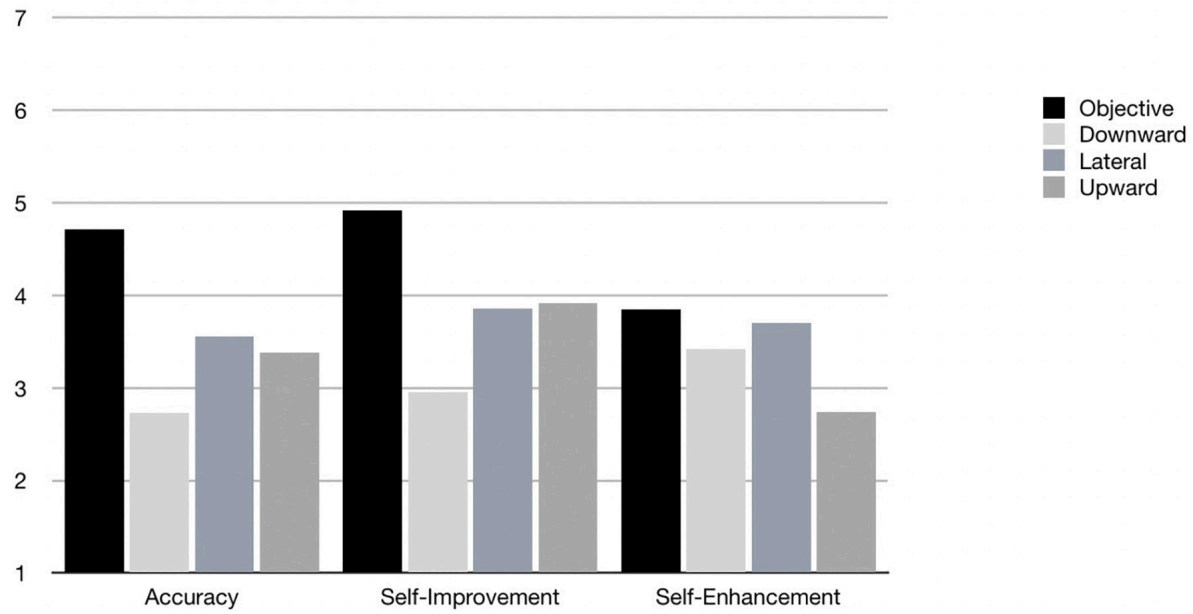

FIGURE 1 | Relative perceived usefulness of information type for meeting each of three self-evaluative motives.

TABLE 3 | Correlations between information use frequency and moderating variables (N = 306).

Information type	Importance	Dissatisfaction	Uncertainty	Self-esteem	Weight loss success
Objective	0.22***	0.07	0.04	0.03	−0.02
Downward	0.04	0.14*	0.10	−0.04	−0.13
Lateral	0.12*	0.07	0.09	0.07	−0.03
Upward	0.18**	0.10^{+}	0.16**	−0.14**	−0.16**
WL Success	−0.04	−0.56***	−0.50***	0.26***	–

$^{+}p < 0.07$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. *WL, Weight Loss.*

comparison information. Women who reported being more successful with their weight loss also reported being more satisfied with their weight, less uncertain about their weight loss progress, and had higher self-esteem. Finally, women who noted being more successful also described using less upward social comparison information.

DISCUSSION

This study examined the self-evaluative strategies female college students employed in their first semester of college, who also self-reported as "trying to lose weight." The sample appears to be fairly typical of other female samples of college students used in weight loss research (Anderson et al., 2003; Herring et al., 2014; Vargas et al., 2014; Zeigler-Hill and Noser, 2015; Dakanalis et al., 2016). The women in this sample had BMIs that ranged from 17.94 ("underweight" according to Centers for Disease Control and Prevention, 2016) to 50.29 ("extreme obesity" according to the Centers for Disease Control and Prevention, 2016). The sample average was at the top end of what the CDC classifies as "normal" weight, with 24.6% in the "overweight" range and 10.5% in the obese range (Centers for Disease Control and Prevention, 2016). The BMI distribution in the current sample is similar to other studies (cf., Herring et al., 2014; Vargas et al., 2014; Dakanalis et al., 2016). On average, women reported trying to lose, on average, nearly 18 pounds, similar to what has been reported in a sample of college-age women (Anderson et al., 2003).

Patterns of Self-Evaluation Activity

The results support the importance of two basic self-assessment motives, accuracy, and improvement, as most relevant for college women trying to lose weight (Festinger, 1954). Accordingly, upward social comparison information was reported as used most frequently, followed by objective information, to evaluate their weight loss goals and progress (Johnson and Stapel, 2010; Meier and Schäfer, 2018). Results supported Festinger's (1954) original theory that, objective information, when available, is an extremely important and efficient way to establish an individual's understanding of where they stand in a self-related domain. Objective information was also rated as the most useful information type for meeting

self-improvement goals, a motive described as a natural consequence of having an accurate idea of one's standing in any self-domain (Festinger, 1954). As expected, downward social comparison information was rated as used least often, and least useful for meeting accuracy and self-improvement goals, also supporting earlier research (Taylor and Lobel, 1989; Buunk et al., 1991).

Self-enhancement goals were perceived as being met best by comparisons with similar others (lateral social comparison information) and those not doing as well (downward social comparison). These results also provide continuing, albeit modest, support for the usefulness of downward social comparison information for meeting self-enhancement needs. Although reported as the least frequently used type of information to assess one's weight loss progress, downward social comparison information was seen as most useful for meeting self-enhancement goals that for accuracy or improvement.

Similar Others as Referents

We expected lateral social comparison information to be perceived as very useful for meeting accuracy goals, as Festinger (1954) originally theorized. In addition, we found compelling data supporting the idea that comparisons to similar others are also favored for meeting self-enhancement and self-improvement goals. For example, lateral social comparison information was rated by participants as more useful for meeting self-enhancement needs than comparing oneself to a worse performing other. Further, we found an especially strong relationship between objective information use and lateral social comparison information use. Although the mean ratings of the usefulness of information use from the current study closely parallel those reported by Wayment (1992), the results regarding lateral social comparison information stand out. Perhaps one reason why lateral social comparison information figured so prominently in this sample is the increase in social media use, specifically with respect to the information college-students receive about and from their friends. Given that friends are often perceived as self-similar, it is reasonable that information from "similarly performing others" might evoke comparisons largely comprised of friends. One additional interesting anecdote was that some participants mentioned it made them feel better to know they were not going through the process of losing weight on their own. Unfortunately, there are not many studies that compare the utility of comparing oneself to similar others for meeting self-enhancement motives since many studies only contrast use and preference for downward and upward social comparison information (e.g., Taylor and Lobel, 1989; Morganstern, 2007; Nabi and Keblusek, 2014). In one recent exception, Fardouly et al. (2017) found upward and downward comparisons were used more often than lateral comparisons for women evaluating their appearance. It could be argued that evaluating one's "appearance" is a different self-domain than weight loss, thus further study into the relative use of lateral and upward social comparison with respect to weight loss is warranted.

Moderators of Information Use Frequency

Two important components of Wayment and Taylor's (1995) integrative model of self-evaluative processes are the situational and individual-difference influences on motive and information use preferences. The perceived importance of "weight loss goals" was positively correlated with frequency of objective information, upward social comparison, and lateral social comparison information use. This pattern supports previous findings that demonstrate self-evaluation activity as more likely to occur when the domain under evaluation is important (Wayment and Taylor, 1995). Dissatisfaction with one's weight loss progress was significantly associated with increased use of downward social comparison information, also supporting earlier research (Wills, 1981). Greater uncertainty about one's weight loss progress was associated with more frequent use of both upward, and downward, social comparison information. Lastly, self-esteem was negatively related to the frequency of upward social comparison information use. Overall, and consistent with research utilizing the integrative model (Wayment and Campbell, 2000; Gotwals and Wayment, 2002), self-evaluative activity was more frequent for those participants who believed their weight loss was important and for those who were dissatisfied and uncertain about their progress. That being said, the type of information they chose to use varied in perceived usefulness for meeting the three different self-evaluative motives.

Self-Evaluation Strategies and Perceptions of Weight Loss Success

Finally, we examined the degree to which self-evaluative information use was associated with perceptions of weight loss success. Not surprisingly, individuals who were dissatisfied with their weight loss progress also reported less success. The perception of weight loss success was also correlated with self-esteem such that, compared to those lower in self-esteem, those with stronger self-esteem reported greater weight loss success. Participants who reported relatively less success were also more likely to say they were uncertain about their weight loss progress. Moreover, perceptions of weight loss success were unrelated to the perceived importance of weight loss. Perhaps the most interesting finding here was that the very information perceived as useful for self-improvement (and the type of information respondents said they used most often), upward social comparison information, was negatively related to success perceptions. That is, individuals who used relatively more upward social comparison information to assess their weight loss progress reported being less successful. Given the correlational nature of these data it is still unknown whether using upward social comparison reduces a person's sense of success (i.e., upward social comparisons may not be particularly useful for meeting self-enhancement needs), or whether those who feel less successful seek out upward social comparison information (i.e., use this information to meet self-improvement needs). This is the conundrum associated with the use of upward social comparison – such information can be useful

for self-improvement, but at the same time may pose a type of self-evaluative threat (Taylor and Lobel, 1989). It could also be that high self-esteem women are somehow able to engage cognitively with upward social comparison information in ways that not only buffer them from the potentially negative affect and instead inspire behavioral regulation (cf. Feeney et al., 2005). In support of this claim, Wayment's (1992) earlier investigation of college students' evaluation of their academic performance found that those high in self-esteem (compared to those low in self-esteem) found all types of information self-enhancing.

Strengths and Limitations

One of the main strengths of the current study is that it was a conceptual replication of work conducted nearly 25 years ago by Wayment and Taylor (1995), who argued that multiple types of self-evaluative information and motives should be examined simultaneously (see also Helgeson and Mickelson, 1995; Cramer et al., 2016 for similar arguments). This study used identical item wording and scale endpoints to assess information use – albeit online instead of on paper. Thus, the results from the current study suggest that the integrative model and method to assess self-reported information appears to be as useful in 2019 as it was in 1992[3]. Another strength is that because respondents completed the survey online, we identified and removed participants who engaged in "satisficing" behavior (Barge and Gehlbach, 2012; Zhang, 2013).

The study also has several important limitations. A major limitation is that we used self-reported estimates of body weight, self-evaluative activity, and indicators of weight loss success. All of these measures are subject to responses constrained by social desirability concerns. We also could have asked additional questions or phrased them differently. For example, our question regarding perceived weight loss success did not have a specific time frame. Our rationale was that each participant had been on their weight loss journey for differing amounts of time (e.g., we asked participants how long they had been trying to lose weight and how satisfied they were with their weight loss "so far"). The absence of a time frame renders our assessment of weight loss success less accurate.

Another major limitation is the convenience sampling method, as college women have very limited generalizability. In fact, 65% of our sample reported body weight and BMIs that were within the normal weight range and yet, also reported trying to lose weight. Given that perceived overweight is often associated with greater disordered eating (Haynes et al., 2018), it is unfortunate that we did not include any indicators of disordered eating. We recommend their inclusion in future studies. A study that includes men would also be helpful. As noted in previous research (Wayment, 1992), males and females may differ in their self-evaluation processes, which may be especially prevalent in the weight loss domain (see Elder, 2012). Another limitation is the cross-sectional design, which precludes any conclusions regarding causality. Longitudinal studies are needed to understand the consequences of specific self-evaluation strategies on multiple motives.

A final limitation relates to validity. Although respondents provided examples of the types of self-evaluative information they used, we do not have good information about college students' real-time exposure to the actual information they may use for self-evaluation. For example, the low reported use of downward social comparison information may be because women have less access to weight-relevant information about those who are not as successful in their weight loss. Given the idealized framing associated with social media posts, there may also be less downward social comparison information available for most normal sized individuals (Betz et al., 2019). To address this limitation, lab studies employing behavioral measures (e.g., eye-tracking) or field studies using experience sampling methods (cf., Myers et al., 2012; Fardouly et al., 2017) could provide more informative insight about information use preferences in real time.

CONCLUSION AND IMPLICATIONS

When it comes to the role of psychological processing related to weight loss in college women, self-evaluation is but one possible contributor, mostly in the context of self-monitoring (Kanfer, 1991; Burke et al., 2011). The research presented here examined self-evaluation strategies in a sample of college women, two-thirds of whom, although they reported weight and weight loss goals representative of college samples used in other studies (Anderson et al., 2003; Herring et al., 2014; Vargas et al., 2014; Zeigler-Hill and Noser, 2015; Dakanalis et al., 2016), reported body weights and BMIs within the normal range. However, for college women, even the perception of being overweight (including inaccurate body perceptions) is associated with weight loss goals and practices (Shamaley-Kornatz et al., 2007; Haynes et al., 2018). Thus, one practical implication is to design educational interventions that help women to understand the consequences of the comparisons for setting weight loss goals, monitoring weight loss progress, and maintaining motivation. In some cases, women can be encouraged to making non-weight-related comparisons to meet self-enhancement needs (van den Berg and Thompson, 2007).

For example, educational materials could be produced that encourage the use of objective information for the articulation of a goal (accuracy motive), the selective use of upward social comparison information and objective information to monitor goal progress (self-improvement motive), and the use

[3]One goal of this study was to examine if average rates of information use might differ between those reported by Wayment in 1992 and what we found by studying college students in 2018. In the original 1992 study, the integrative model of self-evaluation processes was examined in two domains (academic performance and social life) in two samples of college students (N = 116, N = 470). The frequency ratings for information use in the academic domain were as follows: objective (study 1: 5.63, study 2: 5.39), upward social comparison (5.30, 4.44), lateral social comparison (4.40, 4.48), and downward social comparison (3.25, 3.38). The frequency ratings for information use in the social domain were as follows: objective (4.36, 4.72) upward social comparison (4.31, 4.98), lateral social comparison (4.01, 4.51), and downward social comparison (3.31, 3.52). Means from the current study (as reported in **Table 1**) are very similar to those reported in the 1992 study (objective: 5.04, upward social comparison: 5.28, lateral social comparison: 4.41, downward social comparison: 3.58).

of objective and downward social comparison) to maintain one's motivation (self-enhancement). Although not covered in this study, personal forms of information, including feedback from others, are also extremely relevant to these processes (Wayment and Taylor, 1995). Our hope is that these results can contribute to any ongoing effort to raise students' awareness of how self-evaluative information can be helpful or unhelpful to the setting, monitoring, and maintaining weight-related goal pursuits.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Northern Arizona University Institutional Research Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HW and KC designed the study. KC collected the data. HW and BE took the lead on the current manuscript. KC collected the data for this study was part of the thesis work, supervised by HW and BE.

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Affective Consequences of Social Comparisons by Women With Breast Cancer: An Experiment

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Objective: People with severe illness often meet and compare themselves with other patients. Some of these comparison standards do well, others do poorly. Such comparisons could have positive as well as negative consequences depending on whether people identify or contrast from the standard. In the present study, we examine whether patients with breast cancer can benefit from comparisons by engaging in favorable comparison processes.

Design: 102 women diagnosed with breast cancer were randomly assigned to read a (fictitious) self-report from a well or poorly adjusted breast cancer patient.

Main Outcome Measures: Participants reported their affective reaction (mood, anxiety, depression) and specified their comparison process (identification or contrast).

Results: In general, participants engaged in favorable comparison processes by contrasting predominantly with poorly adjusted patients, and identifying with well-adjusted ones.

Participants' Mood Assimilated to the Standard: Participants reported more positive mood after having been exposed to the well-adjusted than the poorly adjusted standard.

Anxiety and Depression Varied With the Type of Comparison Process: It was lower the more they avoided unfavorable comparisons (contrasting with the well-adjusted patient and identifying with the poorly adjusted one).

Conclusion: Patients adjust their comparison processes to the standard to experience favorable comparisons. Especially avoiding unfavorable comparison processes reduces the risk of negative consequences after encountering other patients. Thus, patients may profit from comparisons as long as they engage in the right process.

Keywords: social comparison, breast cancer, contrast, identification, self-esteem, self-efficacy, mood, depression

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INTRODUCTION

Breast cancer is the most common form of cancer among women worldwide (Ferlay et al., 2019). In addition to the physical threats and pains, women with breast cancer face major psychological challenges. Breast cancer creates negative mood, anxiety, depression, and affects patients' self-image (Soo and Sherman, 2015). While coping with this life-changing event, breast cancer patients

are often exposed to the stories of other patients. They learn these stories in books, websites, and internet forums, as well as in the hospital during treatment or at self-help group meetings (Weis, 2003; Cipolletta et al., 2019). It is often argued that learning about the fate, difficulties, and resources of other patients is beneficial for people with serious illness. It would help them assess their situation, feel less alone, and find inspiration to overcome the challenges posed by their condition. However, research shows that comparisons with other people do not only have positive effects. They can also be threatening or discouraging when, for example, the person with whom one identifies is not doing well (see Ussher et al., 2006 for reports of patients attending self-groups) or when the comparison process leads to feeling less fortunate or weaker than others. The effects of social comparisons in patients facing serious illness, such as breast cancer, are thus so far unclear. This research aims to shed light on this issue.

Several studies have examined social comparisons among people with severe chronic conditions (Arigo et al., 2014). Much of this research has been conducted using a narrative method in which patients report natural comparisons and their subsequent reactions (Wood et al., 1985; Bogart and Helgeson, 2000; Cabrera-Perona et al., 2017). Overall, in these observational studies, patients primarily report a positive effect after a comparison, suggesting that social comparisons are an adaptive strategy for patients to maintain positive mood and cope with illness (Arigo et al., 2014). However, these studies should be interpreted with caution as they are based on spontaneous patient reporting and, therefore, are likely to be subject to several biases (e.g., patients may filter out negative experiences). Experimental research offers more controlled conditions for studying this issue.

Only a few experimental studies have been run to investigate the effects of social comparison in patients with severe disease. Their results are equivocal. For example, Stanton et al. (1999) asked patients with breast cancer to listen to the interview of another patient. The patients interviewed in the audiotapes varied concerning prognosis (good, poor, unspecified) and psychological adjustment (good: patient expressing positive emotions; poor: patient expressing high levels of distress; unspecified). Results indicated that women who had listened to the poorly adjusted standard reported feeling better about their own adjustment than those who have listened to the other standards. However, they also reported a more negative affect after listening to the audiotape than before, regardless of the standard. In another study (Van der Zee et al., 1998), breast cancer patients read about an upward (positive adjustment and prognosis) or downward (negative adjustment and prognosis) standard before assessing their affect and indicating their identification with that patient. In this study, in contrast to the results of Stanton et al., participants reported more positive affect after reading about the upward standard and this effect was qualified by the degree of identification: The more participants identified with the upward standard, the more positive their affect was. Thus, although patients with severe illness often report positive outcomes from social comparisons, the experimental evidence is less conclusive. Sometimes they seem to benefit from a comparison with a well-adjusted patient and sometimes from a comparison with a poorly adjusted patient. An explanation for this apparent contradiction may be found in social comparison theory.

Buunk and Ybema (1997) distinguish two comparison processes: identification and contrast. People identify with another person when they feel similar to that person and see her fate as a possible future for them. They then assimilate their feelings and self-evaluation to hers. Conversely, people contrast away from a comparison standard when they perceive him or her as different and are reminded of the fact that they themselves are doing better or worse (Gerber et al., 2018). The Selective Accessibility Model from Mussweiler (2003) focuses in more detail on the cognitive processes behind the two potential outcomes. Feeling similar or different from the other person again plays a key role. Mussweiler (2003) suggests that feeling similar to the comparison standard triggers a search for similarities on specific dimensions of comparison and makes this knowledge accessible. Since self-evaluation is based on accessible knowledge, this selective search leads to assimilation. Conversely, feeling different from the standard triggers a search for dissimilarities, which leads to contrast. Thus, both theoretical models posit that the consequences of a comparison depend not only on the person to whom one compares oneself, or on whether this person experiences positive or negative outcomes, but also on the type of comparison process (identification or contrast) one applies. Social comparison is a highly flexible process.

Patients with breast cancer may take advantage of the flexibility of social comparisons. Indeed, research in social psychology has shown that people facing threatening experiences use social comparisons to improve their self-image and feel better about their situation (for a review, see Wills, 1981). Hakmiller (1966) demonstrated this hypothesis experimentally. He gave subjects who had taken a personality test the threatening feedback that they had a high level of hostility toward their parents (vs. a low level of hostility in the control group). Subjects who received the threatening feedback showed an exaggerated tendency to compare themselves to someone who had received an even more hostile feedback. Subsequent studies have replicated this result and have shown that, given the opportunity to choose their standard of comparison, people under threat compare themselves to downward standards. Cancer patients also show this pattern: When they are interviewed, the spontaneous social comparisons they make are mainly with other patients who are worse off (Wood et al., 1985). But how do cancer patients react if they do not have the possibility to choose their comparison standard?

Previous scholars have assumed that cancer patients who cannot avoid the comparison with another patient would still be able to engage in favorable comparison processes by identifying with upward standards and contrasting with downward standards (Taylor and Lobel, 1989). Similarity appears to play a key role in inducing contrast or identification. However, similarity between two people is not a fixed or given fact, but rather highly subjective. People belong to multiple categories and can be characterized on many dimensions. Perceived similarity thus depends on the characteristics on which one decides to focus. When one encounters a person with whom one could compare oneself, it is thus possible to switch from a focus on similarities to a focus on dissimilarities, and thus from identification to

contrast (Mussweiler et al., 2000). The question is whether people with a severe illness also use this strategy. If this were true, learning the story of any patient could lift their mood, decrease depression, and reduce anxiety. To our knowledge, this has not been experimentally tested yet.

The current project is designed to test the hypothesis that breast cancer patients flexibly adapt their comparison process (identification vs. contrast) to the standard (upward or downward) they are exposed to in order to promote positive outcomes. However, we do not expect this effect to be the same in all patients.

Previous research suggests that the tendency to engage in favorable comparisons depends on personality factors. Some people protect their positive self-concept better than others (Alicke and Sedikides, 2011). One personality factor related to motivated cognition is trait self-esteem. People with high self-esteem are more prone to adopt self-enhancing strategies than people with low self-esteem. They tend to overlook negative information about themselves (van Dellen et al., 2010), they are more likely to make self-serving attributions (e.g., Miller and Ross, 1975), to engage in compensatory self-enhancement after receiving negative feedback (e.g., Baumeister, 1982), and to derogate sources of negative feedback (e.g., Baumgardner et al., 1989). People with high self-esteem also tend to have high self-efficacy (Lane et al., 2004). Self-efficacy is the subjective feeling of being in control (Bandura, 1977). People with high self-efficacy often cope well with threatening situations (Folkman, 1984) and cultivate their feeling of empowerment by making self-serving attributions (Watt and Martin, 1994). Thus, patients with a high self-esteem and a high self-efficacy are likely to cope better with other patients' stories by engaging in favorable comparison processes (Taylor and Stanton, 2007).

In the study presented in this article, we expected women with breast cancer to make favorable comparisons with other patients and we predicted that the more they did, the more beneficial the comparison would be for them. In other words, the more patient contrast with poorly adjusted standards and the more they identify with well-adjusted standards, the better they should feel, and the less anxiety and depression they should experience. In addition, we predicted that the higher women's self-esteem and self-efficacy, the more positive comparisons they make and the greater the benefits they derive.

MATERIALS AND METHODS

In this study, women with breast cancer diagnosis were asked to read a self-report supposedly written by another patient. This self-report was actually the manipulation of the comparison standard. The self-report patient described either the difficulties and struggles she experienced in relation to her illness, depicting a rather depressive and hopeless picture (poorly adjusted standard), or she talked about the ease and speed of adjustment, even pointing out positive consequences from her experience (well-adjusted standard). Before and immediately after reading the self-report, participants indicated their mood. In addition, after reading the self-report, we assessed their feelings of depression and anxiety, the extent to which they identified or contrasted with the standard as well as their propensity to focus on similarities or differences. Prior to reading the self-report, we also measured participants' self-esteem and self-efficacy.

