



Moving Beyond Disciplinary Silos Towards a Transdisciplinary Model of Wellbeing: An Invited Review

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The construct of wellbeing has been criticised as a neoliberal construction of western individualism that ignores wider systemic issues such as inequality and anthropogenic climate change. Accordingly, there have been increasing calls for a broader conceptualisation of wellbeing. Here we impose an interpretative framework on previously published literature and theory, and present a theoretical framework that brings into focus the multifaceted determinants of wellbeing and their interactions across multiple domains and levels of scale. We define wellbeing as positive psychological experience, promoted by connections to self, community and environment, supported by healthy vagal function, all of which are impacted by socio-contextual factors that lie beyond the control of the individual. By emphasising the factors within and beyond the control of the individual and highlighting how vagal function both affects and are impacted by key domains, the biopsychosocial underpinnings of wellbeing are explicitly linked to a broader context that is consistent with, yet complementary to, multi-levelled ecological systems theory. Reflecting on the reciprocal relationships between multiple domains, levels of scale and related social contextual factors known to impact on wellbeing, our GENIAL framework may provide a foundation for a transdisciplinary science of wellbeing that has the potential to promote the wellbeing of individuals while also playing a key role in tackling major societal challenges.

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INTRODUCTION

Here we impose an interpretative framework on previously published literature and theory, laying a foundation for a transdisciplinary framework focused on better understanding and improving wellbeing. First, we briefly summarise some of the complexities and criticisms relating to wellbeing and its construct.

COMPLEXITIES AND CRITICISMS OF WELLBEING

The word “wellbeing” is not a simile for reduced illbeing, quality of life or happiness (Headey et al., 1985; Ryff et al., 2006; Westerhof and Keyes, 2010; Skevington and Böhnke, 2018). Our own work

for example (Fisher et al., 2020; Tulip et al., 2020; Wilkie et al., 2021), has shown that wellbeing may be improved in neurological disorders, and in despite of significant levels of ill-health and distress. These findings reinforce Wong's dual system model of what makes life worth living (Wong, 2012). Negative emotions provide the seeds for personal growth (Wong, 2010; Kashdan and Biswas-Diener, 2015), while major adversity and suffering can lead to "post-traumatic growth" (Joseph and Linley, 2006). Wellbeing interventions have been developed within disciplinary silos leading to a focus on isolated components [e.g., psychological interventions (Carr et al., 2020) are often distinct from the promotion of positive health behaviours (Buecker et al., 2020)]. The scientific focus on what constitutes a happy or good life has been described as "scientific polyannaism" (Yakushko, 2019), while the individual pursuit of wellbeing has been described as a socio-cultural construction of western individualism that places importance on wealth, fame and materialistic pursuits (Carlisle et al., 2009; Davies, 2015; Hull and Pasquale, 2018).

These complexities and criticisms highlight the need to transcend disciplinary boundaries and work towards a transdisciplinary model of wellbeing. Such an approach requires disciplinary integration and recontextualisation of competing theories in such a way that leads to new ideas and knowledge (Choi and Pak, 2006). Wellbeing must be conceptualised as a system, within which the interconnectedness of the individual in relation to their communities and environments must be explored while appreciating the impacts of socio-contextual factors (e.g., inequality, culture) that influence wellbeing and behaviour change theory to identify sustainable solutions for improving wellbeing. We further highlight a role for vagal nerve functioning, a psychophysiological index of wellbeing that affects and is affected by various determinants of wellbeing across multiple domains at multiple levels of scale, providing the theoretical glue around which our GENIAL framework has been developed (Kemp et al., 2017a; Mead et al., 2019; Fisher et al., 2020; Wilkie et al., 2021).

RETHINKING WELLBEING

Here we define wellbeing as positive psychological experience, promoted by connections to self, community and environment, supported by healthy vagal function, all of which are impacted by socio-contextual factors that lie beyond the control of the individual. Our manuscript has been structured around this definition, focusing on each of the domains within which wellbeing may arise, highlighting major socio-contextual factors that lie beyond the control of the individual, and discussing the capacity to sustain positive change, drawing on behaviour change theory at multiple levels of scale.

Self-connection is a relatively new concept, rooted in self-awareness that involves accepting and aligning behaviour based on that awareness (Klussman et al., 2020a,b,c). We suggest that "self-connection" may be supported by the vagus nerve, a structural link between body and mind. Self-connection

is also associated with self-actualisation (Klussman et al., 2020a,b,c) and connectedness with others (Kok and Fredrickson, 2010; Kok et al., 2013), which has been described as a psychological need (Baumeister and Leary, 1995; Deci and Ryan, 2000). Social connectedness is associated with the social relational emotions including gratitude, compassion and awe, all of which are powerful determinants of prosocial behaviour (Stellar et al., 2017; Petersen et al., 2019). These emotions have been associated with higher levels of vagal function (Childre, 2004; Shiota et al., 2011; Bello et al., 2020), and recent thinking suggests that they may be involved in feelings of connection to the natural environment (Petersen et al., 2019) which are again associated with vagal nerve functioning (Richardson et al., 2016).