Participants

102 women with a breast cancer diagnosis participated in this study[1]. On average, the women were 63 years old (range 38–83) and 80% of them had received their first diagnosis more than two years ago (up to 33 years ago); 97 women had had at least one breast operation; 25 were currently in therapy, and 70 were attending a self-help group at the time of the study or had attended one in the past; 69 were married or living with a partner; 28 were currently working whereas 63 were retired (for a more detailed description of the sample, see **Supplementary Table S1**); 52 women read the self-report of the poorly adjusted patient and 50 the self-report of the well-adjusted patient.

Procedure

To recruit participants, we contacted self-help groups in Styria, Austria, and the Styrian Cancer Society, as well as oncology stations at two hospitals and several centers for mammography in Graz, Austria. Women with breast cancer were made aware of the study by flyers and posters and by word-of-mouth recommendation. To conduct the study, a female investigator either met with the women individually or administered the questionnaire to a group of women during a self-help meeting. The women received a package of organic body products as a token of our gratitude and could participate in a small raffle.

The whole study was conducted as a paper and pencil study and was approved by the Ethics Commission of the University of Graz (Austria). Participants first read a short information sheet about the study, they gave their informed consent to participate, and then filled out the questionnaire. This took between 20 and 50 min. Afterward, participants had the opportunity to talk with the investigator in more detail about the purpose of the study and their comparison experiences.

Materials

The questionnaire that we used in this study, the data tables, and syntaxes can be found on https://osf.io/wchdf/[2].

Self-Report

The self-reports were fictitious but compiled from real internet-blog entries. The supposedly author was a 35-year-old women called Anna, living in Vienna. The poorly adjusted and well-adjusted versions were held as similar as possible. Both self-reports were approximately one-page long. Importantly, the described therapy and prognosis were identical. However, the well-adjusted Anna was much more positive, optimistic, and at

[1]We did not run a power analysis before collecting and analyzing the data. However, *post hoc* calculations of power reveal that assuming a small effect size ($f = 0.3$), our sample of 102 participants had a power = 0.851 to detect a significant difference between the comparison processes of our two groups of participants (i.e., based on the two-way ANOVA reported in section "Identification and Contrast").

[2]To protect the anonymity of our participants, we removed some of their demographical variables from the data table.

ease with the illness. Her self-report read like this (translated from the original German version; see the osf link for the whole questionnaire translated in English):

> ". . .Time flew by and I went back to work quickly. I am optimistic soon to be as productive as before, but I will be more serene. My view on some things in life has changed and I will keep working on this. . . ."

In the poorly adjusted self-report, Anna described the following:

> ". . .Everything took forever and I had difficulties to get back to work. I am worried I'll never be as productive as before—my serenity is gone. My view on some things in life has changed and there is nothing I can do about this. . . ."

Perceived Adjustment and Similarity

After having read the self-report, participants rated the adjustment of the standard on a six-point scale (1 = *very poorly*, 6 = *very well*). They also rated their own adjustment in comparison to women with breast cancer in general (1 = *much worse*, 6 = *much better*), their own adjustment in comparison to the self-report standard (1 = *much worse*, 6 = *much better*), and their perceived similarity with the standard (1 = *not at all similar*, 6 = *very similar*).

Identification and Contrast

Items adapted from Van der Zee et al. (2000) were used to measure identification and contrast with the patient of the self-report. Van der Zee et al. created these items based on statements collected from 20 audiotaped interviews with women with breast cancer. Moreover, they pretested the items and adjusted them in a pilot study among breast cancer patients.

The items were tailored to the experimental condition because identification and contrast are depicted differently when they refer to an upward standard or to a downward standard. For example, an item measuring identification in the well-adjusted condition read: "When I think of the woman from the self-report, I am glad that my situation could improve." Conversely, in the poorly adjusted condition identification was phrased: "When I think of the woman from the self-report, I am afraid that my situation will worsen." Example items for contrast were "When I think of the woman in the self-report, I feel frustrated about my own situation" (well-adjusted standard) and "When I think of the woman from the self-report, I am happy that I am well" (poorly adjusted standard). Participants indicated how much they agreed to two identification and two contrast items on six-point scales (1 = *don't agree*, 6 = *fully agree*).

Focus on Similarities or Differences

The focus on similarities or differences while reading the self-report may carry over to other kinds of comparisons. To assess the propensity to focus on similarities or differences, Mussweiler and Damisch (2008) have created a scale in which participants are asked to judge the similarity of five pairs of every-day objects (e.g., white wine and red wine or a blouse and a dress shirt) on six-point scales (1 = *very different*, 6 = *very similar*). We thus also used this scale to measure our participants' focus style.

Mood

Participants indicated their mood on the single valence item of the Self-Assessment-Manikin with a nine-point answer scale. This mood item consists of a series of figures arranged from smiling on the left (coded as 9) to frowning on the right (coded as 1). This item is used in many studies in which participants' availability or cognitive capacities make it difficult to employ a more complex measurement (Bynion and Feldner, 2017). The SAM has been validated by Bradley and Lang (1994). Even though the SAM relies on a single item, its authors found that it strongly corelates with longer scales aimed at assessing affective valence. Our participants completed this item twice: before and immediately after reading the self-report.

Anxiety and Depression

We used the German version of the Hospital Anxiety and Depression Scale (Herrmann-Lingen et al., 1995) to measure these two dimensions. This scale includes seven items capturing anxiety and seven items capturing depression assessed on four points. An example item for the anxiety subscale is "I feel tense and overexcited" [*most of the time (3)—often (2)—sometimes (1)—not at all (0)*] and for the depression subscale "I can still be as happy today as I used to be [*exactly as then (0)—not quite as much (1)—just a little bit (2)—rarely or not at all (3)*]." We modified the instructions usually associated with this scale: We asked participants to answer according to how they currently felt (instead of "last week" in the original instructions). We changed the wording because we wanted to avoid having participants review what had happened to them in the past week.

Self-Esteem and Self-Efficacy

Participants indicated to what extent they agreed with ten items (e.g., "All in all, I am satisfied with myself"; 1 = *not at all true*; 6 = *totally true*) taken from the German version of the Rosenberg self-esteem scale (von Collani and Herzberg, 2003). Moreover, we relied on 10 items to assess their general self-efficacy (e.g., "I have no difficulties to reach my goals and aspirations"; see Schwarzer and Jerusalem, 1995). Participants answered all these items on a six-point scale (1 = *not at all true*, 6 = *totally true*).

RESULTS

Perceived Adjustment

As in previous studies on the same topic (e.g., Wood et al., 1985; Stanton et al., 1999), the vast majority (92%) of our participants judged their own adjustment to be superior to patients with breast cancer in general [$M = 4.89$, $SD = 0.88$, $t(101) = 16.02$, $p < 0.001$; testing against the midpoint of the comparative scale].

Participants perceived the patient in the well-adjusted condition as better adjusted ($M = 5.36$, $SD = 0.96$) than the patient in the poorly adjusted condition [$M = 2.33$, $SD = 1.12$, $t(100) = 14.67$, $p < 0.001$, $d = 2$]. However, the well-adjusted patient was not perceived as an upward standard. In both conditions, participants rated themselves to be better adjusted than the women in the self-report, i.e., their answers to this item were on average above the midpoint of the comparative scale at

3.5 [well-adjusted standard: $M = 4.38$, $SD = 1.05$, $t(49) = 5.94$, $p < 0.001$; poorly adjusted standard: $M = 5.02$, $SD = 1,10$, $t(51) = 10.02$, $p < 0.001$].

Similarity

Participants perceived themselves to be more similar to the well-adjusted ($M = 4.46$, $SD = 1.72$) than to the poorly adjusted standard [$M = 2.15$, $SD = 1.33$, $t(100) = 7.59$, $p < 0.001$, $d = 1.5$].

Several factors may have influenced the way our participants felt similar to the standard. First, the standard that we used in this study was younger (35 years old) than most patients in our sample (on average 63 years old). It could thus be argued that this difference in age prevented our participants to feel similar to the standard and identify with her. Second, more than two-thirds of our participants were currently attending a self-help group or had attended one in the past. This may influence how they related to other women with the same medical condition and, therefore, how they related to the standard. To address these two points, we thus investigated the relation between participants' age and their assessment of similarity with the standard.

We found that age significantly correlated with the similarity ratings ($r = -0.31$, $p \leq 0.001$): Over the whole sample, the younger the participants, the more similar they felt to the standard. Did these results mean that only the younger participants of our sample felt similar and identified with the standard? To answer this question, we calculated the mean similarity ratings made by our participants for each age category, i.e., each decade, and for each kind of standard they had been exposed to. These means (see **Table 1**) show that participants of all age categories reported high levels of similarity with the well-adjusted standard (above 3.8 on a six-point scale) and low levels of similarity with the poorly adjusted standard (below 2.5 on a six-point scale). These results suggest that the young age of the standard did not prevent participants to feel similar to her, when she reported good adjustment.

To investigate the effects of age and self-help group attendance on similarity ratings in the context of our study, we ran an ANCOVA with the type of standard as one factor (well vs. poorly adjusted), the attendance to self-help groups as second factor (attending vs. not-attending), age as a covariate, and the similarity ratings as dependent variable. Results indicated a main effect of standard [$F(1,97) = 44.808$, $p < 0.001$, $\eta_p^2 = 0.316$]: Participants felt more similar to the well-adjusted ($M = 4.49$, $SE = 0.234$) than to the poorly adjusted standard ($M = 2.25$, $SE = 0.231$). We also found a marginally significant effect of age [$F(1,97) = 2.827$, $p = 0.096$, $\eta_p^2 = 0.028$], but the other main effect (attendance to self-help-group) and the interactions were non-significant (all Fs < 0.551, all ps > 0.278).

Taken together these results suggest that our manipulation was effective, and they provide support for our hypotheses. A vast majority of our participants, regardless of their age and attendance to self-help groups, reported high levels of similarity to the well-adjusted standard and low levels of similarity to the poorly adjusted standard.

Identification and Contrast

The internal consistency of both the identification (Cronbach's $\alpha = 0.90$; Spearman–Brown's $\rho = 0.90$) and contrast (Cronbach's $\alpha = 0.88$; Spearman–Brown's $\rho = 0.88$) scales was satisfactory[3]. We hypothesized that women with breast cancer perform favorable comparisons, i.e., that they identify with well-adjusted standards and contrast with poorly adjusted ones. This hypothesis was confirmed by a 2 × 2 ANOVA with standard (poorly vs. well-adjusted) as between-subject variable and comparison (identification vs. contrast) as within-subject variable. As depicted in **Figure 1**, participants reported significantly more identification than contrast for the well-adjusted standard

TABLE 1 | Mean similarity, identification, and contrast ratings made by participants of different age categories (within brackets are the standard deviation values).

		N	Similarity	Identification	Contrast
Poorly adjusted standard	Age < 50	3	1.67 (0.58)	1.67 (0.29)	4.83 (1.26)
	50 ≤ Age < 60	9	2.44 (1.67)	2.39 (1.69)	4.17 (1.71)
	60 ≤ Age < 70	24	2.37 (1.44)	2.13 (1.44)	4.98 (1.01)
	70 ≤ Age < 80	14	1.71 (0.99)	2.00 (1.37)	5.07 (1.07)
	80 ≤ Age < 90	2	2.00 (1.41)	2.50 (0.00)	4.75 (1.77)
Well-adjusted standard	Age < 50	7	5.57 (1.13)	4.71 (1.60)	1.50 (1.32)
	50 ≤ Age < 60	17	4.82 (1.47)	5.35 (1.09)	1.32 (0.56)
	60 ≤ Age < 70	12	3.92 (2.19)	4.17 (1.63)	1.67 (0.94)
	70 ≤ Age < 80	11	3.82 (1.47)	4.82 (1.15)	2.23 (0.96)
	80 ≤ Age < 90	3	3.40 (2.07)	5.50 (0.50)	2.17 (1.61)

N: number of participants.

[3]We report both the Cronbach's alpha and the Spearman–Brown's coefficient because the combination of these two coefficients seems to lead to the most robust assessment of reliability of two-item scales (see Eisinga et al., 2013).

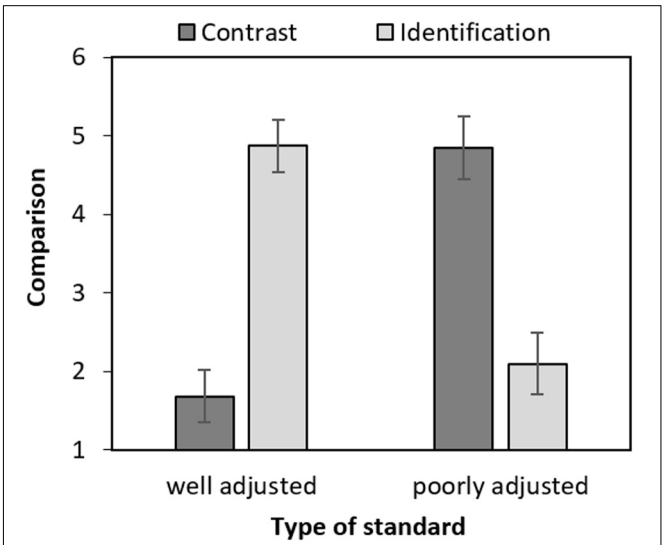

FIGURE 1 | Mean comparison (contrast and identification) by type of standard (poorly vs. well-adjusted). Error bars represent confidence intervals (95%) and were calculated as proposed for within-subject designs by Cousineau and O'Brien (2014).

[$F(1,100) = 143.65$, $p < 0.001$, $\eta_p^2 = 0.59$], but significantly more contrast than identification for the poorly adjusted standard [$F(1,100) = 111.03$, $p < 0.001$, $\eta_p^2 = 0.52$], resulting in a significant interaction [$F(1,100) = 253.92$, $p < 0.001$, $\eta_p^2 = 0.72$]. None of the main effects reached significance (Fs < 1.52, ps > 0.221).

To make sure that age and self-help group attendance did not call our results into question, we reran the 2 × 2 ANOVA with standard (poorly vs. well-adjusted) as between-subject variable, comparison (identification vs. contrast) as within-subject variable, and added the two variables (age and self-help group attendance) as covariates. This new analysis led to similar results as the first ANOVA. The interaction between the variables standard and comparison remained significant [$F(1,97) = 192.591$, $p < 0.001$, $\eta_p^2 = 0.665$]. *Post hoc* tests using a Tukey correction indicated that participants reported more identification than contrast for the well-adjusted standard [$t(97) = 11.27$, $p_{tuckey} < 0.001$] and more contrast than identification for the poorly adjusted standard [$t(97) = 10.86$, $p_{tuckey} < 0.001$]. We also found a significant main effect of age [$F(1,97) = 4.297$, $p = 0.041$, $\eta_p^2 = 0.042$]. Finally, we found a significant interaction between the variables comparison and attendance to self-help groups [$F(1,97) = 4.359$, $p = 0.039$, $\eta_p^2 = 0.043$]; however, none of the *post hoc* tests ran to interpret this interaction led to significant differences (all ts < 2.437, all ps > 0.077). None of the other main effects or interactions reached significance (all Fs < 1.534, ps > 0.219).

Moderation by Self-Esteem and Self-Efficacy

We analyzed whether self-esteem and self-efficacy moderated the interaction reported in the previous section, i.e., between the variables standard (well vs. poorly adjusted) and comparison process (identification vs. contrast). Both, the self-esteem scale ($\alpha = 0.76$) and the self-efficacy scale ($\alpha = 0.91$) were sufficiently internally consistent. Moreover, they correlated with each other ($r = 0.50$, $p < 0.001$).

We ran separate multiple regressions for the contrast and identification scales. We used the macro PROCESS from Hayes (2013) and the bootstrapping method. The predictors were the standard (dummy coded 0 = poorly adjusted, 1 = well-adjusted), the moderator (self-esteem or self-efficacy, centered), and the interaction between both variables. Results indicated a significant Standard × Self-esteem interaction for the contrast scale ($b = -0.56$, $p = 0.049$, 95% CI [−1.12, −0.00]). Simple slope analyses suggested that, in accordance with our hypothesis, the higher participants' self-esteem the lower their tendency to contrast with the well-adjusted standard. This result was, however, only marginally significant ($b = -0.36$, $p = 0.066$). Moreover, the simple slope analyses for contrasting from the poorly adjusted standard were clearly non-significant ($b = 0.199$, $p = 0.330$). Thus, although significant, the Standard × Self-esteem interaction for the contrast scale should be interpreted with caution. The multiple regressions testing the moderation of self-esteem on the identification scale did not reveal any significant results, nor did the moderation involving self-efficacy (see **Supplementary Table S2**).

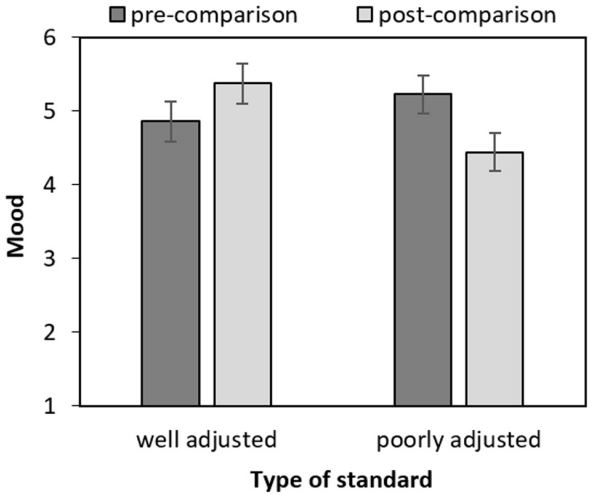

FIGURE 2 | Mood by time (pre- and post-comparison) and type of standard (poorly vs. well-adjusted). Error bars represent confidence intervals (95%) and were calculated as proposed for within-subject designs by Cousineau and O'Brien (2014).

Focus on Similarities or Differences

The internal consistency of the focus on similarities or differences scale proved to be weak ($\alpha = 0.68$). Moreover, the scale did not correlate with perceived similarity to either the well-adjusted standard ($r = 0.20$, $p = 0.176$) or the poorly adjusted standard ($r = 0.08$, $p = 0.575$). Therefore, we refrained from performing the analyses we had planned for this scale.

Mood

Mood was assessed twice, once before the comparison and once immediately after. A 2 × 2 ANOVA was conducted with standard (poorly adjusted vs. well-adjusted) as between-subject factor and time (pre-comparison vs. post-comparison) as within-subject factor. The interaction was significant [$F(1,100) = 23.32$, $p < 0.001$, $\eta_p^2 = 0.19$], but none of the main effects were (Fs < 1.01, ps > 0.317). As depicted in **Figure 2**, participants' mood increased after they had read the well-adjusted standard report [$F(1,100) = 7.22$, $p = 0.008$, $\eta_p^2 = 0.07$] and decreased after the poorly adjusted standard report [$F(1,100) = 17.27$, $p < 0.001$, $\eta_p^2 = 0.15$]. Mood did not significantly differ between condition before the self-report reading [$F(1,100) = 1.56$, $p = 0.215$, $\eta_p^2 = 0.015$], but it did afterward [$F(1,100) = 8.22$, $p = 0.005$, $\eta_p^2 = 0.08$]. Thus, participants' mood assimilated to the mood of the standard.

We hypothesized that the affective reaction to the comparison depends on the type of comparison process. For example, the more participants identify with the poorly adjusted standard, the more their mood shall decrease. To test such moderation effects, we regressed mood differences on the Standard, Contrast, Identification variables, and the interactions of Standard × Contrast and Standard × Identification. We found a significant Standard × Identification interaction (see **Table 2** and **Figure 3** upper panel on the right). Simple slopes indicated

TABLE 2 | Moderation analyses predicting mood difference and anxiety/depression.

	B	SE_b	*p*
Mood differences			
Constant	−1.00 [−1.65, −0.36]	0.33	0.003
Standard	1.63 [0.59, 2.68]	0.53	0.002
Contrast (centered)	−0.08 [−0.39, 0.24]	0.16	0.632
Identification (centered)	−0.24 [−0.52, 0.03]	0.14	0.078
Standard × Contrast	0.43 [−0.08, 0.93]	0.25	0.095
Standard × Identification	0.56 [0.17, 0.95]	0.20	0.005
R^2	0.28		
Anxiety/depression			
Constant	7.37 [6.07, 8.68]	0.66	<0.001
Standard	−0.51 [−2.62, 1.60]	1.06	0.631
Contrast (centered)	−0.31 [−0.95, 0.33]	0.32	0.340
Identification (centered)	1.31 [0.76, 1.86]	0.28	<0.001
Standard × Contrast	1.90 [0.89, 2.91]	0.51	<0.001
Standard × Identification	−1.03 [−1.82, −0.24]	0.40	0.011
R^2	0.32		

Standard is coded 0 = poorly adjusted and 1 = well-adjusted. Square brackets contain 95% confidence intervals for b.

that the more participants identified with the well-adjusted standard the stronger the increase in their moods ($b = 0.32$, $p = 0.026$). The slope for identification with the poorly adjusted standard displayed the opposite effect but was only marginally significant ($b = -0.24$, $p = 0.078$). Although these results are in line with our hypotheses, they should be interpreted with caution. Indeed, we observed a similar pattern for the contrast scale although we had predicted the opposite (see **Figure 3**, upper panel on the left). The Standard × Contrast interaction was not significant (see **Table 2**) but means suggest that, contrary to our hypothesis, the more participants contrasted from the standard the more similar to the standard's their mood became.

Anxiety and Depression

The anxiety subscale (α = 0.79) as well as the depression subscale (α = 0.82) both showed sufficient internal consistency and correlated highly with each other ($r = 0.65$, $p < 0.001$). For ease of interpretation and brevity, we averaged the sum-score of the two subscales[4].

The anxiety/depression score was regressed on Standard, Identification, Contrast, and the interactions Standard × Identification and Standard × Contrast. Both interactions significantly predicted the anxiety/depression score (see **Table 2**) indicating a moderation of the effect of the standard depending on the type of comparison process (see **Figure 3**, lower panel). Simple slope analyses specified that the more participants contrasted from the well-adjusted standard ($b = 1.59$, $p \leq 0.001$) and the more they identified with the poorly adjusted standard ($b = 1.31$, $p < 0.001$), the more anxiety and depression they reported. The remaining slopes were not significant (identification with well-adjusted standard: $b = 0.28$, $p = 0.331$; contrast to poorly adjusted standard: $b = -0.31$, $p = 0.340$).

DISCUSSION

This study was designed to examine the reactions of patients with breast cancer after reading the report of either a well or poorly adjusted fellow patient. Consistent with our hypotheses, we found that when faced with a well-adjusted patient, participants reported more identification than contrast, whereas when faced with a poorly adjusted patient, the opposite occurred. This indicates that the patients were able to adjust their comparison to the standard and, thereby, accomplish favorable comparison processes. Moreover, we found that the type of comparison predicted self-assessment of anxiety and depression after the comparison. The less participants contrasted with the well-adjusted standard and identified with the poorly adjusted standard, the less anxiety and depression they reported. These results suggest that avoiding unfavorable comparison processes is especially beneficial, even more so than engaging in favorable ones. In the context of our study, these results may be related to the fact the participants showed a high level of favorable comparison processes in general.

The mood measure revealed a strong assimilation effect. Immediately after reading that another breast cancer patient had adjusted well, was optimistic and spirited, the women themselves felt happier than after reading the report of a poorly adjusted woman. This effect was more pronounced the more the women identified with the standard. However, there was also a tendency indicating that more contrastive comparison was associated with more mood assimilation. This tendency stands in sharp contrast to the expected consequence of such a comparison (Van der Zee et al., 2000; Mussweiler, 2003). Apparently, the more our participants compared with the standard, regardless whether they later described this comparison process as contrast or identification, the more they showed an immediate, assimilative mood reaction. There are several possible explanations for this result. First, some people argue that assimilation is the primary or more natural mechanism in social comparison (Mussweiler, 2003). Therefore, the immediate affective reaction might be guided by this mechanism and only people who do not compare at all remain unaffected by the standard. Second, assimilation is fostered by similarity (Mussweiler, 2003). In our study, there was an important and obvious similarity between the participants and the standard: both were women who have survived breast cancer. This similarity could explain why participants assimilated their

[4]Analyses of the anxiety and depression scales separately reveal similar results are those found for the average score of both scales.

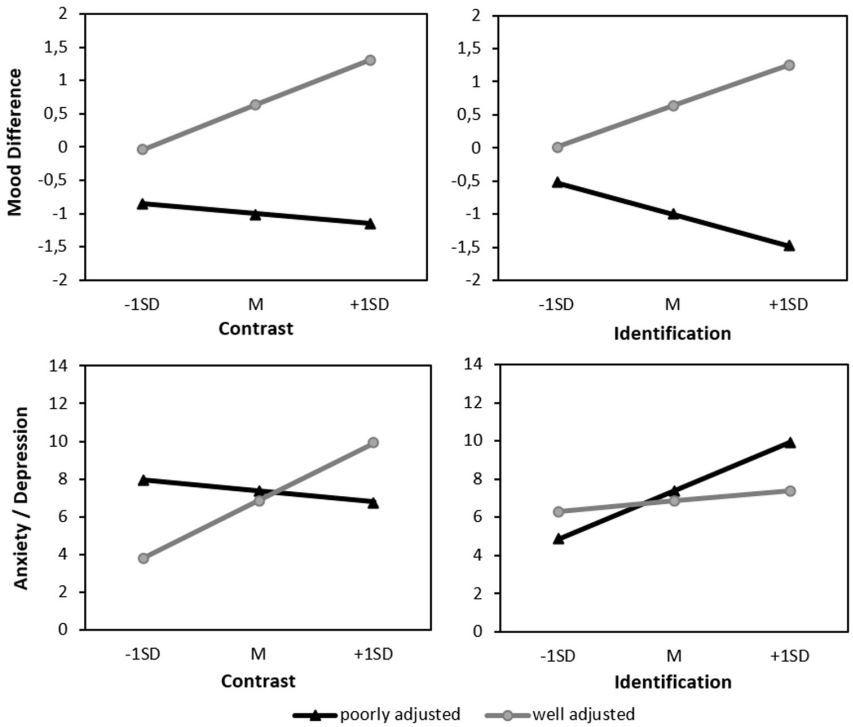

FIGURE 3 | Upper panel: Predicted mood difference ("mood after"—"mood before reading the self-report"). Lower panel: Anxiety/depression by standard (well or poorly adjusted) and contrast/identification.

mood to the positive or negative tone of the other patients' self-report. Finally, one could interpret these results as an expression of sympathy for the standard rather than the consequence of a comparison process. Participants may indeed feel saddened by the report of the poorly adjusted standard and elated by the report of a well-adjusted standard whether they identified with her or not. Future research should investigate the mechanisms of this effect.

When planning this study, we speculated that patients with high self-esteem or high self-efficacy would be more likely to engage in favorable comparison strategies and might therefore profit more from these comparisons. Our results did not support this hypothesis. Except for one interaction (i.e., the moderation of self-esteem on the contrast scale), self-esteem and self-efficacy did not moderate the comparison process itself. This suggests that, contrary to our predictions, people with high self-esteem or high self-efficacy may not profit more from these comparisons.

Even though it is a strength of the present study that the type of comparison was assessed, it is also a weakness. This method allowed us to detect that patients with breast cancer react with favorable comparison processes toward fellow patients, but it limits the interpretation of this effect on affective reactions. Due to the correlative design, it remains unclear whether women who contrast more from a well-adjusted patient feel more anxiety and depression, or whether women who feel more anxiety and depression contrast more from well-adjusted patients. To disentangle both hypotheses, one would need to experimentally manipulate identification and contrast.

In addition, it is important to mention that the items to assess identification and contrast in this study already incorporated an affective component (e.g., "If I think about the women in the text, I am anxious that my situation will get worse."). These items were modeled after those of Van der Zee et al. (2000) and aimed to differentiate between favorable and unfavorable comparison processes. However, it would be interesting to measure identification and contrast without this affective component and, for example, assess participants focus on or thinking about similarities between themselves and the other person while doing the comparison (for similar methods see Petersen et al., 2012; Arigo et al., 2015). In our study, we included the similarity and dissimilarity focus measure for this purpose (Mussweiler and Damisch, 2008). Unfortunately, this measurement turned out to be invalid. More reliable measurements need to be developed to deepen our understanding of comparison processes.

We also want to point out further limitations concerning the generalizability of the results based on the manipulation and sample. First, we manipulated the level of adjustment in the self-report but did not vary information about the prognosis. We used this manipulation because prior research indicates that patients react differently toward these two types of information (Stanton et al., 1999). Moreover, one may argue that in daily encounters the other person's adjustment is more easily detectable than her prognosis (see Graves et al., 2005) and that comparisons with this kind of information is more likely. However, one would

expect that knowing the standard's prognosis or reading a self-report that focuses on other aspects of the cancer experience triggers different comparison process and especially different affective reactions (see Buunk et al., 2009). In general, it would be valuable to explore further, whether the self-serving effects that we observed in this study can be replicated with different types of standards and patients.

Another potential limitation of our study relates to the fact that we introduced the women from the self-report to be 35 years old. This age is much younger than the age of the women in our sample (M_{age} = 63). As outlined above, comparisons are easily influenced by perceived similarity to the comparison standard and people tend to prefer similar others as comparison standard (Goethals and Darley, 1977). In line with this hypothesis, our results indicated that the younger the participants the more similar they felt to the standard, and the less they contrasted from her. This result raised the question of whether the older part of our sample perceived any similarity between them and the standard and could identify with her. In support of this notion, we found that participants of all age categories reported high levels of similarity and identification with the well-adjusted standard and low levels of similarity and identification with the poorly adjusted standard (see **Table 1**). Moreover, we reran our main analyses with age as a covariate and found that the effect of the standard remained highly significant. Altogether, these results suggest that, indeed, our younger participants felt more similar to the standard than our older ones; however, all of them identified strongly with the standard when she reported a good adjustment. These results also suggest that the standard's adjustment (poorly adjusted vs. well-adjusted) plays a much bigger role than age in the extent to which patients identify with her.

When patients with breast cancer encounter another patient, they can rely on many personal characteristics to identify similarities or differences. Age is of them, but our data suggest that the standard's level of adjustment is more determinant. The fact that age did not play a major role in our participants' ratings of similarity and identification is in line with the results obtained by Wood et al. (1985). They examined the narrations of women with breast cancer and found that patients with breast cancer compare themselves to other patients with cancer but other than suffering of the same disease, the actual similarity with the standard did not seem to play a big role. These results, therefore, not only reveal that our manipulation was efficient, but they also support our main hypothesis that women with breast cancer flexibly adjust their comparison processes to their advantage.

Besides these limitations, this study clearly indicates that breast cancer patients' affective reaction toward other patients do not only depend on the type of standard they are exposed to—i.e., whether the other patient is doing well or poorly—but is also related to the type of comparison processes they engage in. Social comparisons can induce both positive and negative feelings. It was thus reassuring to see that in our sample, participants predominantly engaged in favorable comparison processes. However, it might be wise to prepare patients who are newly diagnosed with breast cancer for these unavoidable comparisons and to provide further guidance. Being in contact with fellow patients, sharing experiences, and getting social support can have a positive impact on patients' well-being (Gray et al., 1997; Manning and Dickens, 2007; Stang and Mittelmark, 2008) and no woman should isolate herself out of fear of unfavorable social comparisons.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are freely available in the OSF (https://osf.io/wchdf/).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Commission of the University of Graz (Austria). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KC, RI, and HI conceived the project hypotheses and designed the experimental material. RI and HI collected the data. RI, HI, and GK conducted the analyses. KC, GK, RI, and HI contributed to the interpretation of the results and the writing of the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01234/full#supplementary-material

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When Are Leaders Receptive to Voiced Creative Ideas? Joint Effects of Leaders' Achievement Goals and Personal Sense of Power

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Voiced suggestions for improvement and constructive change (i.e., voiced creative ideas) by employees are important for organizations. In order to reap the benefits of these ideas, leaders need to be receptive. Drawing on achievement goal theory and approach-inhibition theory of power, we examined the joint effects of leader achievement goals and personal sense of power on leader receptivity to voiced creative ideas in two studies. In a field study (Study 1, N = 136), we found that leaders pursuing mastery-approach goals were positively related to leader receptivity. Receptivity for leaders pursuing performance-approach goals was found to be contingent upon their personal sense of power, with a positive (negative) association under conditions of high (low) sense of power. Similarly, in experimental study (Study 2, N = 93), in which we manipulated leader achievement goals, the receptivity of performance-approach goal leaders was contingent upon their sense of power. When sense of personal power was high, performance-approach goal leaders displayed higher levels of receptivity than when their personal sense of power was low. An implication is that personal sense of power may prevent leaders with performance-approach goals from disregarding creative ideas that are put forward by their subordinates. These findings extend insight into how and when leaders are receptive to voiced creative ideas.

Keywords: leader receptivity, employee voice, creativity, goal orientation, power

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INTRODUCTION

In light of an increasingly global, competitive, and turbulent markets, it is well recognized that employee creativity has become a key driver for organizational innovation and longer-term growth (Zhou and Shalley, 2003). Leaders realize that they can no longer succeed by merely focusing on developing own ideas (Griffin et al., 2007) and depend more than ever on employees to proactively advance bottom-up change by voicing constructive ideas for improvement. In fact, leaders acknowledge the value of employee creativity—the generation of novel and potentially useful ideas about organizational products, practices, or procedures (Amabile, 1988)—as being crucial for

organizations' future prosperity (Shalley et al., 2004). Yet, research suggests that many leaders see the voicing of creative ideas by followers as threats or distractions, and thus fail to benefit from employees' proactive and creative voice (Detert and Burris, 2007; Sijbom et al., 2015b).

In this paper we seek to expand our theoretical understanding on how and when leaders benefit from employees' proactive and creative voice. Specifically, we focus on leaders' receptivity to employees' voice of creative ideas, with receptivity defined as the degree to which leaders are willing to consider and explore creative ideas (Grant et al., 2011; Sijbom et al., 2015b). Receptivity is a necessary prerequisite for further realization of voiced creative ideas within organizations (Amabile et al., 2004; Zhou et al., 2019). Comprehending how and when leaders are receptive to these ideas is thus crucial in reaping the benefits of employee creativity. Drawing on social influence (Cialdini and Goldstein, 2004) and followership literature (Uhl-Bien et al., 2013) we view the voicing of creative ideas as a challenging proactive behavior by followers, with the attempt to influence their leaders in changing their "ways of doing things." Leaders, however, are not passive recipients of follower influence (Oc and Bashshur, 2013) and motivational and dispositional factors amplify or attenuate their receptivity to voiced creative ideas of followers.

In fact, achievement goals have been identified as an important motivational factor at the root of leaders' responses to voiced creative ideas (Sijbom et al., 2015a,b, 2016). We focus here on approach achievement goals rather than avoidant achievement goals as the latter have been shown to be consistently maladaptive (Payne et al., 2007). Specifically, we delve more deeply into the effects of two types of approach goals that have been considered: mastery-approach goals and performance-approach goals. Mastery-approach goals, which are centered on the development of competence, have been consistently and strongly related to positive responses. However, performance-approach goals, which are centered on the demonstration of competence, have been related to both positive and negative responses. The blend of positive and negative responses subscribes to the hybrid nature of performance-approach goals (Elliot and McGregor, 2001; Anseel et al., 2011) and makes identifying the expected relationship with voice receptivity for leaders pursuing these goals more complicated. That is, it remains unclear under what conditions leaders with performance-approach goals display more or less receptivity in response to voiced creative ideas.

To shed light on the boundary conditions influencing this relationship between performance-approach goals and receptivity, we integrate the achievement goal framework with the literature on power dynamics, which are ubiquitously present in leader-follower relations. Specifically we focus on how, with a performance-approach mindset, leaders' receptivity might be affected by their perceptions of their abilities to influence their followers, which is referred to as leaders' personal sense of power (Anderson et al., 2012). We focus on sense of power because, according to the approach-inhibition theory of power (Keltner et al., 2003) personal power should influence whether performance-approach leaders perceive creative input as a positive vehicle to help them perform well or perceive it as a threat to their perceived competence. Individuals who feel powerful are more approach-oriented (Galinsky et al., 2008), and will tend to perceive creative input positively. Consequently, leaders pursuing performance-approach goals should be more receptive to voice when they also have a high sense of personal power. In contrast, leaders who feel powerless are more avoidance-oriented (Galinsky et al., 2008), and so leaders with performance-approach goals will be less receptive to voice if their sense of personal power is low.

Our paper makes several theoretical and empirical contributions. First, we contribute to the body of research that focuses on the critical role that leaders fulfill in the process of translating voiced creative ideas into implemented ideas. We thus extend theorizing about the importance of motivational factors in relation to effective leadership behaviors. Leaders' achievement goal crucially affect their receptivity and consequently (lack of) idea implementation. Second, we contribute to the literature on power by showing that possessing a sense of power prevents the situation in which leaders with performance-approach goals demonstrate ineffective leadership behaviors (i.e., disregarding creative ideas). Although leaders' hierarchical position provides them with the power to allocate resources, their sense of power determines whether they use their position effectively. Third, our research adds to insights on leaders' dependence on followers. Specifically, we demonstrate that leaders actively perceive and respond to follower influence. That is, leaders' reactions to followers' challenging proactive behaviors are shaped by leaders' motivational and dispositional factors. To examine these relationships, we conducted two studies: a survey study of leaders working across a wide range of professions and industries and a laboratory experiment with participants who role-played the role of leader.

THEORY AND HYPOTHESES

Conceptualization of Achievement Goals

Achievement goals are cognitive-perceptual frameworks that describe how people define, experience, and respond to competence-relevant situations, including the workplace (DeShon and Gillespie, 2005; Elliot, 2005). Although there are various models of achievement goals, with slightly different terminology, all models make the mastery-performance distinction (Farr et al., 1993; VandeWalle, 1997; Elliot and McGregor, 2001; Payne et al., 2007). This distinction reflects differences in the definition of competence, whereby mastery goals use a self-referenced standard whereas performance goals use an other-referenced standard (Elliot and McGregor, 2001).

In dominant conceptualizations of achievement goals, mastery and performance goals are further bifurcated into approach goals, in which the focus is directed toward positive or desirable outcomes, and avoidance goals, in which the focus is on avoiding negative or undesirable outcomes (Elliot and McGregor, 2001; Baranik et al., 2010). Avoidance goals have consistently shown to be maladaptive forms of self-regulation (Payne et al., 2007). Given that adaptive rather than maladaptive behaviors are required in order to utilize the potential of voiced ideas, we focus only on approach goals because they are considered

to be adaptive forms of self-regulation (Payne et al., 2007). Consequently, in our research we focus on the effects of mastery-approach and performance-approach goals (cf. Poortvliet et al., 2007; Miron-Spektor and Beenen, 2015). Mastery-approach goals entail striving to do better than before and focus on improving their own competence and exploring new knowledge or skills. Performance-approach goals entail striving to do better than others and focus on demonstrating their competence, and to seek favorable judgments from others (Elliot and McGregor, 2001; DeShon and Gillespie, 2005; Payne et al., 2007).

Achievement goals have been conceptualized as a relatively stable personality trait or as a situational domain-specific state (DeShon and Gillespie, 2005). Dispositional achievement goals refer to stable patterns of cognition and action that result from the chronic pursuit of achievement goals in different situations over time, whereas situational domain-specific achievement goals reflect a similar pattern in a specific domain (i.e., work domain) (DeShon and Gillespie, 2005; Payne et al., 2007). We follow conceptual and empirical considerations that suggest that achievement goals may be best suited for the domain-specific level (VandeWalle, 1997; Elliot, 1999; Baranik et al., 2010). Accordingly, we examined leaders' achievement goals specific to the work domain, both assessed (Study 1) and induced (Study 2).

Leaders' Mastery-Approach Goals and Receptivity to Voiced Ideas

Leaders pursuing mastery-approach goals are focused on developing and gaining competence by acquiring new skills and mastering new situations (Nicholls, 1984; Dweck, 1986). Accordingly, they are likely to perceive voiced creative ideas as instrumental feedback information that provides them with important diagnostic information and suggestions for making improvements in their managerial domain. As such, voiced creative ideas represent an important source for learning for leaders that can benefit their performance and self-development. Indeed, previous findings show that, in the receipt of feedback, mastery-approach goals are positively related to outcomes that are beneficial for development and learning, such as explorative interest (Sijbom et al., 2015a), learning opportunity appraisal (Sijbom et al., 2015b) and motivation to learn (Colquitt and Simmering, 1998). In turn, these positive developmental reactions result in positive and adaptive responses to the receipt of feedback, creating a positive spiral (e.g., Sijbom et al., 2015b; Gong et al., 2017; Zhu and Akhtar, 2017). We therefore expect this earlier research to be replicated, and we propose the following:

Hypothesis 1: A higher mastery-approach goal in leaders is positively associated with leaders' receptivity to voiced creative ideas.

Leaders' Performance-Approach Goals and Receptivity to Voiced Ideas

Leaders pursuing performance-approach goals have a desire to demonstrate superior leadership performance relative to others, including their followers (Nicholls, 1984; Dweck, 1986), thereby making their leader qualities an important and relevant aspect of their leadership image (Dweck and Leggett, 1988). On the one hand, leaders pursuing performance-approach goals put in effort, and persist toward these goals with the aim to outperform others. Thus, similar to leaders pursuing mastery-approach goals, voiced creative ideas might lead to effective leader behaviors because using voiced creative ideas can help leaders to fulfill their goals of outperforming others. On the other hand, performance-approach goals are associated with self-presentation concerns and fear of failure (Elliot and Church, 1997) making them vulnerable forms of regulation. Accordingly, given their focus on competence demonstration, performance-approach goal leaders may perceive followers' creative input as evaluative feedback information that draws attention to potential deficiencies in their leadership competence, and thus threatening their desired image of being a competent leader.

These mixed associations show the somewhat complex and hybrid nature of performance-approach goals (Anseel et al., 2011). For example, performance-approach goals have been related to both positive and negative affect (Van Yperen, 2006). Also, both approach and avoidance temperament are antecedents of performance-approach goals (Elliot and Thrash, 2002), meaning that performance-approach goals potentially encompass both "approach"-related aspects and "avoidance"-related aspects. As such, other factors may be crucial to take into account because they determine whether the "positive" or "negative" aspects of performance-approach goals emerge (Anseel et al., 2011; Sijbom et al., 2015b). Accordingly we do not formulate a hypothesis concerning the direct relationship between performance-approach goals and receptivity, but instead propose the moderating role of leaders' sense of power.

Leaders' Sense of Power as a Moderator

We propose that leaders' personal sense of power may be an important leader characteristic that affects the relationship between leaders' performance-approach goals and their receptivity to creative voice. Personal sense of power is defined as "the perception of one's ability to influence another person or other people" (Anderson et al., 2012 p. 316). It can be viewed of as a psychological state that occurs when a person perceives that he or she is capable of influencing others. Since influence over others can be understood only in relation to others, sense of power is inherently a social-related concept (Anderson et al., 2012). In terms of the leader-follower relation, leaders' sense of power thus relates to their feeling that they are capable of influencing their followers.

We draw on the approach-inhibition theory of power (Keltner et al., 2003) as a basis for understanding the potential moderating effect of personal sense of power on the relationship between leaders' performance-approach goal and their receptiveness to voiced creative ideas. According to this theory, sense of power triggers the activation of the behavioral approach and inhibition systems. High levels of power activates processes associated with the behavioral approach system, such as attention to rewards and positive emotions, whereas low levels of power activates processes associated with the behavioral inhibition system, such as attention to risks or threats and negative emotions (Keltner et al., 2003). Drawing

on this theoretical framework, we suggest that leaders' sense of power acts as a crucial boundary condition that determines whether the relationship between performance-approach goals and receptivity is positive or negative. Our line of reasoning integrates the hybrid nature of performance-approach goals with the approach-inhibition theory of power.

If leaders pursuing performance-approach goals have a relative low sense of power, this activates the behavioral inhibition system. Under these conditions, the "avoidance" components of performance-approach goals are activated, meaning that leaders pay attention to risk or threats, which subsequently may inhibit them from being receptive to ideas. Creative voice challenges the current ways of doings things by signaling problems or identifying opportunities for improvement. Under conditions of low sense of power, leaders may interpret creative voice as evaluative feedback information that draws attention to potential deficiencies in their leadership competence. By perceiving voiced ideas as negative evaluative feedback regarding the self, this may cast doubt among their feelings of competence. Also, voiced ideas may be perceived as being threatening to their desired image of being a competent leader. By voicing creative input, subordinates may highlight that some state of affairs that are under the leaders' responsibility for overseeing are insufficient or at least suboptimal. Leaders may thus worry about appearing incompetent in the eyes of others because the voiced creative ideas may signal inferiority of their leadership competence rather than the superiority they aim for. Due to this image threat appraisal, performance-approach goal leaders can be expected to become motivated to preserve their image, thereby inhibiting them from being receptive to creative voice.

In contrast, relative high levels of sense of power triggers the activation of the behavior approach system. Under these conditions, performance-approach goal leaders are more focused on rewards and positive outcomes. Thus, high sense of power can be expected to activate the "approach" component of performance-approach goals, leading them to pay more attention to the instrumental value of the creative voice rather than possible (negative) social consequences. Creative voice is instrumental because it may help leaders reaching their goal of appearing competent and gaining favorable (competence) judgments. Previous research from the feedback domain showed when the "approach" component is activated, performance-approach goals pay more attention to the content of the feedback (Anseel et al., 2011). Also, Sijbom et al. (2015b) showed that performance-approach goal leaders may be receptive to voiced ideas when employees do not highlight underlying problems. Accordingly, under conditions of high sense of power, leaders may show effective leadership behaviors (i.e., relative high levels of receptivity to voiced ideas). We test the following hypothesis:

Hypothesis 2: Leaders' sense of power moderates the association between leaders' performance-approach goals and their receptiveness to voiced creative ideas, such that this association is positive for leaders with a high sense of power, and negative when leaders' sense of power is low.

Mastery-approach goal leaders are less concerned with influencing other people. Rather they are focused on developing their own competences and skills as a leader. Owing to this learning interest, mastery-approach goal leaders can be expected to be receptive to voiced creative ideas, irrespective of their sense of power, and hence we focus only on main effects for this variable.

OVERVIEW OF STUDIES

Our research model is depicted in **Figure 1**. We tested our hypotheses in two studies using different methodologies (field study and experimental study) and different samples (leaders and students). In Study 1, we measured our variables in a survey in a sample of leaders. In Study 2, we manipulated achievement goals in a sample of students who role-played the role of leader and performed a management marketing task. Study 1 thus has the advantage of showing evidence of the phenomenon in real work settings, albeit being weak in terms of disentangling causality, whereas Study 2 has the advantage of demonstrating causal effects of achievement goals on receptivity, albeit suffers from low generalizability.

STUDY 1

Method

Sample and Procedure

We recruited a total of 137 participants from Amazon's Mechanical Turk (MTurk) to complete an online questionnaire

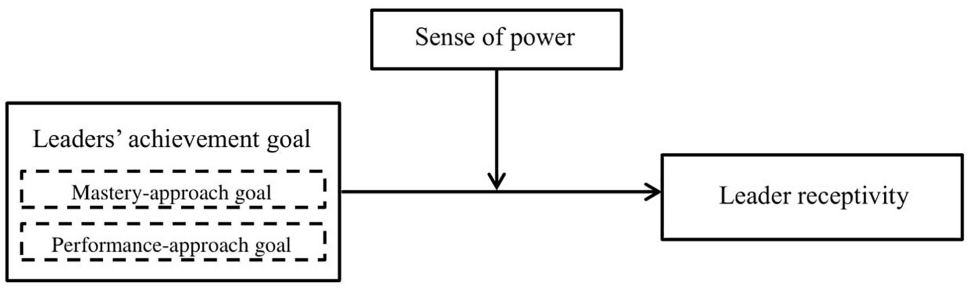

FIGURE 1 | Research model.

in exchange for $1,50. In order to get a relevant sample, a system qualification was used such that only individuals located in the United States could participate. Furthermore, respondents had to explicitly answer a question ("yes" or "no") whether they held a supervisory position with at least three subordinates. Only when they answered "yes" they could proceed with the survey. Finally, at the end of the survey respondents indicated how many years they were in a supervisory position and how many subordinates they supervised. With these questions we checked whether the respondents met our inclusion criteria. One respondent was excluded because he/she indicated to not supervise any subordinates, leaving N = 136 (81 male, M_{age} = 34.5 years, SD_{age} = 10.9). The respondents' mean total work experience was 15.2 years (SD = 9.8); mean total work experience in a supervisory position was 7.1 years (SD = 6.8); and mean number of subordinates supervised was 10.3 (SD = 14.9; with a minimum of 3 and a maximum of 156).

The questionnaire first assessed participants' general sense of power and their achievement goals. They were then asked to think about a situation in which a follower voices a creative idea, after which their receptivity toward that idea was assessed.

Measures

Leaders' performance-approach goal (α = 0.93) and leaders' mastery-approach goal (α = 0.79) were measured using the corresponding three-item subscales of the Achievement Goal Questionnaire-Revisited (AGQ-R; Elliot et al., 2011). Items were adapted to fit the work context of the research by changing the domain from a class setting ("In my classes") to a work setting ("In my work"; for similar adaptations see Sijbom et al., 2015b; Sijbom et al., 2019). Participants rated three items for the performance-approach goal construct (e.g., "My aim is to outperform other colleagues in my work") and three items for the mastery-approach goal construct (e.g., "My aim is to perform better in my work than I have done in the past"). Response categories ranged from 1 (*not true*) to 7 (*extremely true*).

Personal sense of power (α = 0.87) was assessed using the eight-item scale developed and validated by Anderson and Galinsky (2006). Items were adapted to fit the work context by including "at work" in each item (Anderson et al., 2012). Sample items include "In my relationships with others at work I can get people to listen to what I say" and "In my relationships with others at work my ideas and opinions are often ignored (reverse-coded)." Response categories ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

Leaders' receptivity (α = 0.66) was measured using four items. Leaders were first asked to think about a situation in which a subordinate voices a creative idea. Then they answered the four items to assess their receptivity. Two items were based on Sijbom et al. (2015b): "How likely is it that you would like to discuss the ideas together with the subordinate?" and "How likely is it that you would let the subordinate know that you will work out the creative idea together?". Two other items were created for the purpose of this study: "How likely is it that you thank the subordinate for thinking along, but will ignore the creative idea?" (reverse-scored) and "To what extent do you want to show support for the creative idea?". The response categories ranged from 1 (*not at all*) to 7 (*very much*).

We investigated total work experience (in years) as a potential control variable. Leaders who have more years of work experience have shown to be positively related to adoption decisions (Damanpour and Schneider, 2006), which may confound the examined relationships. We also included power sharing as a potential control variable using a five-item scale (α = 0.75) from De Hoogh and Den Hartog (2008); example item is "I allow subordinates to influence critical decisions"). Leaders who share their power with their subordinates can also be expected to more receptive to ideas and suggestions of these subordinates, which may confound the examined relationship in this research. Finally, performance-avoidance goal (α = 0.93; e.g., "My aim is to avoid doing worse than other colleagues in my work") and mastery-avoidance goal (α = 0.87; e.g., "My goal in my work is to avoid doing worse than I have done before") were measured as potential control variables using the corresponding three-item subscales of the AGQ-R (Elliot et al., 2011). Research shows that both avoidance goals are correlated with both approach goals (Payne et al., 2007).

Of these potential control variables, only tenure and power sharing were significantly correlated with one (or more) of the independent variables and the dependent variable (see **Table 1**) and were included as control variables in our analyses (Becker, 2005; Becker et al., 2016).

TABLE 1 | Means, standard deviations, and correlations (Study 1).

Variable	Mean	SD	1	2	3	4	5	6	7	8
1. Gender[a]	–	–								
2. Tenure[b]	15.23	9.79	−0.02							
3. Power sharing	4.96	0.94	−0.15	0.06						
4. Mastery-avoidance goal	4.84	1.64	0.18*	−0.22*	0.08					
5. Performance-avoidance goal	4.88	1.66	0.22*	−0.23*	−0.08	0.54**				
6. Mastery-approach goal	5.91	0.98	0.22*	0.01	0.17*	0.36**	0.10			
7. Performance-approach goal	5.24	1.55	0.08	−0.19*	−0.14	0.22*	0.62**	0.07		
8. Personal sense of power	5.53	0.92	0.15	0.17*	0.07	−0.05	−0.02	0.25*	0.08	
9. Receptivity	5.16	0.98	0.11	0.20*	0.44**	0.08	0.11	0.30**	0.02	0.32**

*N = 136. *p < 0.05; **p < 0.001. [a]0 = "male", 1 = "female". [b]N = 135.*

Results

Table 1 displays the means, standard deviations, and correlations of the variables included in our study.

Table 2 displays the results the hierarchical regression analyses. After standardizing the independent variables (Aiken and West, 1991) we entered them into the regression analysis in three consecutive steps. In the first step, the control variables (tenure and power sharing) were entered. In the second step the main effects variables of mastery-approach goals, performance-approach goals, and personal sense of power were entered. In the third step, the interaction terms were entered.

Hypothesis 1 stated that higher mastery-approach goals in leaders would be positively associated with their receptivity toward voiced ideas. As can be seen in Model 2, a significant effect of leader mastery-approach goal on receptivity was found, $b = 0.17$, $SE_b = 0.08$, $\beta = 0.18$, $p = 0.022$, thereby providing support for Hypothesis 1. Also, Model 2 shows that personal sense of power had a significant positive effect on leader receptivity, $b = 0.22$, $SE_b = 0.08$, $\beta = 0.23$, $p = 0.004$. Although we did not formally hypothesize this relationship, this finding was expected based on the literature showing that sense of power activates approach behaviors.

The main effect of performance-approach goal on receptivity was not significant, $b = 0.08$, $SE_b = 0.07$, $\beta = 0.08$, $p = 0.310$. However, as stated in Hypothesis 2, we expected leaders' sense of power to moderate the association between leaders' performance-approach goals and their receptiveness to voiced creative ideas, such that this association is positive for leaders with a high sense of power, and negative when leaders' sense of power is low. The coefficient associated with the performance-approach goal × personal sense of power interaction term was significant (Model 5; $b = 0.19$, $SE_b = 0.07$, $\beta = 0.21$, $p = 0.008$) and this interaction explained incremental variance in leader receptivity beyond main effects (see Model 4), $\Delta R^2 = 0.04$, $F(1, 127) = 8.01$, $p = 0.005$. As recommended by Becker et al. (2016) we also tested a model without the control variables. The results for the main effects remain similar. The coefficient associated with the performance-approach goal × personal sense of power interaction term became marginally significant ($b = 0.15$, $SE_b = 0.08$, $\beta = 0.16$, $p = 0.065$). However, the performance-approach goal × personal sense of power interaction still explained incremental variance in leader receptivity beyond main effects ($\Delta R^2 = 0.03$, $F(1, 131) = 4.08$, $p = 0.045$. These changes in results with and without control variables indicate that the control variables do affect the outcomes and are relevant to include. We therefore proceeded with the results that include control variables.

Based on inspection of the interaction plot (see **Figure 2**), we can conclude that the association between leaders' performance-approach goal and receptivity differs significantly in the hypothesized direction at different levels (one standard deviation above the mean score and one standard deviation below the mean score) of personal sense of power. We conducted simple slope analyses to further interpret our significant interaction (Aiken and West, 1991; Dawson, 2013). Results showed a significant positive association between leaders' performance-approach goals and receptivity under conditions of high (+1 SD) personal sense of power, $b = 0.19$, $SE_b = 0.08$, b = 0.19, $p = 0.024$, and a non-significant negative association under conditions of low (−1 SD) personal sense of power, $b = -0.19$, $SE_b = 0.12$, $\beta = -0.19$, $p = 0.130$. These results indicate that under conditions of high personal sense of power, the individual slope does significantly differ from 0. Accordingly, we found partial support for Hypothesis 2. A relevant supplementary question is whether receptivity differs for leaders high on performance-approach goals. Results showed a significant positive association between sense of power and receptivity for leaders high on performance-approach goals (+1 SD), $b = 0.43$, $SE_b = 0.10$, b = 0.43, $p < 0.001$, and a non-significant association under conditions for leaders low on performance-approach goals (−1 SD), $b = 0.05$, $SE_b = 0.10$, $\beta = 0.05$, $p = 0.626$. These results indicate that leaders high on performance-approach goals are sensitive to sense of power, with higher (lower) levels of receptivity when sense of power is high (low).

TABLE 2 | Results of regression analyses.

	Receptivity				
Steps and variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Step 1 (control variables)					
Tenure	0.17*	0.15*	0.16*	0.17*	0.17*
Power sharing	0.43**	0.39**	0.39**	0.40**	0.40**
Step 2 (independent variables)					
Mastery-approach goal		0.18*	0.17*	0.19*	0.19*
Performance-approach goal		0.08	0.08	−0.00	0.00
Sense of power		0.23**	0.23**	0.24**	0.24**
Step 3 (interaction terms)					
Mastery-approach goal × sense of power			0.07		0.03
Performance-approach goal × sense of power				0.22**	0.21**
ΔR^2	0.22**	0.11**	0.00[a]	0.04[a]*	0.04[a]*
Adjusted R^2	0.21**	0.31**	0.30**	0.34**	0.34**

*N = 136. Standardized regression coefficients are reported for the respective regression steps. [a] ΔR^2 represents the incremental variance explained over Model 2. *p < 0.05; **p < 0.001.*

STUDY 2

Study 2 concerns an experimental study in which leader achievement goal (performance-approach goal vs. mastery-approach goal) is manipulated rather than measured, thereby enabling us to more strongly show that achievement goals cause different levels of receptivity. Therefore, we reformulated Hypothesis 2 into a testable form for Study 2. As above, we do not expect receptivity of leaders with induced mastery-approach goals to be affected by leaders' sense of power.

Hypothesis 2: Leaders with induced performance-approach goals, rather than leaders with induced mastery-approach goals, display higher (lower) levels of receptivity under conditions of high (low) sense of power.

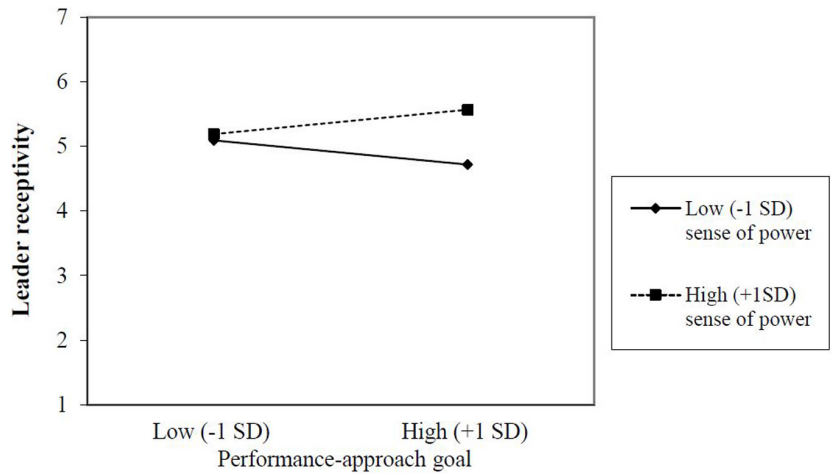

FIGURE 2 | Interaction effect of leaders' performance-approach goal and sense of power on leader receptivity.

Method

Participants and Design

A total of 98 Australian business school undergraduates participated in an online experimental study for partial course credit. Personal sense of power was assessed in a survey prior to participation in an experiment. Participants were randomly assigned to one of the two conditions (performance-approach goal condition vs. mastery-approach goal condition) of the between-subjects design. Five participants were excluded as they did not provide a short narrative as part of the achievement goal manipulation, leaving a final sample of $N = 93$ [of whom 50,5% were female; $M_{age} = 19.59$, $SD_{age} = 1.7$; performance-approach goal condition ($n = 44$); mastery-approach goal condition ($n = 49$)]. Gender and age had no effects and are not discussed further.

Procedure

After signing informed consent, participants completed the general sense of power questionnaire. Next, participants performed a management marketing task (for details, see Sijbom et al., 2015a). In this task, participants were assigned a leadership role and performed an in-basket task in which they had to respond to emails from their subordinates. Specifically, participants were assigned to the role of the company's marketing manager, who was responsible for positioning and selling fast-food products on the market. In the scenario, the organization had developed a new product, so-called fat-free fries, and a project team was composed to successfully introduce the product to the market. Besides the marketing manager, who operated as the team leader, the project team consisted of three subordinates. The marketing manager assigned the team members the task of developing informative sentences that could be used as input for crafting the final marketing strategy propagated by the marketing manager. In actuality, the team members were nonexistent, and in their role of marketing manager, the participants received standardized input. After responding to the input of two team members, the participants received an e-mail from a third team member, named Sandy. In the e-mail, Sandy proposed the use of a different marketing strategy to introduce the new product, which prior research has shown that it is judged as being a creative (i.e., novel and potential useful) marketing strategy in the context of the company (Sijbom et al., 2015a). Given that Sandy communicated this creative idea for renewing the marketing strategy to the leader, Sandy's proposal can be considered to be a voiced creative idea. After completing the dependent variables and the manipulation checks, the participants were debriefed and thanked for their participation.

Achievement Goal Manipulation

To manipulate the achievement goal of participants, we used the achievement goal manipulation procedure developed and previously used by Sijbom et al. (2015a; 2015a; 2015b). The manipulation consisted of three coherent aspects from which a specific achievement goal was derived. First, different information with respect to the organizational climate (competitive vs developmental climate) was given. Second, a personal leadership motto was imposed on the participants. The motto in the performance-approach goal condition was: "Managers are superiors and, therefore, must demonstrate their superior competences in their executive work with subordinates." In the mastery-approach condition, the motto was: "Managers are developers and, therefore, must keep developing their competences in their executive work." The participants then had to write a short narrative in which they clearly advocated their characteristic leadership motto and had to describe their emotions and beliefs associated with it. This narrative procedure is used to intensify the manipulation (Poortvliet et al., 2007). Finally, participants were given a specific goal that varied according to condition. Participants in the performance-approach goal condition read the following: *"In line with your motto, your goal as a leader is to demonstrate your leadership competences to your subordinates."* In the mastery-approach goal condition participants read the following: *"In line with*

your motto, your goal as a leader is to develop your leadership competences" (Sijbom et al., 2015a).

Measure

Achievement Goal Manipulation Check

Participants had to indicate which leadership motto they held as a manager. Participants could choose between (1) "Managers are superiors and, therefore, must demonstrate their superior competences in their executive work with other" (performance-approach goal condition), (2) "Managers are developers and, therefore, must keep developing their competences in their executive work" (mastery-approach goal condition), and (3) "I did not receive information with respect to a motto."

Also, we assessed the degree to which participants were committed to their assigned achievement goal. We used a five-item scale to assess goal commitment ($\alpha = 0.78$; Klein et al., 2001). After participants had their specific achievement goal assigned, they answered the following items: "I am strongly committed to pursuing this goal"; "It wouldn't take much to make me abandon this goal" (reverse-coded); "I think this is a good goal to shoot for"; "It's hard to take this goal seriously" (reverse-coded); and "Quite frankly, I don't care if I achieve this goal or not" (reverse-coded). The response categories ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

Personal sense of power ($\alpha = 0.88$) was assessed using the same eight-item scale of Anderson and Galinsky (2006) as in Study 1. The correlation with the dummy-variable of achievement goal condition was non-significant ($r = -0.06$, $p = 0.570$).

Leader receptivity ($\alpha = 0.77$) was assessed using a four-item scale. All items started with the stem: "How likely is it that you will let Sandy know that. . .", followed by different statements: ". . .you would like to discuss the input together with Sandy?; ". . .you seriously want to discuss the input during the next meeting of the project team?"; ". . .you want to further develop the input together with Sandy?"; and ". . .you will not use Sandy's input" (reverse-coded). The first three items were developed and used by Sijbom et al. (2015b). We developed the fourth negatively framed item for the purpose of this study. The response categories ranged from 1 (*extremely unlikely*) to 7 (*extremely likely*).

Results

Manipulation Checks

In the performance-approach goal condition, 73% answered the information check correctly. This was 94% in the mastery-approach goal condition. Results of a *t*-test revealed that the goal commitment scores of participants in the performance-approach goal condition ($M = 5.47$, $SD = 1.00$) were not significantly different from the goal commitment scores of participants in the mastery-approach goal condition ($M = 5.60$, $SD = 0.87$), $t(91) = -0.68$, $p = 0.50$. This indicates that participants in both conditions were committed to their recommended goal. Hence, the manipulation of achievement goals was successful. When participants who incorrectly answered this question were excluded, the pattern of results was the same and still significant.

Leader Receptivity

To examine the interactive effect of achievement goal and personal sense of power on leader receptivity, we performed a regression analysis. Achievement goal (0 = performance-approach goal condition, 1 = mastery-approach goal condition), standardized personal sense of power, and their interaction were used as the independent variables. The analysis revealed a nonsignificant main effect of achievement goal, $B = -0.03$, $SE_b = 0.18$, $\beta = -0.02$, $p = 0.86$, 95% CI for B [−0.40, 0.33], meaning that leaders with an induced performance-approach goal did not statistically differ from leaders with in induced mastery-approach goal with respect to their receptivity. Although not formally hypothesized, a significant main effect of personal sense of power was found, $B = 0.26$, $SE_b = 0.09$, $\beta = 0.29$, $p = 0.006$, 95% CI for B [0.08, 0.44].

Hypothesis 2 predicted an interaction between leaders' achievement goals and sense of power such that leaders with induced performance-approach goals, rather than leaders with induced mastery-approach goals, display higher (lower) levels of receptivity under conditions of high (low) sense of power. The analysis revealed a significant interaction between achievement goal and personal sense of power (see **Figure 3**), $B = -0.47$, $SE_b = 0.18$, $\beta = -0.36$, $p = 0.01$, 95% CI for B [−0.83, −0.11]. Simple slope analyses showed that receptivity of leaders in the mastery-approach goal condition did not vary at different levels of sense of power, $B = 0.02$, $SE_b = 0.13$, $\beta = 0.02$, $p = 0.88$, 95% CI for B [−0.24, 0.27]. For leaders in the performance-approach goal condition, leader receptivity did significantly vary at different levels of sense of power, with higher (lower) levels of leader receptivity under conditions of high (low) sense of power, $B = 0.49$, $SE_b = 0.13$, $\beta = 0.54$, $p < 0.001$, 95% CI for B [0.24, 0.74]. Together these results provide support for Hypothesis 2 that the receptivity of performance-approach goal leaders is moderated by their sense of power.

DISCUSSION

Being receptive to creative voice is crucial for leaders to benefit from employee creativity. In the present research, we investigated how and when leaders show effective leader behaviors, that is, when they are receptive in response to voiced creative ideas. Building on achievement goal theory and approach-inhibition theory of power, we showed in two studies that receptivity of leaders pursuing performance-approach goals is contingent upon their sense of power. That is, leaders pursuing performance-approach goals were more receptive when they had relatively high levels of sense of power, and were less receptive when they had relatively low levels of sense of power. Furthermore, leaders pursuing mastery-approach goals were associated with more receptivity toward voiced creative ideas. This relationship was not contingent upon their sense of power. Together, these studies confirm our basic notion that in their reactions toward voiced ideas, leaders pursuing performance-approach goals are sensitive to their sense of power.

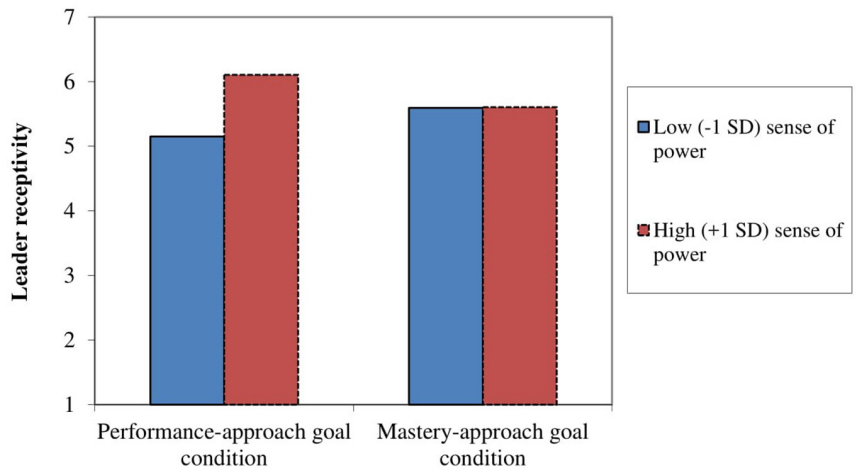

FIGURE 3 | Interaction effect of achievement goals (0 = performance-approach goal condition; +1 = master-approach goal condition) and sense of power on leader receptivity.

Theoretical Implications

Our study contributes to the literature investigating the receiving side of creativity. Rather than identifying and investigating antecedents and determinants of voice (Chamberlin et al., 2017) we answer to recent calls in the literature to focus more on the receiving side of voiced creativity (Zhou et al., 2019). Our study adds to the importance that perceiver characteristics have on their reactions toward voiced creative ideas.

First, our study showed that achievement goals of leaders are an important motivational factor that affects their reactions to voiced creative ideas, with mastery-approach goals being clearly positively related to leaders' receptivity. This finding is in line with earlier research showing that leaders pursuing mastery-approach goals were positively related to the adoption of voiced creative ideas (Sijbom et al., 2015a). As such, these results add to the literature on the role of motivational factors in relation to creative voice endorsement (Zhou et al., 2019). Also, these results add to the robustness of the idea that mastery-approach goals are related to adaptive responses to proactive behaviors of employees.

Second, and related to the important role of leader achievement goals, our study sheds light on the hybrid nature of performance-approach goals (Elliot and Church, 1997; Anseel et al., 2011). Importantly, we identified sense of power, being a perceiver characteristic, as a crucial boundary condition that can clarify when pursuit of performance-approach goals might results in (in)effective leader behaviors. When leaders in pursuit of performance-approach goals have a high sense of power, they show adaptive behaviors toward voiced ideas, whereas they show maladaptive behaviors when experiences low sense of power. These results underscore the importance of perceiver characteristics (Zhou et al., 2017) and as such help to unravel and better understand the hybrid nature and responses of leaders pursuing performance-approach goals. Our study expands earlier studies that have identified moderators of the performance-approach goal-outcome relationship, including type of feedback (Anseel et al., 2011) characteristics of the creative idea (Sijbom et al., 2015b) and characteristics of the creative idea sender (Sijbom et al., 2015a, 2016). Importantly, our study focuses on attributes of the leader as key influencers on the social process of receptivity, rather than this earlier research that has focused mostly on attributes of the idea or the voicer. Focusing on leader attributes mean our research identifies important implications for leader development, as we discuss shortly.

Finally, we provide implications for the literature on the psychology of power. Specifically, we show that for those with structural power (i.e., leaders), sense of power is a relevant characteristics to take into account (see also, Fast et al., 2012; Haselhuhn et al., 2017). While leaders have formal power over their employees, their sense of power varies which affects their endorsement, such as receptivity to voiced ideas. Our study shows that sense of power operates in two ways. One way sense of power operates relates to direct positive effects on receptivity. This is in line with earlier findings showing that leaders with a high sense of power seize more opportunities than those with low sense of power (Sturm and Antonakis, 2015). The other way in which sense of power operates is in terms of moderating the effects of the relationship between performance-approach goals and receptivity. That is, high sense of power can enable leaders pursuing performance-approach goals to overcome the tendency to show maladaptive responses when receiving ideas from their employees. Altogether, our findings suggest that sense of power is an important variable for leader receptivity.

Practical Implications

Organizations that want their leaders to be more receptive to voiced creative ideas, should stimulate mastery-approach goals among leaders. One way organizations may realize this is by creating a working environment in which leaders are stimulated to develop skills and competences. To achieve this, organizations should aim to install and establish specific practices aimed at learning. For instance, by emphasizing evaluation in terms of progress and effort, by defining success in terms of

development and improvement and by accepting mistakes as part of the learning process, organizations may be able to create such a learning-focused working environment (Ames, 1992; Dragoni, 2005).

Receptivity to voiced ideas may also be enhanced by increasing a sense of power among leaders, especially when they have strong performance-approach goals. Organizations can help leaders in this regard by cultivating their sense of power. First, leaders can activate their sense of power by recalling an experience in which they had power or felt powerful. Second, research demonstrated that several individual differences are associated with personal sense of power. For example, individuals who focus more on the positive, rewarding aspects of themselves and their relationships (behavioral approach system) have a higher sense of power than those who attend to more negative, and threatening aspects of their relationships (behavioral inhibition system) (Anderson et al., 2012). Also, internal locus of control is positively associated with sense of power (Anderson et al., 2012). If organizations want leaders with relatively high levels of sense of power, they may focus on such individual differences in recruitment and selection processes. Finally, our findings also suggest that if organizations make effort to reduce leaders' feelings of low power, this may help to make them more receptive. Since sense of power is about individuals' perceived capability to influence others, organizations should consider designing interventions aimed at techniques that have been shown to increase self-efficacy, such as role modeling (learning from other leaders), verbal persuasion, and enactive mastery (Bandura, 1997). For example, one way to enhance feelings of power may be through coaching (Edmondson, 2003) with coaching being a form of verbal persuasion. Also higher-level management might enhance feelings of power among leaders through structural empowerment (Seibert et al., 2004; Spreitzer, 1995) such as through work redesign to increase leaders' job autonomy (Parker, 2014).

Limitations and Directions for Future Research

Our study has several desirable features (e.g., different methodologies, different samples, and different operationalization of achievement goals). In Study 1 we measured our variables in a survey study among a sample of leaders, which is good for external validity. At the same time, Study 1 used a cross-sectional design, which does not allow for making causal inferences. In Study 2, we used an experimental design, that allows us to demonstrate causal effects of achievement goals on receptivity, albeit suffers from low generalizability.

Besides these strengths, our studies have some limitations. First, in our studies we focused on leader reactions to creative voice. Therefore, in our studies we used an idea that was creative (both novel and useful). A limitation is that it is not possible to test whether different levels of creativity of the voiced idea are influencing the results (Zhou et al., 2019). Future research may therefore investigate leaders' responses to voiced creative and uncreative ideas.

Second, in Study 1 we relied on an MTurk sample. Although we checked whether participants met our study inclusion criteria (i.e., holding a managerial position), we did not include attention checks nor did we screen for HIT completion success rates (Chmielewski and Kucker, 2020) which limits us in determining the quality of the data.

Third, in Study 2 73% of participants in the performance-approach goal condition indicated the correct motto (that is, passed the manipulation check). This percentage is lower compared to previous studies using the same manipulation (Sijbom et al., 2015a,b) and may explain why we did not found any differences in receptivity between the mastery-approach goal condition and the performance-approach goal condition[1].

Fourth, we investigated leader receptivity to voiced ideas. Although, receptivity is an important first step of idea endorsement, further steps need to be taken to implement voiced creative ideas (Burris, 2012; Li et al., 2019). These steps include getting more detailed information to further validate the idea, evaluating the pros and cons, and considering whether the idea is feasible in terms of available resources. Future research may therefore include measures that also capture the idea implementation part. Additionally, since we only used self-report measures for receptivity, future research may include more objective measures of receptivity and endorsement, like allocation of resources (i.e., budgets).

A final limitation has to do with our focus on investigating sense of power as a moderator of the relationship between achievement goals and receptivity. As a result, our studies did not investigate underlying mechanisms that can explain why the interaction between leaders' performance-approach goals and sense of power leads to differences in leader receptivity. Therefore, future research may investigate process mechanisms such as image threat appraisal (Sijbom et al., 2015a) and effort in processing the idea (Li et al., 2019) that may explain the moderating effects we found in the present research.

CONCLUSION

In this paper we examine leader receptivity as being an important outcome in order to reap the benefits of voiced creative ideas. Across two studies, using different methodologies and samples, we found that achievement goals of leaders determine their receptivity. Mastery-approach goals are positively related to receptivity. For performance-approach goals their effects where contingent upon their personal sense of power. That is, leaders pursuing

[1] Please note that a study of Sijbom et al. (2016) Study 2 that investigated integrative management of creative ideas, also did not find significant differences between the mastery-approach goal condition and the performance-approach goal condition. Future research is therefore needed to better understand the (lack of) differential effects of achievement goals.

performance-approach goals were more receptive when they had relative high levels of sense of power, and were less receptive when they had relatively low levels of sense of power. All in all, the results underscore the importance of achievement goals leaders pursue on their ability to reap the benefits of voiced creative ideas.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies were reviewed and approved by the Ethical Committee of the University of Groningen (Study 1) and the Human Research Ethics Office of the University of Western Australia (Study 2). Online informed consent was obtained from all participants.

AUTHOR CONTRIBUTIONS

RS contributed to the theorizing, data collection, data analysis, interpretations of results, and writing. SP contributed to the theorizing, interpretations of results, and writing. RS and SP are collectively responsible for the final completion of the manuscript. All authors contributed to the article and approved the submitted version.

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How Reliably Can We Measure a Child's True IQ? Socio-Economic Status Can Explain Most of the Inter-Ethnic Differences in General Non-verbal Abilities

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Roma children have been discriminated against for many years as they are denied access to high-quality education based on their scores on general non-verbal IQ tests. Rushton et al. (2007) showed that Roma perform more poorly than non-Roma on one such test (i.e., Raven Progressive Matrices), but suggest that this underperformance could be explained by Roma's low socio-economic status. In this paper, we tested the non-verbal abilities of Roma children and expanded on the research of Rushton et al. (2007) by investigating empirically the potential mediating effects of socio-economic status on children's performance on Raven Progressive Matrices. Results showed that the performance of Roma children was, on average, significantly lower than the performance of their non-Roma peers; however, the effect of ethnicity was partially mediated by the parents' education and living conditions (while the parents' income had no significant effect). As hypothesized by Rushton et al. (2007) some socio-economic factors can explain important variability in the performance of Roma children on general non-verbal tests, and their poor performance on such tests may lead to an underestimation of the true population mean.

Keywords: Roma children, intelligence, socio-economic status, Raven Progressive Matrices, segregation

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INTRODUCTION

Several studies have investigated the differences between different ethnic groups when it comes to their performance on general non-verbal abilities tasks (e.g., Herrnstein and Murray, 1994; Lynn, 2006; Lynn and Mikk, 2007). One such study, published in the journal *Intelligence* more than 10 years ago (Rushton et al., 2007) measured the non-verbal abilities of a large sample of Roma minority from Serbia and indicated that, on average, their IQ was significantly lower than that of their non-Roma European counterparts and similar to that of sub-Saharan groups. The study by Rushton et al. (2007) may fuel a bias in social comparison that could subject Roma people to discrimination (Schuch, 2016) based solely on the assessment of their cognitive abilities with an IQ test that is assumed to be culturally neutral. Not only does the study by Rushton et al. (2007) have the potential to support exclusionary practices against Roma (particularly children) that are reported in many European countries, but the conclusions of the study are questionable since the research did not account for many of the confounding variables that could explain the poor performance of Roma on the non-verbal test, including the socio-economic status of participants in the study. Since

then, no additional study has been conducted to further investigate this issue, and it is not clear to what extent the performance of Roma on such assessments is a reliable indicator of their cognitive abilities, nor to what extent their performance is affected by socio-economic circumstances. In this short report, we extend Rushton et al.'s study by measuring the performance of an identically sized sample of Roma on the same general non-verbal abilities test (i.e., Raven Progressive Matrices) and comparing it with the performance of non-Roma from the same communities, while accounting for the socio-economic status of the participants.

The Implications of the Assessment of General Non-verbal Abilities of Roma Children

Roma is an ethnic minority that has a long history of struggling with poverty, marginalization, discrimination, and social injustice (Schuch, 2016; Sutherland, 2017). One of the main discriminatory practices against Roma children has long been their segregation in schools that offer low quality educational programs, some of which are designed for students with intellectual disabilities (Save the Children, 2001; O'Nions, 2010; Brüggemann, 2012; White, 2012; FXB Center for Health and Human Rights at Harvard University, 2015; Cashman, 2016; Amnesty International and European Roma Rights Centre, 2017; Messing, 2017). The aforementioned studies show that the overrepresentation of Roma students in segregated schools is often explained by the fact that general IQ tests (such as Raven Progressive Matrices) are used to identify students with intellectual disabilities, and Roma children typically perform more poorly on such tests than do their non-Roma peers. However, the practice of using general intelligence tests to assess the eligibility of Roma children to attend high-quality schools is problematic for two reasons.

First, basing school placement solely or primarily on such intelligence tests may lead to social comparisons (Festinger, 1954) that have a negative effect on Roma children, as a group. In addition, the practice of excluding children from mainstream schools can detrimentally impact their identity formation (Erikson, 1968). In the case of Roma children, an early unsuccessful performance on such tests, coupled with a resulting placement in less competitive schools, can shape their identity through upward social comparisons with the majority of their non-Roma peers (e.g., "*We, Roma students, are not smart enough to attend the good schools that other students attend*"). Social comparison research on minority groups has indicated that group membership strongly influences a perceived similarity with other members of the group (i.e., assimilation on the basis of identity) (Brewer and Weber, 1994; Mussweiler and Bodenhausen, 2002). Research has also shown that comparisons with members from other groups can increase a perceived dissimilarity with individuals from the reference group (i.e., contrasting effects in self-evaluations) and can lead to self-stereotyping (Mussweiler and Bodenhausen, 2002; Mussweiler, 2003).

The results of such tests do not only affect the Roma children's self-perception. Rather, these results may also encourage educational stakeholders to make downward social comparisons of Roma children as a group, thereby justifying their educational segregation by claiming that Roma children would be more likely to fail if they attended mainstream schools with a regular curriculum (e.g., *"These tests prove that many Roma children are not smart enough, and it is for their own good that they are placed in less competitive schools"*). In other words, instead of increasing efforts toward an inclusive education, some educational stakeholders could use the results of intelligence tests to justify their exclusion of Roma children from the mainstream schools.

Second, the usage of standardized intelligence tests as a selection criterion for the placement of Roma children in schools has already been heavily criticized because the tests are not as culture-free as they claim to be. Advocates for Roma children voice concerns that such tests can put Roma children at a disadvantage, as their performance can rely on contextual factors with which Roma children are not familiar. Therefore, using the results of these tests to place Roma students in schools with an abbreviated curriculum and low academic expectations is a discriminatory practice. Indeed, empirical evidence shows that intelligence tests are culturally loaded (Kan et al., 2013), and even the results of less culturally sensitive non-verbal tests such as Raven Progressive Matrices (RPM) are still biased by the background of their participants (Owen, 1992). The studies indicate that different contextual factors can lead to different patterns in children's performances on general IQ tests. However, to date, there are no empirical studies to support the claim that Roma children might perform poorly on general non-verbal IQ tests due to the influence of certain contextual factors on their development.

One set of contextual factors known to correlate with IQ is the socio-economic status (SES) of the test taker. This construct is usually measured by several indicators, including education, income, and living conditions (Grusky, 2001). Multiple studies indicate that a significant amount of variance in the IQ of children is explained by the SES of their families, and the environmental influence on IQ is particularly strong among children raised in families with low SES (Heckman, 2006; Hanscombe et al., 2012; Von Stumm and Plomin, 2015). Thus, it is plausible to believe that the IQ scores of many Roma children can be at least partially explained by their typically low SES, although no study has empirically investigated this hypothesis.

The Non-verbal Abilities of Roma

Several studies have measured the performance of Roma on IQ tests, with the most well-known research published by Rushton et al. (2007). In this study, the general intelligence of 323 Roma adults from 3 Serbian communities was measured using Raven's Progressive Matrices. The authors justified their use of this test by citing its popularity and high psychometric properties among a large variety of cultural groups (Raven et al., 1991). The test measures general intelligence (the *g* factor) as described by Spearman (1927), with a focus on non-verbal skills and analogical thinking (Raven et al., 1998). The authors used both Colored Progressive Matrices (which are typically administered to children and/or adults with low intellectual

ability) and Standard Progressive Matrices (which are typically administered to adults). The study was unique because it included a large sample size of Roma participants tested individually. The results indicated that Roma performed very poorly as compared with other European groups and performed similarly to Sub-Saharan groups. Although their findings, which indicated a poor performance of Roma on general IQ tests, are consistent with previously and subsequently published studies (Raven et al., 1998; Save the Children, 2001; Bakalar, 2004; Dolean and Tincas, 2018), the authors acknowledged several limitations of their study.

One limitation is the possibility that the scores of Roma might reflect the educational background of participants and "may seriously underestimate the true Roma population mean" (Rushton et al., 2007, p. 10). Their concern seems to be justified. A recently published meta-analysis from 42 data sets including 600,000 participants indicates that a longer education increases intelligence by 1 to 5 IQ points for each additional year of schooling (Ritchie and Tucker-Drob, 2018). The authors concluded that "education appears to be the most consistent, robust, and durable method yet to be identified for raising intelligence" (Ritchie and Tucker-Drob, 2018, p. 1). These results suggest that the Roma's performance on IQ tests might be lower than that of their peers due to their low level of education. Consequently, accounting for the number of years of schooling of the parents of Roma children seems crucial to interpreting the results of their IQ tests, especially as recent findings have shown that SES explains an important variance in Roma children's IQ (Lervåg et al., 2019) and parenting programs that aim to educate Roma parents about helping their children with schoolwork seem a feasible strategy for the alleviation of this disadvantage.

Another limitation of the study conducted by Rushton et al. (2007) is the possibility that Roma might perform poorly on IQ tests as a result of their poverty. Indeed, poverty has been found to impede IQ performance measured with RPM (Mani et al., 2013) because it is believed that the concerns related to poverty have adverse effects on mental resources. Furthermore, poverty can lead to a "sub-optimal level of nutrition that has an adverse effect on general intelligence" (Rushton et al., 2007, p. 10). Although the authors have not supported their assumptions with empirical evidence, subsequently published studies indicate that IQ varies based on the quality of the participants' food intake (Von Stumm, 2012; Nyaradi et al., 2013; Robinson et al., 2018), and children raised in poverty have a low-quality diet (e.g., Leung et al., 2014). It is a plausible assumption that Roma's substandard economic background may impede their access to nutritious food. Therefore, when we measure the IQ of Roma and compare it with the IQ of their non-Roma peers, it is essential to account for income as a potential confounding variable that can lead to unequal access to proper nutrition among participants, in addition to other poverty-related concerns that may explain lower scores on IQ tests. This is important because, if improper nutrition is a contributing factor to the poor performance of Roma children on such tests, developing school programs that provide Roma children with nutritious meals could potentially improve their test performance.

Finally, Rushton et al. (2007) stressed that Roma tend to live in inadequate housing conditions which might impede their cognitive development. The authors mentioned that "Roma children grow up in disadvantaged conditions, often live in overcrowded homes and are not as exposed to the intellectual stimulation and test taking attitudes typically associated with high test scores" (Rushton et al., 2007, p. 10). Indeed, empirical evidence suggests that inadequate physical environments (such as overcrowded homes) can have a detrimental effect on children's cognitive development due to improper cognitive stimulation (Solari and Mare, 2012; Ferguson et al., 2013). Furthermore, overcrowded housing can adversely impact the home support network and the homework environment through phonological interference (Vasilev et al., 2018), which can, in turn, adversely impact the education of Roma children. Thus, in order to understand the underlying mechanisms that explain the performance of Roma on IQ tests, we also need to account for housing conditions as a potential confounding variable. This issue is important because, if quality of housing is a strong predictor of the children's performance on non-verbal abilities tests, then social programs focused on improving the housing conditions of Roma children could have meaningful positive outcomes on their performance.

The Present Study

In this study we aim to expand Rushton et al.'s findings by measuring the general intelligence (*g*) of an identically sized sample of Roma using the same test (RPM). However, unlike Rushton et al. (2007) whose study was focused on adults, our study will focus on children. We believe that studying children is particularly important given the context of school segregation justified by low scores on general IQ tests. While Rushton et al. (2007) did not use a control sample of non-Roma participants from the same communities (and instead compared the scores with the nationally normed scores of adults from Serbia), we compare the IQ of Roma children with the performance of their non-Roma peers residing in the same communities. We believe such comparison is important to minimize the potential effects of the socio-economic circumstances that may lead Roma children to perform poorly on IQ tests and to distinguish between such environmental factors and the actual cognitive abilities of Roma (as a distinct ethnic group). Furthermore, we address the acknowledged limitations of the Rushton et al. (2007) study by accounting for the following potential socio-economic variables that could explain a reported low performance on IQ tests: the parents' education (both the mother's and the father's), wealth (income), and living conditions (the number of people per room living in one household). We hypothesize that the reported low performance of Roma children on RPM can be at least partially explained by these socio-economic factors.

We ask the following questions:

1. Is the IQ of Roma significantly lower than the IQ of non-Roma?
2. Can the potential differences in IQ be partially explained by differences in socio-economic status?

MATERIALS AND METHODS

Data Collection Context

This study was part of a longitudinal research focused on the factors that contributed to the development of academic skills in Roma children from Romania. The research followed the ethical guidelines of the higher education institution of the first author. The data used in this study was collected in October 2014. The participating children were individually tested with multiple cognitive and academic measures, including the non-verbal abilities (see below) by trained research assistants with backgrounds in psychology and/or educational sciences. The children were tested in quiet rooms, in their schools. The socio-economic data was collected from parents by the classroom teachers during parent-teacher conferences. The teachers assisted the few parents whose literacy skills were too limited to independently complete the demographic data. Information regarding the children's ethnicity was found in the official school records and confirmed during the parent-teacher conferences.

Participants

Five hundred Roma and non-Roma children from two school districts located in the Transylvania region of Romania participated in our study. The selection of the participants was random, and their participation in this study was voluntary and contingent on the written consent of their parents. The children were all registered in the First grade in one of the 21 participating schools. The schools were selected because their demographic information indicated that many of them had a high percentage of Roma children enrolled. All schools were state funded (like the majority of schools in Romania) and enrollment was not based on the students' financial status. The Roma and non-Roma children participating in this study were recruited from the same communities, although some schools (and communities) had a higher percentage of Roma children than others.

Out of the 500 participants, 322 were Roma (172 boys, Mage = 89.57 months, *SD* = 5.05) and 178 were non-Roma (89 boys, Mage = 88.22 months, *SD* = 4.18).

Measures

General Intelligence

The General Intelligence score was assessed using Raven's Colored Progressive Matrices (RCPM) (Raven et al., 1991). The scale includes 36 items with increased complexity, and the responses were coded from 0 to 36. The internal consistency of our data indicated that the measure had a high reliability (Cronbach's alpha = 0.86).

Socio-Economic Status

The socio-economic status data was collected from parents through a questionnaire. The data collected included information about the mother's education, the father's education, family income, and living conditions. Each parent's level of education was coded on a scale from 1 (elementary education) to 9 (doctorate). The two educational indicators correlated strongly ($r = 0.755$, $p < 0.001$) and consequently, we have created a composite score of the parents' education by calculating the average of the two scores. The income data collected was ranked on a scale from 1 (less than 50 USD/month) to 13 (more than 1000 USD/month). For the living conditions, we have calculated a score reflecting the ratio between the number of family members relative to the number of rooms per household. The scores ranged in our study from 0.5 to 10.

RESULTS

To answer the first question, we conducted a one-way ANCOVA to test for differences in IQ between Roma and non-Roma students, with age as covariate (see also descriptive statistics in **Table 1**). There was a significant effect of ethnicity on IQ, after controlling for age $F(2,473) = 101.05$, $p < 0.001$, partial $\eta^2 = 0.18$. Roma children had lower IQ scores ($M = 14.87$, $SD = 5.47$) than non-Roma children ($M = 20.44$, $SD = 6.10$).

To answer the second question, we first compared the SES indicators of Roma and non-Roma children. The results indicated that the Roma children had parents with a lower level of education $t(262.68) = -13.81$, $p < 0.001$, $d = 1.47$, they lived in households with lower incomes $t(282.67) = -8.68$, $p < 0.001$, $d = 0.90$, and their living conditions were poorer $t(479.69) = 9.46$, $p < 0.001$, $d = 0.80$ as compared to those of their non-Roma peers. Next, we ran a Pearson product-moment correlation to assess the relationship between each SES indicator and the IQ scores of our participants. Results show that there was a moderate positive correlation between IQ and the parents' education, $r = 0.494$, $p < 0.01$, and income, $r = 0.345$, $p < 0.01$, as well as a moderate negative correlation between IQ and living conditions, $r = -0.329$, $p < 0.01$. The results supported the hypotheses that (a) the SES of Roma children was lower than that of their non-Roma peers, and (b) the SES can explain important variance in IQ scores. Consequently, we conducted

TABLE 1 | Descriptive statistics.

Variable	Roma children				Non-Roma children			
	M	*SD*	Minimum	Maximum	*M*	*SD*	Minimum	Maximum
IQ	14.85	5.45	1.00	33.00	20.40	6.08	4.00	33.00
Parental education	1.91	0.92	1.00	7.00	3.52	1.35	1.00	7.50
Income	4.37	2.65	1.00	12.00	6.99	3.34	1.00	13.00
Living conditions	3.41	1.88	0.50	9.00	2.07	1.26	0.50	10.00

a one-way ANCOVA to test for differences in IQ between Roma and non-Roma students, while controlling for age, parents' education, living conditions and income as covariates. While the effect size diminished considerably, we still found a significant effect of ethnicity on IQ, $F(5,431) = 14.78$, $p < 0.001$, partial $\eta^2 = 0.03$. Roma children had lower IQ scores ($M = 14.87$, $SD = 5.47$) than non-Roma children ($M = 20.44$, $SD = 6.10$). Both the parents' education $F(5,431) = 32.03$, $p < 0.001$, and living conditions $F(5,431) = 5.53$, $p = 0.02$ were found to have an effect on IQ.

The results suggested that some SES indicators (i.e., parents' education and living conditions) partially mediate the relationship between ethnicity and IQ, but the magnitude of their predictive effect can vary. Therefore, we subsequently conducted a mediation analysis using Process Macro (Hayes, 2017). The socioeconomic indicators were entered as parallel mediators. Results indicated significant indirect effects of ethnicity on IQ through education ($B = 2.27$, $SE = 0.49$, 95% CI = 1.34, 3.28) and living conditions ($B = 0.46$, $SE = 0.22$, 95% CI = 0.02,0.89). Income was not a statistically significant mediator (95% CI = −0.26,0.95). Furthermore, pairwise contrasts suggested a larger indirect effect of ethnicity on IQ through education as compared to the indirect effect through living conditions ($B = 1.81$, $SE = 0.60$, 95% CI = 0.67, 3.02) (see **Table 2**).

DISCUSSION

The present study aimed to test whether and to what extent Roma children perform more poorly than their non-Roma peers from the same communities on non-verbal tests such as RPM, as well as to measure to what extent socio-economic factors explain test performance.

As anticipated, and in line with previous findings, Roma children performed significantly more poorly than their non-Roma peers on non-verbal abilities tests, and the effect size between the means of the two groups was medium, with ethnicity explaining 18% of the variance of the IQ test performance. Our findings are in line with those of Rushton et al. (2007) and other studies (see above) and suggest that, on average, the Roma perform significantly more poorly than their non-Roma peers on RPM.

TABLE 2 | Bootstrapped estimates and confidence intervals for total effects, specific indirect effects, and pairwise contrasts of indirect effect.

	B	*SE*	95% CI	
			Lower	Upper
Total direct effect	2.77	0.69	1.41	4.12
Indirect effects				
Education	2.27	0.49	1.34	3.28
Living conditions	0.46	0.22	0.02	0.89
Income	0.31	0.30	−0.26	0.95
Total	3.04	0.46	2.18	3.96
Contrasts				
Education vs. Living conditions	1.81	0.60	0.67	3.02

The most important facet of our study was accounting for the potential effects of SES indicators on the IQ test performance of Roma children. As anticipated (e.g., Brüggemann, 2012; Dolean et al., 2016, 2019), the SES of Roma children was significantly lower than the SES of their non-Roma peers, with effect sizes ranging from 0.80 to 1.47 SD. These contrasts supported the assumption that the non-verbal abilities of Roma children might be at least partially explained by their low SES. Our further analysis confirmed this hypothesis. The results indicating a strong predictive effect of parent's education and living conditions on IQ test scores of Roma children are consistent with previous research (Solari and Mare, 2012; Ferguson et al., 2013; Ritchie and Tucker-Drob, 2018). They posit that even the non-verbal IQ tests can be culturally loaded (Kan et al., 2013), and the performance on RPM is dependent on contextual factors (Owen, 1992). They also indicate that Roma children do not have an equal opportunity to perform well on non-verbal IQ tests when compared with their non-Roma peers because their socio-economic circumstances related to parents' education and living conditions make them more likely to perform poorly on these tests. It was particularly interesting to find that income was not an important predictor of IQ test scores after we accounted for the parents' education and living conditions. This is surprising, as existing literature claims that income can be strongly associated with cognitive abilities in general (Noble et al., 2015) and IQ scores measured with RPM, in particular (Mani et al., 2013). However, education and income are usually measured under the same construct (SES) and few studies disentangle the two variables as ours does.

When we compared the two ethnic groups after accounting for the SES indicators, we still found a significant effect for ethnicity, although this effect size was small and substantially diminished when compared with our previous analysis. Our results suggest that indeed, some of our measures of socio-economic status captured most of the variance between the two ethnic groups; however, the influence of the variables was not strong enough to completely mediate the effects of ethnicity on the IQ scores. It is very possible that other factors might play an important role in the performance of Roma children on IQ tests, underscoring both the limitations of this study and providing directions for further research.

One of these factors is kindergarten attendance. Several reports indicate that throughout Europe, Roma children attend kindergarten less frequently than their non-Roma peers (European Union Agency for Fundamental Rights [FRA], 2011). For instance, the report indicated that in Romania (where kindergarten attendance was not mandatory at the time the data was collected), the percentage of non-Roma children attending kindergarten was twice that of their Roma peers. Given that some skills measured by RPM can be dependent on abilities that are formed in kindergarten such as print concept, stamina in test-taking situations, self-regulation abilities, following directions and manipulating abstract geometrical shapes, it is fair to assume that the kindergarten attendance (or lack thereof) of the children

in our study could have had a significant effect on their test performance. Furthermore, the potential differences between Roma and non-Roma kindergarten attendance rates could explain a general familiarity with test-taking conditions, in that children who attended kindergarten may have been more likely to perform better on any test, including RPM (Hausknecht et al., 2007). For instance, two recent longitudinal studies (Dolean et al., 2019; Lervåg et al., 2019) indicated that the school attendance rate of Roma children explained an important variance in performance on vocabulary and reading tests beyond cognitive and non-cognitive factors, and partially mediated the effects of SES on children' test performance. Thus, not accounting for kindergarten attendance is a limitation of this study, and further research is needed to explore the extent to which the kindergarten attendance rate of Roma children could explain their performance on tests administered at the beginning of their schooling experience.

Other variables that might explain the differences in performance of the two groups on RPM that are not accounted for in this study are related to cultural aspects that could influence Roma children's attitudes toward school and their motivation in test-taking situations. Several studies underscore important cultural differences between Roma and their non-Roma peers from the same communities, in that, on average, Roma do not seem to place as great a value on education (and the opportunities offered by schools) as their non-Roma peers (Cretan and Turnock, 2008; Kosko, 2012). This phenomenon can be explained by the fact that Roma typically have more difficulties than non-Roma in translating the advantages of schooling into gainful employment and realizing the positive outcome of such a laborious effort. These cultural differences could explain an important variance in test-taking situations, as research has shown that an important variance in the performance of students on cognitive tests is explained by their motivation and attitude toward tests (Penk and Richter, 2017; Gignac et al., 2019). Thus, not accounting for the potential differences in motivation and attitude toward school between Roma and non-Roma children is another limitation of this study.

Finally, the samples of Roma and non-Roma children were not balanced. Although unequally sized groups are common in research, there is a risk that the underrepresented group (non-Roma) might lose statistical power. Given this limitation, the interpretation of our results needs to be treated with caution.

IMPLICATIONS

For many years Roma minority children have been denied access to high-quality education based on their underperformance on tests that measure their general non-verbal abilities, such as RPM. Such poor performance could have potentially fueled a downward social comparison (Festinger, 1954) that made educational stakeholders feel justified in the exclusionary practices of Roma children simply because they do not meet the standards of the non-Roma majority. The results of this study show that such tests do not measure the true, unbiased general cognitive performance of Roma children and point out that factors associated with the parents' education and living conditions (but not income) explain much of their underperformance on this test. The results confirm most of the assumptions made by Rushton et al. (2007). They also indicate that non-verbal IQ tests such as RPM can "underestimate the true Roma population mean" (Rushton et al., 2007, p. 10), and therefore, cannot be fairly used to assess the potential of Roma children without accounting for their socio-economic background. Consequently, in order to address the poor performance of Roma children on IQ tests, a more comprehensive assessment battery needs to be used that would account for the socio-economic factors affecting the development of Roma children. Furthermore, given that IQ is a strong predictor of educational achievement (Ritchie and Tucker-Drob, 2018), our data indicate that a strong focus of educational policies geared to help Roma children perform well in school should be placed on the enhancement of the lifelong learning experiences of Roma parents, as well as the improvement of the living conditions of Roma children.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The manuscript adheres to ethical guidelines in the APA Code of Conduct and Ethics Guidelines from Romania. The studies involving human participants were reviewed and approved by Babes-Bolyai University Research Ethic Committee. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

DD contributed with the data collection and manuscript framework and writing. AC contributed with the statistical analysis and reporting of the results. All authors contributed to the article and approved the submitted version.

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The Role of Comparisons in Judgments of Loneliness

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Loneliness—perceived social isolation—is defined as a discrepancy between existing social relationships and desired quality of relationships. Whereas most research has focused on existing relationships, we consider the standards against which people compare them. Participants who made downward social or temporal comparisons that depicted their contact with others as better (compared to other people's contact or compared to the past) reported less loneliness than participants who made upward comparisons that depicted their contact with others as worse (Study 1–3). Extending these causal results, in a survey of British adults, upward social comparisons predicted current loneliness, even when controlling for loneliness at a previous point in time (Study 4). Finally, content analyses of interviews with American adults who lived alone showed that social and temporal comparisons about contact with others were both prevalent and linked to expressed loneliness (Study 5). These findings contribute to understanding the social cognition of loneliness, extend the effects of comparisons about social connection to the important public health problem of loneliness, and provide a novel tool for acutely manipulating loneliness.

Keywords: comparisons, social comparison, loneliness, emotion, well-being, contrasts

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INTRODUCTION

Loneliness, the emotional distress stemming from social connections that are perceived to be inadequate (Cacioppo and Patrick, 2008), is generally defined in terms of a discrepancy between perception of existing relationships and the idiosyncratic standards desired for those relationships. Nevertheless, most research on loneliness has focused on existing relationships, and surprisingly little attention has been given to the standards against which people compare them. The present line of research addresses this gap by examining how differences in comparison standards influence loneliness.

Loneliness can stem from dissatisfaction with the quantity *or* quality of relationships. For instance, loneliness is referred to as "a situation experienced by the individual as one where there is an unpleasant or inadmissible lack of (quality of) certain relationships. This includes situations in which the number of existing relationships is smaller than is considered desirable or admissible, as well as situations where the intimacy one wishes for has not been realized" (de Jong-Gierveld, 1987, p. 120). Although an objectively low quantity (few hours in the week spent with others) or quality (lack of close supportive friends) of contact with others is a risk factor for loneliness, the causal

direction of this relation is unclear (Klinenberg, 2012), and a large body of research has shown that objective social contact and subjective loneliness are distinct constructs (e.g., Cutrona, 1982; Peplau and Perlman, 1982; Russell, 1996; Pressman et al., 2005; Dykstra and Fokkema, 2007).

Objective social contact and subjective loneliness are imperfectly related because of differences in the way people think about their contact with others—that is, because of intervening social cognition (Cacioppo and Patrick, 2008). Social cognition, therefore, is a promising route for understanding and influencing loneliness. There are three options for people who feel, or are at risk of feeling, lonely: increase the achieved level (quantity or quality) of social contact, decrease the desired level of social contact, or reduce the importance of the gap between the two (Perlman and Peplau, 1981). The latter two options, which are cognitive rather than behavioral strategies, appear to be both ubiquitous and potentially effective. Older adults indicated they would recommend to other lonely adults coping strategies that lower expectations about, or the importance of, social contact (Schoenmakers et al., 2012). Related research has shown that manipulating cognition, such as the salience of social connections, changes how people respond to social exclusion (Twenge et al., 2007). A meta-analysis of attempts to reduce loneliness found that the most successful interventions tested with randomized controlled trials (RCTs) were those that targeted maladaptive social cognition rather than actual social contact (Masi et al., 2011). However, these interventions were generally weeks- or months-long individual or group cognitive behavioral therapy sessions, in which many aspects of cognition were addressed (e.g., jealousy, communication, stress), so they do not clearly identify effects on loneliness of adjusting the desired level of social contact.

One influence on people's *desired* levels of social contact is likely to be the perceived contact achieved by similar others: that is, social comparisons (Hyman, 1942; Festinger, 1954; Wills, 1981; Suls et al., 2002; Mussweiler, 2003). People are uncertain about their abilities and opinions, and reduce uncertainty by comparing themselves to others; these others provide a standard against which one's own qualities—like intelligence or athleticism—may be evaluated (Festinger, 1954). People can be uncertain about loneliness too (e.g., Perlman and Peplau, 1981), so others' quality and quantity of social contact may provide a standard against which one's own social contact can be measured. Indeed, previous work on loneliness alludes to an effect of such comparisons. Dykstra et al. (2005) pointed to: "...the possible role of *social comparison* processes (Festinger, 1954) in late life loneliness. Older adults might be less lonely because they feel their social circumstances compare favorably in terms of earlier expectations or relative to peers" (p. 728). However, we are aware of little work that has directly tested the role of comparisons in loneliness.

Just as people feel worse about themselves in the presence of a highly competent other, and better about themselves in the presence of an incompetent other (Morse and Gergen, 1970), people should feel more lonely when comparing themselves to an individual with a better quality or quantity of social contact (upward comparison, Suls et al., 2002), and less lonely when comparing to an individual whose social contact is worse than their own (downward comparison). Indeed, Schoenmakers et al. (2012) describe a form of coping with loneliness that involves lowering expectations, which "...can be done by, for example, not expecting one's children to visit as often, realizing that breaking down barriers to improve relationships is too costly, **or comparing oneself with someone who is worse off**." (emphasis added; p. 354).

Similar others are not the only potential reference point for a comparison standard—oneself at other points in time also provides such a standard (Wilson and Ross, 2000). People feel better about themselves when they believe they have improved over time, and worse if they believe they have declined. If people evaluate loneliness using temporal comparisons of the present self to a past self, they should feel lonelier when comparing the present to a past with a better quality or quantity of social contact (upward comparison), and less lonely when comparing to a time in the past when social contact was worse (downward comparison). As with social comparisons, there is some evidence that people make temporal comparisons about their contact with others (Suls, 1986). In a longitudinal study of new students at college, loneliness was predicted by satisfaction with one's social relationships, which in turn was related to comparisons with previous relationships as well as comparisons with one's peers (Cutrona, 1982).

In sum, people should feel less lonely when they recognize their achieved (present) quantity or quality of social contact as surpassing a comparison standard, and lonelier when they see it as falling short of a comparison standard, whether these standards are social or temporal. Note that comparisons can focus on how the target and the self are similar as well as on how they differ (Mussweiler, 2003). However, because we consider comparisons in which one party is *better* and one is *worse*, our examination is confined to the comparisons that identify dissimilarities, referred to as contrasts. We first tested the effect of contrasts with three experiments in which people were instructed to make downward or upward social or temporal contrasts, and their feelings of loneliness were measured (Studies 1, 2, and 3). We then used a large-scale secondary survey dataset to see how contrasts were linked to loneliness over time (Study 4). Finally, we content-analyzed a sample of interviews with American adults living alone, to observe whether people spontaneously made social and temporal contrasts when they talked about their contact with other people, and whether these contrasts were linked to their feelings of loneliness (Study 5). We report how we determined our sample sizes, all data exclusions (if any), all manipulations, and all measures administered in each of the studies.

STUDY 1

We hypothesized that people would feel less lonely when they made downward social or temporal contrasts, and more lonely when they made upward social or temporal contrasts. We had no reason to expect that one type of contrast (social vs. temporal) would be more effective, but we left this as an empirical question. We randomly assigned participants to make downward or

upward social or temporal contrasts—or in a control condition, not to make any contrasts—before measuring their current feeling of loneliness.

Loneliness is most often measured using the 20-item revised UCLA Loneliness Scale (Russell, 1996), which we administered. However, the UCLA scale addresses feelings in general over an extended period of time: respondents indicate "how often" (*never, rarely, sometimes*, or *always*) they feel left out, isolated, shy, etc. If participants average their responses over an extended period of time, combining how they feel immediately after the manipulation with how they remember feeling in the recent past, then this scale provides a less-than-ideal tool for identifying an effect of the contrasts manipulation. Moreover, some UCLA scale items refer to commonalities with others (e.g., "My interests and ideas are not shared by those around me") which might be affected by contrasts between one's present and an alternative without necessarily tapping the emotional experience of loneliness. Accordingly, we also measured loneliness by simply asking participants how true it was that "right now, I feel lonely."

Methods

Participants and Design

Two hundred fifty-five individuals recruited *via* MTurk[1,2] completed the survey materials in return for a $0.48 payment. We concluded data collection when reaching the pre-determined sample size of 50 per condition, which a G*Power analysis (Faul et al., 2007) shows has 95% power to detect an effect size of $f = 0.275$ in a 5-group ANCOVA with two covariates. Four people were excluded from analysis for not writing as directed in response to the manipulation, as discussed in more detail in the Manipulation Check section below. The final sample of 251 included 127 men, 123 women, and one who identified as "agender," ages 18–70 ($M = 37$ years, SD = 12.59). The experiment used a 2 (contrast direction: downward, upward) × 2 (contrast type: social, temporal) between-subjects design with an additional no-contrasts control condition.

Materials and Procedure

Participants were randomly assigned to one of the five experimental conditions. In the social contrast conditions, they read instructions that elicited contrasts between their own and others' living situations:

> First, we are interested in how your present living situation (who you live with, where you live, how you live) *compares to other people's living situations*. In the space below, please briefly describe two ways that your present living situation is [better/worse] than other people's living situations.

The text in brackets differed depending on whether participants were assigned to make downward or upward contrasts. Participants in the downward contrasts condition were asked to identify ways their own living situation was better, and those in the upward contrasts condition were asked to identify ways their own living situation was worse. We used parallel instructions in the temporal contrast conditions to elicit contrasts between present and past living situations, except that we removed the text that appears in italics above, and instead asked participants to describe how their present living situation: "*. . .compares to your living situations in the past*." The fifth group of participants, assigned to a control condition, were not asked to make any contrasts and proceeded immediately to the measures below.

Thereafter, participants were asked: "Right now, how true is this statement of you? 'I feel lonely.'" The 7-point response scale had the options *extremely untrue* (1), *moderately untrue* (2), *somewhat untrue* (3), *neither true nor untrue* (4), *somewhat true* (5), *moderately true* (6), and *extremely true* (7). They then completed the 20-item Revised UCLA Loneliness Scale (Russell, 1996), which asks respondents to indicate "how often you feel the way described in each of the following statements," where options are *never* (1), *rarely* (2), *sometimes* (3), and *often* (4). We computed the sum of the 20 items for each participant after reverse-coding the appropriate items ($\alpha = 0.96$). Participants also reported their gender, age, relationship status, and living situation (live alone or live with other people), and provided any comments they wished to, before being presented a code with which to obtain payment *via* MTurk.

Results and Discussion

Manipulation Check

A member of the research team read all responses, and four respondents that did not follow instructions (i.e., did not describe elements of their present living situation) were excluded from analysis.

Initial examination of the responses showed that in many cases, it was not possible to distinguish between social and temporal contrasts. For example, a participant wrote: "I have personal space that no one else can enter." This is clearly a downward contrast but it's not clear whether the contrast is to other people who do not have personal space, or to a time in the past when the participant did not have personal space. Other examples where direction can be inferred but social vs. temporal cannot are: "There is no fighting" and "I don't get to see my friends very often." While reading, the researcher also coded whether or not each respondent mentioned other people. This coding was used in follow-up exploratory analyses described below.

Preliminary Analyses: Demographic Characteristics and Loneliness

Although only a minority of participants (35; 14%) lived alone, they reported more loneliness than those who lived with others, both in terms of current feelings ($M_{Alone} = 4.23$, SD = 1.88 vs. $M_{Others} = 2.94$, SD = 1.84) and on the UCLA scale ($M_{Alone} = 49.09$, SD = 12.73 vs. $M_{Others} = 40.69$, SD = 13.47), $ts(249) > 3.44$, $ps \leq 0.001$. Men and women did not differ in loneliness, $ts(248) < 0.92$, $ps > 0.35$, but age was related to

[1] Although concerns have been raised about the veracity of responses from MTurk participants, these concerns were much less prevalent when this study was conducted in early 2014, a time when research suggested that MTurk participants were similar to traditional samples in their responses to a variety of well-established research paradigms, and also similar to the general US population in their demographic characteristics (Buhrmester et al., 2011; Goodman et al., 2013; Paolacci and Chandler, 2014).

[2] www.mturk.com

loneliness, such that older participants reported less momentary loneliness, $r(249) = -0.12$, $p = 0.008$, and marginally less loneliness on the UCLA scale, $r(249) = -0.12$, $p = 0.055$. With participants ranging in age from 18 to 70, these negative correlations are in line with research finding that loneliness is higher in late adolescence and young adults than in middle-aged adults [review by Qualter et al. (2015)]. Importantly, randomization was effective; the portion of participants living alone vs. with others did not differ across the experimental conditions, $\chi^2(4) = 6.87$, $p = 0.14$, nor did participant age differ across condition, $F(4, 246) = 1.56$, $p = 0.19$. To increase the power to detect an effect of the contrast manipulations over and above the role of these other factors, we adjusted for living status and age in subsequent analyses.

Momentary Loneliness (Single-Item Measure)

Because the design was not fully factorial (2 × 2 plus a control condition), we began by simply assessing differences across the five conditions, using an ANCOVA with condition as a between-subjects factor and age and living status (alone or with others) as covariates. When the single-item measure of current loneliness was the dependent variable, the effect of condition was not significant at the $p < 0.05$ level, $F(4, 244) = 2.14$, $p = 0.07$. Nevertheless, given the preliminary and thus somewhat exploratory nature of this initial study, we conducted a series of contrasts to answer specific research questions. We calculated adjusted marginal means for both momentary loneliness (single-item) and UCLA loneliness by condition. These group means, adjusted for living status and age, are depicted in **Figure 1**.

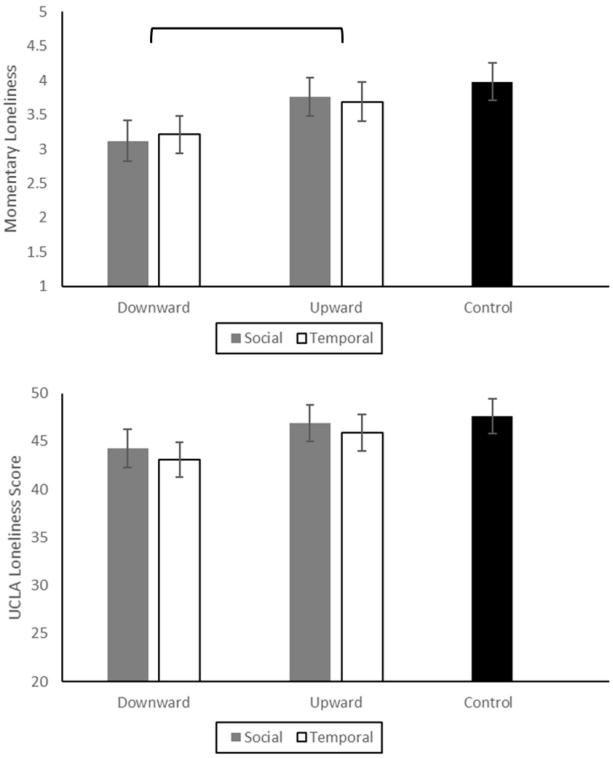

FIGURE 1 | Adjusted marginal means for each condition for Study 1. Since the control condition included no contrasts, we present it separately in black. Momentary loneliness is a single item 7-point response scale and the UCLA scale has 20 items with a 4-point response scale. These values are adjusted for age and living status (alone, with others). Error bars are standard error and brackets indicate significant differences at the $p < 0.05$ level.

First, we compared downward to upward contrasts, collapsing across the social vs. temporal conditions. As predicted, downward vs. upward contrasts produced relatively lower vs. higher loneliness, $F(1, 194) = 4.85$, $p = 0.029$, $\eta^2_{partial} = 0.023$. Next, we tested whether downward contrasts reduced loneliness, and whether upward contrasts increased loneliness, compared to the control condition. Downward contrasts did reduce loneliness, $F(1, 151) = 7.49$, $p = 0.007$, $\eta^2_{partial} = 0.047$, but upward contrasts did not affect loneliness compared to the control condition, $F(1, 145) = 0.67$, $p > 0.25$. Finally, we tested whether social vs. temporal contrasts had different effects on loneliness. They did not; participants who made downward contrasts were similarly lonely if these contrasts were social or temporal, $F(1, 92) = 0.795$, $p > 0.25$, and participants who made upward contrasts were also similarly lonely whether their contrasts were social or temporal $F(1, 98) = 0.01$, $p > 0.25$. This was not surprising given that our examination of participants' written responses to the contrast manipulations suggested that contents of social and temporal contrasts were largely indistinguishable.

As noted in the "Manipulation Check" section above, some participants' contrasts referred to contact with others (e.g., I do/do not live with a loving partner) while some did not (e.g., I do/do not have spare money). It is conceivable that the latter types of issues still have downstream effects on contact—having no spare money might prevent one from spending time with friends or meeting new people, for instance. However, these types of contrasts do not unambiguously alter the comparison standard for determining a desired level of social contact, and so they might have weaker or no appreciable effects on loneliness (see Swann et al., 2007). As this was the first study and somewhat exploratory in nature, we wondered whether (social or temporal, downward or upward) contrasts focusing on contact with other people have stronger effects on subsequent loneliness. To examine this question, we divided participants in the contrast conditions into those who had generated one or two contrasts mentioning other people ($n = 95$) and those who had not generated any contrasts mentioning other people ($n = 103$), and repeated the analyses above separately for these two groups.

For participants whose contrasts mentioned other people (plus participants in the control condition), an ANCOVA with the five experimental conditions as a between-subjects factor and age and living status as covariates showed a significant effect of condition on feelings of loneliness, $F(4, 141) = 2.823$, $p = 0.027$, and $\eta^2_{partial} = 0.069$. As in the full sample, downward vs. upward contrasts reduced loneliness, $F(1, 91) = 6.808$, $p = 0.011$, $\eta^2_{partial} = 0.065$, and downward contrasts reduced loneliness compared to the control condition, $F(1, 108) = 9.17$, $p = 0.002$ $\eta^2_{partial} = 0.078$, but upward contrasts did not affect loneliness compared to the control condition, $p > 0.25$.

For participants whose contrasts did *not* mention other people, the ANCOVA showed no effect of condition,

$F(4, 149) = 0.64$, $p > 0.25$, $\eta^2_{partial} = 0.017$, and so we did not conduct any follow up contrasts. Although these results must be interpreted with caution because participants were not randomly assigned to make comparisons about contact with others vs. comparisons about other aspects of the living situation, they suggest—as one would expect—that it is contrasts pertaining to contact with other people that appreciably affect loneliness, at least in a sample of this size. In other words, the effect of our contrast manipulation was only found for the 52% of the 198 participants in the contrast conditions who mentioned other people in their contrasts.

This finding is useful in speaking against an availability bias or mood-based explanation for the results. Participants who thought about how their house was comparatively bigger or income comparatively better should have felt happier, and had a heightened availability of mood-congruent thoughts, than participants who thought about how their house was smaller or income worse. However, these participants did not differ in the loneliness they reported, speaking against such mundane explanations for the manipulation's effects.

UCLA Loneliness Scale

We followed the same series of steps to analyze UCLA Loneliness Scale scores. As with the single-item measure, an ANCOVA with the five experimental conditions as a between-subjects factor and age and living status (alone vs. with others) as covariates showed no significant effect of condition, $F(4, 244) = 1.20$, $p > 0.250$. The UCLA scores by condition mirror the pattern of self-reported current feelings of loneliness (see **Figure 1**), the differences were just smaller. However, when we tested effects on UCLA scores for participants whose contrasts mentioned other people (plus participants in the control condition), there was a significant effect of condition on feelings of loneliness, $F(4, 141) = 3.48$, $p = 0.01$, $\eta^2_{partial} = 0.084$. Just as with momentary feelings of loneliness, in this portion of the sample, downward vs. upward contrasts produced relatively lower vs. higher loneliness, $F(1, 143) = 3.17$, $p = 0.002$, $\eta^2_{partial} = 0.051$, and downward contrasts reduced loneliness compared to the control condition, $F(1, 108) = 4.93$, $p = 0.028$, $\eta^2_{partial} = 0.044$, but upward contrasts did not affect loneliness compared to the control condition, $F(1, 85) = 0.44$, $p > 0.25$.

These results represent initial support for the idea that loneliness is influenced by differences in the standard to which people compare their present achieved social contact. Identifying how achieved contact with others was better than a comparison target reduced loneliness compared to identifying how achieved contact was worse than a comparison target. These results are consistent with the idea that momentary social cognition—for instance, the relationships and standards presently on one's mind—can exert powerful effects on judgment. Here these results extended to answers on the UCLA loneliness scale, a trait measure—suggesting that even relatively fleeting social cognition can influence the way that people retrospect on and report their experiences over the recent past.

Secondary to the difference between participants who made downward vs. upward contrasts, we saw that downward contrasts reduced loneliness compared to a no-contrasts control condition, suggesting that such contrasts might be an effective intervention against loneliness. Although this recommendation is consistent with the finding that the most successful RCT-tested interventions against loneliness target social cognition (Masi et al., 2011), one must consider that reducing loneliness compared to a control condition depends on the average level of loneliness for control participants and perhaps on their existing social cognition; we do not know what kinds of contrasts, if any, control condition participants mentally make when they evaluate and report on their loneliness. Since an intervention to reduce loneliness is likely to be most effective when developed using samples of individuals with high levels of loneliness, in our non-clinical samples we instead focused on replicating and understanding the relative effects of making downward vs. upward contrasts.

STUDY 2

The aim of Study 2 was to replicate the effect on loneliness of downward vs. upward contrasts. In order to strengthen this effect, and in hopes of identifying it in the whole sample rather than a subsample (based on the content of the contrasts), we explicitly instructed all participants to make contrasts about contact with others. As in Study 1, however, they were free to consider the quantity or quality of contact, or both dimensions.

We further utilized a portion of the sample in Study 2 to test another question of interest: would the effects of the manipulation be sustained over time? We did not necessarily anticipate that they would be, since the effects of social cognition on judgment should dissipate when the cognition changes. However, it was conceivable that effects would linger temporarily; we conducted seven daily follow-ups with a sub-sample of participants to see if this was the case, and if so, how long the effects persisted.

Method

Participants and Design

Six hundred and thirty-one individuals in the United States recruited *via* MTurk, who had not participated in Study 1, completed the baseline survey materials in return for a $1.00 payment; a subset received an additional payment of up to $2.00 for completing follow-up surveys. We used a target sample size of 150 per cell and omitted the no-contrast control condition. This change meant that data would be analyzed with a 2 (contrast direction: downward, upward) × 2 (contrast type: social, temporal) between-subjects ANOVA. With two covariates (as in Study 1) this sample size had 98% power to detect an effect of the size observed in Study 1 (Faul et al., 2007). Upon content analysis, 30 (4.7%) were excluded since they did not complete the contrasts as assigned. The final sample included 341 men, 259 women, and one person who identified gender as "FTM." Respondents were ages 18–82 ($M = 32$ years, $SD = 9.80$). Participants were randomly assigned to one cell of the 2 (contrast direction: downward, upward) × 2 (contrast type: social, temporal) between-subjects design (*ns* per cell = 147–154).

Materials and Procedure

The initial survey was similar to the materials and procedure of Study 1. The contrast manipulations were modified such that participants were asked to make comparisons about contact with other people. We provided an example of the relevant comparison in order to make sure that the instructions were clear. All participants first read:

> First, we are interested in how your present living situation (who you live with, where you live, how you live) compares to other people's living situations, specifically in terms of contact with other people (who you interact with, how those interactions go).

Thereafter, they read text that differed by condition (the text in italics is the portion that differed). In the downward social contrast condition, instructions read:

> For example, you might think that your living situation is *better* than other people's *because you live with someone whose interests are compatible with your own, and many people don't*. This is just an example; you should come up with your own answers. In the space below, please briefly describe two ways that your present living situation, in terms of contact with other people, is *better* than other people's living situations.

In the upward social contrast condition, instructions read:

> For example, you might think that your living situation is *worse* than other people's *because many people live with someone whose interests are compatible with their own, and you don't*. This is just an example; you should come up with your own answers. In the space below, please briefly describe two ways that your present living situation, in terms of contact with other people, is *worse* than other people's living situations.

In the downward temporal contrast condition, instructions read:

> For example, you might think that your living situation now is *better* than in the past *because now you live with people whose interests are more compatible with your own*. This is just an example; you should come up with your own answers. In the space below, please briefly describe two ways that your present living situation, in terms of contact with other people, is *better* than past living situations.

And finally, in the upward temporal contrast conditions instructions read:

> For example, you might think that your living situation now is *worse* than in the past *because you used to live with people whose interests were more compatible with your own*. This is just an example; you should come up with your own answers. In the space below, please briefly describe two ways that your present living situation, in terms of contact with other people, is *worse* than past living situations.

After making the specified contrasts, participants completed the single-item measure of loneliness and the UCLA Loneliness scale. To camouflage the purpose of the study, we presented these items intermixed with five measures unrelated to loneliness. These measures asked participants about their liking for music, liking for reading, how much they had slept the previous night, how often in the past week they had eaten breakfast, and how often they had skipped meals; the latter two were taken from Hays et al. (1984), and shown to be unrelated to loneliness (Hays and DiMatteo, 1987). We then measured demographic information and gave the opportunity to comment as in Study 1.

For 7 days thereafter, we emailed a subsample of participants ($n = 256$) a link to complete a short survey that allowed us to test whether initial effects of the manipulation would be sustained. To camouflage the purpose of the study, for the first 6 days, participants were asked to name what they had eaten for lunch the previous day[3] and to indicate how much they currently liked music and liked reading, as well as to answer the single-item question about loneliness. On the seventh day, participants were administered these items plus the UCLA Loneliness Scale and the two meal regularity items. They were asked how much they had enjoyed participating in the series of surveys and what they thought the study was testing. They were then provided with another opportunity to comment on the survey and thanked for participation.

Results

Immediate Effects

As in Study 1, a sizable minority of participants (95; 15.8%) lived alone, and they reported more loneliness than those who lived with others, both in terms of current feelings ($M_{Alone} = 3.65$, SD = 1.86 vs. $M_{Others} = 2.82$, SD = 1.85) and on the UCLA scale ($M_{Alone} = 44.34$, SD = 14.25 vs. $M_{Others} = 39.72$, SD = 13.23), $ts(581) > 3.07$, $ps < 0.01$. As in Study 1, gender did not relate to either measure of loneliness, $Fs < 1$, and older participants again reported less loneliness on the UCLA scale, $r(599) = -0.09$, $p = 0.02$. They also reported less momentary loneliness, though the relation was only marginally significant this time, $r(599) = -0.07$, $p = 0.07$. Just as in Study 1, therefore, we adjusted for living status and age when testing the effects of the contrast manipulations.[4]

We modified our analysis strategy from Study 1. Since there was no control condition we used a 2 (contrast direction: downward, upward) × 2 (contrast type: social, temporal) factorial ANOVA to test the effects of the contrast manipulations. In addition, we analyzed the two dependent variables (current feelings of loneliness and UCLA scale scores) simultaneously. The two measures of loneliness were strongly correlated, $r(599) = 0.66$, $p < 0.001$, although not so highly as to be collinear, satisfying the requirement for MANOVA (e.g., below 0.8; MANOVA Assumptions, 2020). A MANOVA with age and living status (alone, with others) as covariates showed a multivariate effect of contrast direction, $F(2, 595) = 38.02$, $p < 0.001$, $\eta^2_{partial} = 0.11$, no multivariate effect of contrast type, $p > 0.25$, and no multivariate interaction effect of contrast direction by type, $p > 0.25$. Adjusted marginal means are

[3] Another group of participants ($n = 258$) were asked to generate one downward contrast each day instead of reporting what they had eaten for lunch the previous day. Follow-up analyses from these participants are not presented here.

[4] Unlike in Study 1, age and living status differed across condition. Note that power to find small effects statistically significant was much higher given the large sample size. Most importantly, the effects reported here are virtually unchanged if age and living status are not included as covariates; they are included for comparability with Study 1.

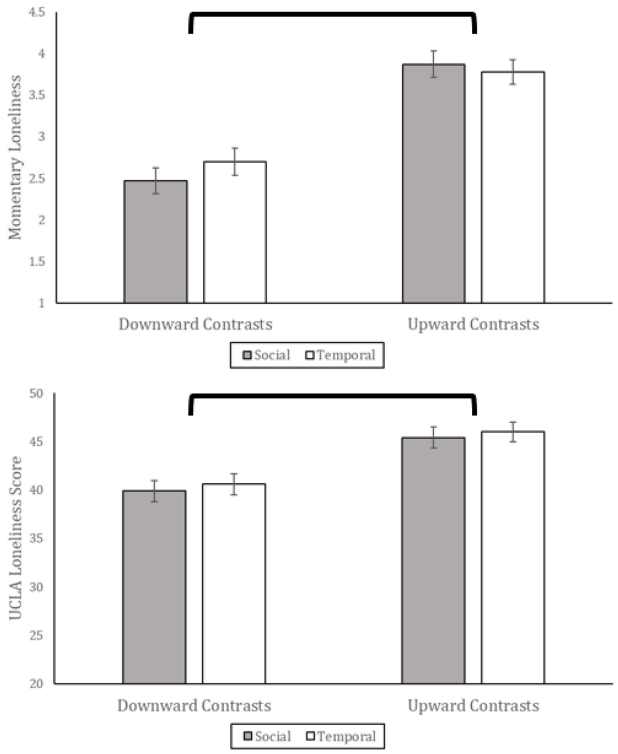

FIGURE 2 | Adjusted marginal means for each condition for Study 2. Momentary loneliness is a single item 7-point response scale and the UCLA scale has 20 items with a 4-point response scale. These values are adjusted for age and living status (alone, with others). Error bars are standard error and brackets indicate significant differences at the $p < 0.05$ level.

presented in **Figure 2**. Whether social or temporal in nature, downward contrasts reduced loneliness compared to upward contrasts on the single-item measure of current feelings, $F(1, 595) = 76.25$, $p < 0.001$, $\eta^2_{partial} = 0.11$, and on the UCLA scale, $F(1, 595) = 31.60$, $p < 0.001$, $\eta^2_{partial} = 0.06$. These effects remained strong when omitting age and living status as covariates ($ps < 0.001$).

Sustained Effects

Next, we tested whether differences in loneliness following the manipulation were sustained, for the set of participants who were contacted with innocuous daily follow-up surveys ($n = 256$). To do so we analyzed their daily reports of loneliness using Generalized Estimating Equations. This analysis has the advantage of including all participants who completed at least one follow-up survey, unlike a traditional repeated-measures analysis where only all the participants who completed all follow-ups would be analyzed. The predictors were baseline contrast direction (downward, upward), baseline contrast type (social, temporal), and day, plus all interaction effects. Again, living status and age were included as covariates. There was a significant effect of day, Wald $\chi^2(1) = 21.99$, $p = 0.003$, and a contrast direction by day interaction effect, Wald $\chi^2(1) = 46.21$, $p < 0.001$. Pairwise comparisons showed that although participants who made downward contrasts reported less loneliness than those who made upward contrasts immediately after the manipulation, $p < 0.001$, this difference was erased by the first follow-up survey, $p > 0.25$, and not detectable at subsequent follow-ups (see **Figure 3**). The lack of difference between conditions on Days 1–7 indicates that the effects of the manipulation do not persist over time, at least not to an extent observable in a sample of this size.

In Study 1, compared to the control condition, downward contrasts reduced loneliness, but upward contrasts did not significantly increase loneliness. One might therefore expect that the difference between downward and upward contrasts immediately after the manipulation ("Baseline") is driven more by downward than upward contrasts; that loneliness in the upward contrasts condition is close to a theoretical control condition level. If this were the case, then we might also expect that loneliness on the follow-up Days 1–7 would be close to this level. Instead, **Figure 3** highlights a relatively large reduction in loneliness in the days after making upward contrasts, and a relatively small increase in loneliness in the days after making downward contrasts. The picture painted by **Figure 3** implies that each manipulation influenced loneliness (in opposite direction) relative to a hypothetical control condition, although we can only infer this given that there was no true control condition in this study.

As in Study 1, we hesitate to draw conclusions about one or the other condition driving the effect that we observed immediately after the manipulation, since it is likely to depend on participants' initial levels of loneliness. We addressed this question in Study 3.

STUDY 3

In Study 3, we used scores on the UCLA scale to divide participants into groups of low vs. high loneliness, before asking them to make downward or upward social contrasts about their contact with others. This served two goals. First, with content analysis we could test whether people who were high in loneliness were *able* to make downward contrasts about their contact with others, and whether people who were low

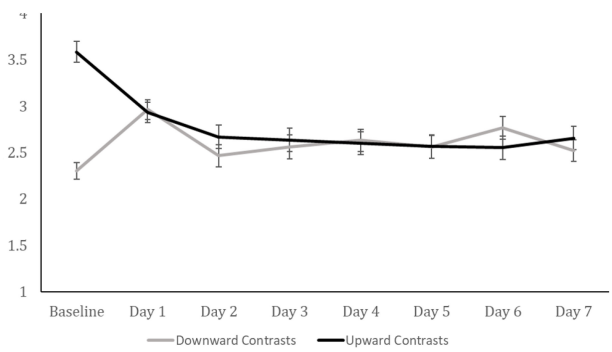

FIGURE 3 | Average reported momentary loneliness at baseline, and over seven further days, following the first contrast made. Error bars are standard error and the only significant group difference based on direction of contrast was found at baseline.

in loneliness were able to make upward contrasts, when asked to do so. Our supplementary analyses in Study 1 found a strong effect of the manipulation, on both momentary (single-item) loneliness and the UCLA scale, among participants whose contrasts mentioned other people. One mundane explanation for this finding is an attrition bias: participants in the downward contrasts condition who were extremely lonely refrained from making contrasts about their contact with other people (and mentioned their income or the size of their house instead) because they were unable to make such downward contrasts. Finding that participants who are high in loneliness can in fact make downward contrasts about contact with others, and that participants low in loneliness can make upward contrasts about such contact, would speak against this explanation.

Second, we tested whether the manipulation was differentially impactful for people who were high or low in loneliness to start with. To identify a sufficient sample of participants relatively high in loneliness, we used a university student sample where loneliness was known to be rather widespread. Because doing so limited the possible sample size, we omitted the temporal contrasts conditions, reasoning that social contrasts might be more relevant to these relatively young participants. Peer comparisons are known to be ubiquitous for young adults like these (Gibbons and Buunk, 1999).

Finally, we administered a measure of interpersonal closeness in order to test the specificity of the manipulation and the extent to which it might be due to demand characteristics. Manipulating the way that participants see their own social contact as exceeding vs. falling short of a standard for such contact should affect loneliness (e.g., Schoenmakers et al., 2012), but not the closeness participants feel to a specific other person. Finding that the manipulation affects feelings of loneliness but not interpersonal closeness would argue against demand characteristics as the explanation for the effect of the contrasts manipulation.

Methods

Participants and Design

Two hundred forty-one undergraduate students at University of California, San Diego participated in the experiment for partial class credit. The sample included 44 men and 197 women, ages 18–35 (M = 20.62, SD = 2.13). The experiment used a 2 (social contrast direction: downward, upward) × 2 (initial loneliness: low, high) between-subjects design. As in Study 1, we aimed for 50 participants per condition after excluding incorrect responses. Content analysis, which we used as a manipulation check and exclusion criteria in the first two experiments, played an additional role here: It allowed us to test whether participants high in loneliness were able to make downward contrasts. Exclusions are therefore described in more detail below.

Materials and Procedure

Participants first completed a survey including basic demographic information and the UCLA scale (Russell, 1996) as well as the Ten-Item Personality Inventory (Gosling et al., 2003) and Beck Depression Inventory (Beck et al., 1996); the latter are not analyzed here. Cacioppo and Patrick (2008) (p. 271) report that high loneliness is defined as summed UCLA scale scores of 44 or higher, so we created two groups, low (n = 111) vs. high (n = 130), based on the cut-off score of 44.

Participants were then randomly assigned to make either two downward or two upward social contrasts using the instructions from Study 2. Thereafter they used a 7-point scale (1 = *extremely untrue*, 7 = *extremely true*) to indicate how a series of randomly-ordered statements applied to them. The measures included the single-item question about momentary loneliness ("I feel lonely") as in Studies 1 and 2, and filler items about liking for music and reading as in Study 2. We also added a single-item pictorial measure of interpersonal closeness, the Inclusion of Other in the Self scale (Aron et al., 1992). The scale depicts two circles representing "self" and "other" in seven degrees of overlap (depicted in online materials), which participants were asked to use to indicate the level of perceived closeness with their "closest friend."

Following these measures, we administered the Reading-the-Mind-in-the-Eyes test (Baron-Cohen et al., 2001) and the Empathy Quotient scale (Baron-Cohen and Wheelwright, 2004). These assessments addressed secondary hypotheses, and are not analyzed here. All test materials are posted at[5].

Results and Discussion

Of 241 respondents, 70 (29%) did not make both of the contrasts they were asked to; in other words, they did not provide two contrasts that involved mention of other people, as instructed, and similar to our past cited studies, they were excluded. They were roughly evenly distributed across the downward (n = 31, 25.2%) and upward (n = 39, 33.1%) contrast conditions, $\chi^2(1) = 1.80$, $p = 0.18$. A binary logistic regression analysis indicated that participants low rather than high in initial loneliness were marginally less likely to complete the manipulation as instructed, $b = 0.53$, Wald $\chi^2(1) = 3.45$, $p = 0.063$; the odds of failing to complete the two instructed contrasts were 1.71 times higher for participants low in loneliness. However, there was no interaction effect between initial loneliness group and contrast condition, $b = 0.28$, Wald $\chi^2(1) = 0.95$, $p > 0.25$, indicating that the heightened tendency of participants low in loneliness to not make the instructed social contrasts was equally true whether they were instructed to make downward or upward contrasts. This finding strengthens the conclusions drawn from the supplementary results of Study 1 by speaking against an attrition bias driving those results.

Next, we tested the effect of the manipulation on the 172 participants who made the two contrasts as instructed, constituting in this case a check that the experimental manipulation was completed. As in Studies 1–2, men and women did not differ in the dependent variable indicator of momentary loneliness, $t(170) = 0.83$, $p > 0.25$. In this sample, a very small number of participants (n = 6, 3%) lived alone; they did not differ in present loneliness from those who lived with others, $t(170) = 0.16$, $p > 0.25$. Age was also unrelated to present loneliness in this sample, $r(170) = -0.08$, $p > 0.25$, unlike in Studies 1–2, probably because of the small age range of

[5] osf.io/6csyh

participants in Study 3. Therefore, we did not include age or living status as covariates in the analyses below.

Momentary loneliness and interpersonal closeness were correlated, $r(170) = -0.30$, $p < 0.001$, so we next tested whether the effects of the manipulation would be specific to loneliness (rather than closeness), and whether these effects would depend on initial loneliness. To do so we conducted a repeated-measures ANOVA with on the scores, by adding measure (momentary loneliness or closeness) as a within-subjects predictor, along with the between-subjects predictors of loneliness group (low or high) and contrast condition (downward or upward). This analysis showed a marginally significant 3-way interaction effect of measure by contrast condition by initial loneliness, $F(1, 168) = 3.57$, $p = 0.06$, $\eta^2_{partial} = 0.021$ (see **Figure 4**).

To clarify this interaction we conducted between-group t-tests based on condition, separately on groups of "low" or "high" initial loneliness from the UCLA scale. For participants initially low in loneliness, downward contrasts resulted in marginally lower momentary loneliness than upward contrasts, $t(81) = -1.97$, $p = 0.053$. For participants initially high in loneliness on the UCLA scale, the contrasts manipulation had no effect on momentary loneliness, $p = 0.7610$. The contrasts manipulation did not appreciably affect perceived closeness to one's closest friend, for participants initially low in loneliness, or initially high in loneliness, ps > 0.250. The specificity of the manipulation's effect—influencing loneliness but not interpersonal closeness—speaks against demand characteristics as an explanation.

In light of the effects of downward vs. upward contrasts seen in Studies 1 and 2, in samples where loneliness was rather low on average, it is probably unsurprising that the manipulation produced differences in loneliness for those students who were not highly lonely to start with. Nevertheless, this finding has important implications for the design of interventions against loneliness; it suggests that modifications would have to be made in order to utilize contrasts to decrease such feelings among the highly lonely.

In sum, the contrasts manipulation affected participants who were already low, but not high, in loneliness. This could, importantly, reflect an aspect of highly lonely individuals being somewhat resistant to such a brief contrast manipulation. It is possible that those already high in loneliness may not be affected by such a transitory consideration—whether they take it seriously or not—just because they may have already resigned to the "lonely mind" (Cacioppo and Hawkley, 2009).

High (trait) lonely participants didn't change in their (state) loneliness, so one interpretation would be that the effects are driven by the upward contrasts condition (i.e., upward contrasts increase loneliness). This interpretation would be in line with the relatively large decrease in loneliness in the days following an upward contrasts manipulation that we observed in Study 2 (**Figure 1**). We therefore wondered what happens over time if people continue to make upward contrasts—do they experience sustained increases in loneliness? This question was not amenable to an experimental design since it would imply making people lonely (and perhaps inducing the negative health consequences of these feelings) over time. Instead, we used a panel survey.

STUDY 4

In Study 4, we analyzed data from a population-representative sample of older adults in the United Kingdom. The measures of contrasts available in this panel study refer to courtesy and respect in service-based interactions (i.e., at restaurants, stores, or hospitals). These contrasts in Study 4 are more specific—and, one would expect, less important—than contrasts generated by participants in Studies 2–3, so we expected their effects to be weaker. However, the large representative sample that was contacted repeatedly in this study not only allowed us to track (small) predictive effects of upward contrasts on loneliness over time, it also complemented the American MTurk workers and university students who participated in Studies 1–3 to facilitate conclusions about generalizability.

Methods

Participants and Design

The English Longitudinal Study of Aging (ELSA) includes approximately 12,000 respondents recruited to provide a

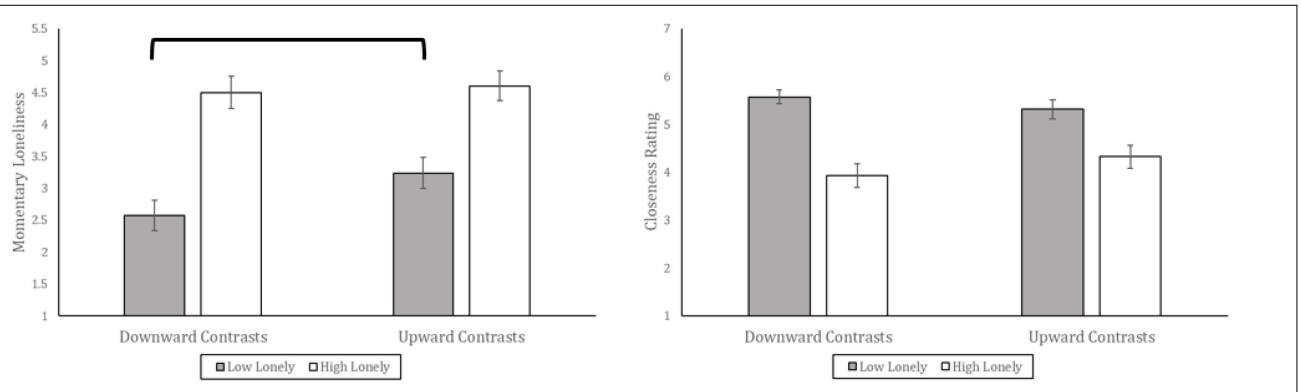

FIGURE 4 | Momentary loneliness (single-item measure) and closeness to one's closest friend as a function of downward vs. upward contrasts and initial loneliness (UCLA Loneliness scale score). These are group means and the error bars are standard error. The bracket indicates a finding within the Low Lonely group of contrast direction affecting loneliness at $p = 0.05$.

representative sample of the English population aged 50 and over. Further information about the sample and methodology is available at[6]. We analyzed data from Waves 4 (2008–2009; $n = 11{,}050$), 5 (2010–2011; $n = 10{,}275$), and 6 (2013–2014, $n = 10{,}601$).

Materials

The complete list of measures administered per wave is available at[7]. In order to test how upward contrasts relate to loneliness over time, we identified measures of both variables, as well as appropriate control variables, from the items administered.

Contrasts

At Wave 5 only, three items pertaining to upward social contrasts were presented in a section with the instructions: "In your day-to-day life, how often have any of the following things happened to you?" The first item asked whether "You are treated with less courtesy or respect than other people," the second asked whether "You receive poorer service than other people at restaurants or stores," and the third was "You receive poorer service or treatment than other people from doctors or hospitals." For all items, the response options were *almost every day* (6), *at least once a week* (5), *a few times a month* (4), *a few times a year* (3), *less than once a year* (2), and *never* (1). There were 7,901 valid responses to the three items and their internal reliability was acceptable ($\alpha = 0.68$), so we summed responses to these items as an indicator of the frequency of upward social contrasts (ranged from three to 18, $M = 4.91$, SD = 2.16).

Loneliness

At Waves 4, 5, and 6, two items in the ELSA survey measured loneliness. On the first, respondents indicated whether or not they had felt lonely much of the time during the past week (*no* = 0, *yes* = 1). The second item was: "How often do you feel lonely?" with response options *hardly ever or never* (1), *some of the time* (2), and *often* (3). At all three waves, responses to the two items were strongly correlated [Wave 4 $r(7346) = 0.57$, $p < 0.001$; Wave 5 $r(7988) = 0.57$, $p < 0.001$; Wave 6 $r(7712) = 0.56$, $p < 0.001$] and were summed to create a single indicator of loneliness (ranged from one to four at each Wave, $M_{T4} = 1.48$, SD = 0.83; $M_{T5} = 1.49$, SD = 0.83; $M_{T6} = 1.49$, SD = 0.83).

Control variables

Particularly in light of the way that upward social contrasts were measured in ELSA, it was important to establish that any link between contrasts and loneliness was not spuriously related to a third variable such as a negative worldview, or generalized negative affect. As the best available items to control for such a third variable, we used items intended to measure personality dimensions of neuroticism and agreeableness (Saucier, 1994). Cacioppo and Hawkley (2009) reported that the personality dimensions predictive of loneliness included high neuroticism and low agreeableness (see Marangoni and Ickes, 1989; Cacioppo et al., 2006). To measure neuroticism, ELSA participants were asked to indicate how well "Moody" and "Nervous" described them, and to measure agreeableness, participants were asked to indicate how well "Sympathetic," "Warm," and "Helpful" described them, using response options *a lot* (1), *some* (2), *a little* (3), and *not at all* (4). These items were administered at Wave 5 only. We calculated the mean of the respective items to obtain indicators of neuroticism ($\alpha = 0.47$, ranged from one to four, $M = 2.96$, SD = 0.69) and agreeableness ($\alpha = 0.70$, ranged from one to four, $M = 1.47$, SD = 0.49). The two variables were only weakly correlated, $r(8847) = -0.04$, $p < 0.001$.

Results and Discussion

First, we tested the cross-sectional relation of contrasts to expressions of loneliness, using the Wave 5 data. Thus, we modeled loneliness using multiple regression with amount of upward contrasts as a continuous predictor (Model 1). As expected, more frequent upward contrasts predicted higher concurrent loneliness, standardized $\beta = 0.14$, $t(7797) = 12.36$, $p < 0.001$, adjusted $R^2 = 1.9\%$. This relationship remained significant when controlling for neuroticism and agreeableness in Model 2, $\beta = 0.08$, $t(7722) = 7.28$, $p < 0.001$, adjusted $R^2 = 7.1\%$. As in previous work (Marangoni and Ickes, 1989; Cacioppo et al., 2006), in this multivariate analysis lower neuroticism predicted higher loneliness, $\beta = -0.23$, $t(7722) = 20.31$, $p < 0.001$, and lower agreeableness predicted higher loneliness, $\beta = 0.05$, $t(7722) = 4.59$, $p < 0.001$. Controlling for neuroticism and agreeableness helps to establish that the reason this measure of contrasts, which pertained to how one perceives treatment from others, relates to loneliness is not spuriously due to a negative way of seeing things. Results for both regression analyses are presented in **Table 1**.

Next, we tested the relationship between contrasts and loneliness over time. Loneliness was relatively stable over time (Wave 4 loneliness with Wave 5 loneliness $r(6902) = 0.65$, $p < 0.001$; Wave 5 loneliness with Wave 6 loneliness $r(7269) = 0.68$, $p < 0.001$), and sample sizes were slightly reduced by excluding participants who were missing responses at some waves. Nevertheless, contrasts at Wave 5 predicted loneliness at Wave 5 even when controlling for loneliness at Wave 4 along with controlling for neuroticism and agreeableness in Model 3, $\beta = 0.03$, $t(6687) = 0.03$, $p = 0.001$. Thus, in this population-representative sample of older adults in the United Kingdom, a small but reliable amount of the variance in loneliness was associated with upward social contrasts.

However, controlling for loneliness at Wave 5, contrasts did not predict loneliness at Wave 6, $\beta = 0.014$, $t(7107) = 1.56$, $p = 0.12$.[8] In line with the theorizing above and results of the daily follow-up in Study 2, this result may speak to the importance of

[6]http://www.elsa-project.ac.uk/

[7]http://www.ifs.org.uk/ELSA/documentation

[8]Because contrasts were measured at only one Wave, this data is not amenable to more sophisticated investigation of causal relationships like a cross-lagged panel analysis. We did test the relationship between contrasts and changes in loneliness with a latent difference score model estimated in Mplus (version 7.11; Muthén and Muthén, 2012). This method produced conclusions identical to the regression analyses above: controlling for neuroticism and agreeableness, both of which predicted the change from Wave 4–5 but not the change from Wave 5–6, contrasts measured at Wave 5 predicted the change in loneliness from Wave 4–5, standardized coefficient 0.036, $p < 0.001$, but not the change in loneliness from Wave 5–6, standardized coefficient −0.018, $p = 0.16$.

TABLE 1 | Regression analysis predicting loneliness at wave 5 from other wave 5 predictors.

	Adjusted R^2	Predictors	$\beta_{standardized}$	B	SE	*t* value	*P* value	VIF	AIC
Model 1	0.019	(Intercept)		1.218	0.023	53.12	<0.001		18,935.8
		Contrasts	0.139	0.053	0.004	12.36	<0.001		
Model 2	0.071	(Intercept)		2.006	0.056	35.63	<0.001		18,316.9
		Neuroticism	−0.229	−0.274	0.013	−20.31	<0.001	1.06	
		Agreeableness	0.051	0.086	0.019	4.59	<0.001	1.01	
		Contrasts	0.082	0.031	0.004	7.28	<0.001	1.06	
Model 3	0.433	(Intercept)		0.782	0.051	15.53	<0.001		12,290.1
		Loneliness at Wave 4	0.619	0.611	0.009	65.13	<0.001	1.07	
		Neuroticism	−0.102	−0.12	0.011	−10.48	<0.001	1.11	
		Agreeableness	0.032	0.054	0.015	3.5	<0.001	1.01	
		Contrasts	0.031	0.012	0.004	3.24	0.001	1.07	

examining concurrent social cognition to understand loneliness. That is, contrasts are associated with loneliness at the same point in time, not in the future. If people make different contrasts (i.e., they change the way they think about their social contact), then loneliness should change.

Study 4 is valuable in showing a relationship between contrasts and changes in loneliness, which is not accounted for by personality indicators of a negative outlook on life, and which extends the earlier samples in age, culture, and representativeness. This relationship is particularly striking in light of the measure of contrasts, which by tapping courtesy and respect in service interactions, refers to contrasts that are more specific and probably less important than those identified in the experimental manipulations. In spite of their specificity and likely low importance, these contrasts explained variance in loneliness concurrently as well as from the past to the present. One limitation of the experiments (Study 1–3) that is not addressed in the survey design of Study 4, however, is whether people *spontaneously* make social and temporal contrasts when thinking about their contact with other people. We used content analysis in Study 5 to gain insight into this issue—how prevalent are such contrasts in conversations about daily life, what do they look like, and are they linked to expressions of loneliness.

STUDY 5

In the course of research about the experience of solo living, Klinenberg (2012) interviewed middle-aged middle-class adults and older adults who lived alone. These were long-form, semi-structured interviews utilizing open-ended questions around the topic of living alone. Since contrasts were not the research topic of interest, participants were not asked whether or how they compared their social contact to others or to the past; therefore, we content-analyzed the interview transcripts to look for the presence of spontaneous contrast statements. We also noted whether or not participants, who lived alone and therefore were likely to have objectively low social contact, described themselves as lonely. To avoid coder bias producing a link between the presence of contrasts and perceived loneliness in a transcript, we used a multi-step coding method.

Participants and Design

There were 122 transcribed one-on-one interviews collected by Klinenberg (2012); see data collection details on p. 235–237) available for analysis. Interview subjects were adults who lived alone in major metropolitan areas of the United States, primarily four boroughs of New York City (Brooklyn, the Bronx, Manhattan, and Queens). Age and gender information, where available, is noted below.

Procedure

First, a research assistant read the 122 interviews and noted the interviewee's gender and age (if specified) as well as whether or not the interviewee was asked about loneliness. Twenty-five interviews that did not include this question were excluded from analysis. The remaining sample of 97 included 69 women and 28 men ages 33–97 (19 interviewees did not provide their ages). In this sample, 48 interviewees (49%) reported being lonely (i.e., said "yes" when asked if they were lonely), 39 (40%) reported not being lonely (i.e., said "no"), and 10 (10%) gave an unclear answer.

In the second step of coding, one of three research assistants read each of the 97 interviews and extracted each statement that they saw as pertaining to comparisons about one's life or living situation. They extracted 689 statements formed of one or more contiguous sentences, of which 314 (46%) were classified as social contrasts, 270 (39%) as temporal contrasts, and 105 (15%) as unclear or neither of these.

In the third step, the 584 social and temporal contrast statements from the 97 interviews were sorted in a random order and the identity of the interviewee was concealed. These statements were then coded by two research assistants as downward contrasts in which the present was better than the comparison standard, upward contrasts in which the present was worse than the comparison standard, or unclear/can't tell. After the first pass coding, the research assistants discussed approximately one-third of the cases on which they had disagreed, before re-coding the remaining disagreements. This method yielded high inter-coder agreement, Cohen's Kappa = 0.72. Of the 106 remaining disagreements, 75 (71%) were resolved by a third coder, and 31 (29%) that

could not be resolved were discarded from analysis. This coding procedure resulted in 553 contrast statements from interviews with 96 participants; frequencies by direction and type, along with examples, are summarized in **Table 2**.

Results and Discussion

The first thing to note is that contrast statements were common in the interviews. Considering only those contrasts where the direction was clear, interviewees made an average of 1.35 downward social contrasts (SD = 1.69), 0.76 upward social contrasts (SD = 1.06), 1.07 downward temporal contrasts (SD = 1.39), and 1.26 upward temporal contrasts (SD = 1.15). Eighty percent of interviewees made at least one clear downward contrast, and eighty-seven percent made at least one clear upward contrast. In the subset of participants ($n = 80$) where age could be identified, older participants were less likely to have made a downward temporal contrast, $r(78) = -0.25$, $p = 0.026$.

How did contrasts in the interviews relate to expressions of loneliness? When we compared the three groups of participants, who were lonely, not lonely, and unclear in their response, there was no difference in the mean number of contrast statements of the various types, $Fs(2, 93) < 1.09$, $ps > 0.25$. However, in a binary logistic regression analysis, the presence (vs. absence) of *downward* temporal and social contrasts together marginally predicted being lonely (vs. not being lonely), $\chi^2(2) = 5.04$, $p = 0.08$. The coefficients on the dummy variables representing the presence of downward social contrasts, $b = -0.72$, $\exp(b) = 0.49$, and downward temporal contrasts, $b = -0.67$, $\exp(b) = 0.51$, indicated that the probability of being lonely was lower for participants who made these contrasts. The presence (vs. absence) of upward temporal and social contrasts, on the other hand, was unrelated to loneliness (vs. not being lonely), $\chi^2(2) = 0.05$, $p > 0.25$.

Why might the predictive links to expressed loneliness be driven by the presence vs. absence of (downward) contrasts, rather than the number of contrasts of various types? Several factors are worth considering. Methodologically, extracting the comparative statements from their context—which has the benefit of preventing coder bias (i.e., coders were blind to participants' loneliness when coding the direction of the contrasts)—has the side effect of leaving some statements unclear in direction. Presence vs. absence is thus measured with more precision than number. More interesting theoretically, it is possible that contrast statements that are particularly strong or meaningful to the participant—information that is impossible to discern from an interview transcript—might compensate for more, but weaker, contrasts of opposite direction (Swann et al., 2007). In sum, however, this content analysis suggests both the prevalence of spontaneous social and temporal contrasts about contact with others, and a link between those contrasts and loneliness.

GENERAL DISCUSSION

Loneliness stems from the perception that the present living situation has inadequate social connection (Cacioppo and Patrick, 2008). As with many perceptions, *inadequacy* here is determined by comparing the present to a criterion, such as social connection *apparently* achieved by others or in one's own past. When the present living situation surpasses the criterion, people should feel less lonely than when the present living situation falls short of a criterion. In line with this speculation, the results from five studies suggest that downward contrasts, which depict the present quality and/or quantity of social contact as better than a given standard, produce lower loneliness than upward contrasts, which depict the present social contact as worse than

TABLE 2 | Contrast frequencies and examples by type and direction in Study 5.

	Contrast direction		
Contrast type	**Downward**	**Upward**	**Unclear**
Social	130 (23.5%) A lot of single women feel like failures or something and they get a man and they're just like oh good I've made it you know? And they'll marry a guy that almost, well not that they can't stand, but that bugs them and even that they've ion respect for or whatever but they've already put a year or two of doling into it and he's basically harmless audit's like going back into the dating world it would be like having your teeth pulled out They can't deal with that... And I just see a lot of that as being sort of false and not really my priority because of fear of not having someone or because my ego needs it or I need die validation.	73 (13.2%) Despite the way I live I am a very relational person and, to me, meaning comes from relationships so when there are not people there sometimes I think too much about. . . you get existential problems about living alone. What is this for? Who am I giving it to? Where is the love in my life? All these questions come to bear on you when you live alone in a different way. I say that to other people and they say that's not true, when you live with other people you get the same questions They're just not as insisting because there's more distraction.	93 (16.8%)
Temporal	103 (18.6%) And being alone, really alone is a lot easier than being that alone that's because of the coldness in a relationship. I would much rather live alone then deal with something like that again.	121 (21.9%) I liked sharing the minutia of daily life, I liked things that—now that I live alone, so much of my daily experience never gets reported. But living with someone else you tell silly crazy things that don't matter in the big scope, but they make you feel more like a person when those little things register, so I liked that. I liked being able to plan in person whatever we were going to do	33(6.0%)

a standard. These results contribute to an important gap in the literature on loneliness, which is generally defined in terms of a discrepancy between existing relationships and the standards desired for those relationships. Whereas previous research has largely focused on the existing relationships, the present studies show that the other component of the definition also plays an important, even causal, role.

The mixed methods of these studies contribute different strengths. The first three, with experimental designs, show a causal relation between contrasts and loneliness. Although this relation may well be bidirectional—lonely people probably have a tendency to see themselves as relatively worse off—very briefly induced downward vs. upward contrasts produced consistent differences in loneliness, demonstrating that in this direction the relation can be understood as causal. The large survey dataset analyzed in Study 4 indicated that upward social contrasts (even in specific and minor life domains) can explain variance in both concurrent loneliness and changes in loneliness over time, in a population-representative sample of older adults. And adding richness to the experimental and survey data, the content analyses in Study 5 suggest that temporal and social contrasts are a common ingredient in thoughts and conversations about daily life among individuals at risk of feeling lonely (i.e., solo dwellers).

The contributions of this research are both theoretical and practical. On the theoretical side, we show that loneliness is influenced by the standards against which people compare their social connections. This finding is fully in line with work that defines loneliness as a discrepancy between existing relationships and the standards desired for those relationships (e.g., Cacioppo and Patrick, 2008)— supporting it empirically complements the bulk of research that has focused on determinants in terms of relationships themselves rather than standards. It is also interesting theoretically to note that when social and temporal contrasts were both examined (Study 1, 2, and 5), they appeared to exert similar effects. Note that there may be groups for whom one or the other type of contrast comes more naturally or is more powerful (see e.g., Lyubomirsky and Ross, 1997). However, in our studies both content and effects of the two types of comparisons were largely indistinguishable. The present research also suggests that downward contrasts may decrease loneliness (Study 1 and 5) and upward contrasts may increase loneliness (Study 2, 3, and 4) compared to some reference value, but more research is needed on this point. We suspect the answer will depend at least in part on the level of loneliness and the style of thinking with which participants begin.

One practical implication concerns how to study downstream consequences of loneliness. Most investigations use correlational methodology. When experiments are utilized, they have relied on time- and labor-intensive methodologies like hypnosis to induce loneliness (Cacioppo et al., 2006). Future research can use the quick and inexpensive identification of contrasts to induce relatively high vs. low loneliness and study downstream consequences. Importantly, the effect of the contrast manipulation on momentary loneliness was mainly prevalent only when participants engaged in contrasts that mentioned other people.

A further practical implication concerns interventions against loneliness. Such interventions are often based on changing existing relationships—introducing participants to new people or helping them feel closer to those they know. Or, one might change the relationships that are salient; for instance, reminding people about their social connections, which enhances trust in others, reduces aggression in response to social exclusion (Twenge et al., 2007). The present research suggests that targeting the standards against which these relationships are evaluated is a fruitful avenue to explore, but more exploration is needed. Indeed, interventions targeting social cognition appear to be the most beneficial (Masi et al., 2011), but they often involve weeks- or months-long sessions of cognitive therapy. Future research might explore how to make the effects of contrasts identified here more powerful, perhaps by having participants make more than two contrasts, by inducing social and temporal contrasts at the same time (see Zell and Alicke, 2009), by building on temporal contrasts to help participants generate counterfactual statements about what they could have done differently and could do differently in the future (Epstude and Roese, 2008; Smallman and Roese, 2009), or by harnessing assimilation processes as well as contrasts. Then, incorporating contrasts into social cognition interventions might make those interventions more expedient as well as more effective.

The present studies focused on downward and upward comparisons in which people identify dissimilarities between their present living situation and a standard. One should note that making comparisons by identifying similarities, which leads to assimilation rather than contrast in judgment (Mussweiler, 2003; Bless and Schwarz, 2010), might produce effects opposite to those hypothesized and identified here. For example, people instructed to identify ways that their living situations were *similar to* someone else's living situation might feel less lonely if that someone else had a high rather than low quality of social contact. Assimilation processes explain why merely seeing a well-off target (e.g., someone with extremely high-quality relationships) does not necessarily make observers feel lonely (Bless and Schwarz, 2010). Interventions against loneliness based on social comparisons might therefore induce both downward contrasts and upward assimilation.

In addition, future research might usefully extend the examination of comparison processes. For instance, one could examine lateral comparisons (i.e., no difference between self and other; no change between past and present), or comparisons to a possible future self. This latter type of comparison might occur spontaneously if people assimilate their circumstances to a downward social target and feel threatened that a possible future self could end up in the same situation as the worse-off other, or if people assimilate their circumstances to an upward social target and feel inspired that a possible future self could end up in the same situation as the better-off other (e.g., Strahan and Wilson, 2006). Future studies may also add mood measures taken (before and) after the manipulation, in order to rule out possible more generalized mechanisms of the manipulation's impact on loneliness judgments. We also note that SES/income level was not incorporated

in these studies, but as it shapes potential valuation of life conditions, it should be measured in future studies.

Finally, while the present paper focused on the role of social comparisons, it is important to remember that feelings of loneliness are determined by multiple sources. Classic work focused on aberrant processing of social stimuli that promote positive social interactions (Cacioppo and Hawkley, 2009). More recent theorizing highlights a possible role of interoceptive dysregulation, in which lonely individuals lose the ability to accurately "tune in" to one's own internal, especially emotional, states and properly use them in social judgments (Arnold et al., 2019). Recent related research also highlights the deficits in spontaneous responding of lonely individuals to positive signals of social connection (Arnold and Winkielman, 2020). As such, future studies may explore the interaction of higher-order social comparison processes with these more basic mechanisms.

In sum, the primary contribution of this series of studies is the attention to the comparison standards that people use to evaluate their loneliness. Feelings of loneliness produce unmistakable emotional distress, often accompanied by a host of undesirable health consequences (Cacioppo and Patrick, 2008). As the present research highlights, these feelings depend not only on objective information about existing relationships, but also on the way that people think about those relationships and the standards against which people compare them.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/supplementary material.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by UCSD IRB HRPP. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HK conceived of the initial studies and drafted the first manuscript. AA contributed Study 3 and linkage with other studies, added substantial contributions and considerations, and including figures and analyses. EK and PW also provided crucial edits. All authors approved the current manuscript.

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