THE VAGUS NERVE AND WELLBEING

The vagus nerve connects the central nervous system to many different organs including heart, gut, liver and lungs. While the vagus nerve is one of several responses systems contributing to the experience of wellbeing, it has a regulatory role over many including the sympathetic nervous system (Porges, 2011; Deuchars et al., 2018), hypothalamic-pituitary-adrenal axis (Porges, 2011), immune functioning (Tracey, 2002; Pavlov and Tracey, 2012), brain-gut interactions (Bonaz et al., 2018; Fülling et al., 2019) neurogenesis and epigenetic mechanisms (Follesa et al., 2007; Biggio et al., 2009; O'Leary et al., 2018). Research now links vagal function to positive emotions (Geisler et al., 2010; Kok and Fredrickson, 2010; Kok et al., 2013), meaning and purpose in life (Zilioli et al., 2015; Dang et al., 2021), emotion regulation (Geisler et al., 2010; Williams et al., 2015), executive function (Williams et al., 2019; Eggenberger et al., 2020), psychological flexibility (Kashdan and Rottenberg, 2010; Colzato et al., 2018), prosocial behaviours (Kemp et al., 2012; Geisler et al., 2013; Kok et al., 2013), positive health behaviours (Werner et al., 2015; Young and Benton, 2018), biopsychosocial resilience (Dedoncker et al., 2021), time spent in nature (Richardson et al., 2016; De Brito et al., 2020) and future morbidity and mortality (Hillebrand et al., 2013; Jandackova et al., 2016; Fang et al., 2020). Various theoretical models have been proposed within which these findings have been interpreted. The neurovisceral integration model (Thayer et al., 2009) presents the vagus nerve as a structural link between mind and body, arguably representing a psychophysiological correlate of self-connection. An iteration of this model (Kemp et al., 2017b) described HRV as a missing structural link between psychological moments and mortality, mediating the association between wellbeing and longevity vs. illbeing and premature mortality. Polyvagal theory (Porges, 2011) illustrates a role for the vagus nerve in the social engagement system, supporting the capacity for social connection (Holt-Lunstad et al., 2010; Kemp et al., 2017a). The evolutionary model for the wellbeing benefits of nature (Richardson et al., 2016) features the vagus nerve within a physiologically based model of affect. Interestingly, meta-analysis (Bello et al., 2020) has demonstrated a role for the vagus nerve in feelings of

compassion, an experience supporting connection to self, others and nature (Neff, 2003; Petersen et al., 2019). Compassion is often facilitated through loving kindness meditation, which builds positive emotions, promotes feelings of social connectedness and raises levels of vagal function in an upward spiral relationship (Kok et al., 2013).

In summary, we view healthy vagal functioning as fundamental in supporting an individual's capacity for connection to self, others and nature, while also acknowledging external impacts on vagal functioning that impact wellbeing.

THE INDIVIDUAL DOMAIN AND WELLBEING

Mental and physical wellbeing are core components of overall health that are intimately and bidirectionally associated (Kemp and Quintana, 2013; Steptoe et al., 2015). Mental wellbeing encompasses hedonic (positive emotions) and eudaimonic (flourishing) wellbeing (Diener et al., 1999; Ryan and Deci, 2001; Fredrickson, 2004; Wong, 2012; Ryff, 2014), and while competing theories have focused on one or the other, Seligman's PERMA model—encompassing positive emotions, engagement, relationships, meaning and achievement—has characterised wellbeing as their combination (Seligman, 2012, 2017). Recent meta-analysis (Carr et al., 2020) reported that a variety of positive psychological interventions consistent with PERMA theory have small to medium effects on wellbeing ($g = 0.39$) as well as related outcome measures including character strengths ($g = 0.46$), quality of life ($g = 0.48$), depression ($g = -0.39$), anxiety ($g = -0.62$), and stress ($g = -0.58$). Findings from the English Longitudinal Study of Ageing reported that individuals with higher levels of eudaimonic wellbeing display a three-fold higher rate of survival over an 8.5-year follow-up period (Steptoe et al., 2015). Optimism is associated with a 11–15% longer lifespan and greater odds for achieving “exceptional longevity” (Lee et al., 2019). Vagal function may play a mediating role in these longevity outcomes (Zulfiqar et al., 2010; Kemp et al., 2017a,b; Hernández-Vicente et al., 2020).

The association between mental and physical wellbeing ($r = 0.347$) (Ngamaba et al., 2017) does not depend on whether objective or subjective measures of health status are used, or differ across those with or without chronic conditions (Ngamaba et al., 2017). More than 80% of the vagal nerve fibres are afferents, conveying sensory information from the viscera to the central nervous system (Yamakawa et al., 2015), providing an important communication pathway for the beneficial effects of positive health behaviours to influence brain and behaviour. As the vagus nerve provides a structural link between mind and body (Kemp et al., 2017b), we suggest that interventions focused on building mental and physical wellbeing may facilitate the experience of wellbeing to a greater extent than focusing on one or the other separately. As well as mental and physical wellbeing, the functioning of the vagus nerve is also associated with social connectedness (Kok and Fredrickson, 2010; Porges, 2011; Kok et al., 2013), the topic that we turn to next.

THE COMMUNITY DOMAIN AND WELLBEING

There is much evidence to suggest that community is deteriorating (Kemp et al., 2017a), including generational shifts in narcissism (Twenge, 2013), declines in perspective taking and empathic concern (Konrath et al., 2011), increasing individualism (Santos et al., 2017) and inequality (Nolan and Valenzuela, 2019). Community is more than an aggregation of individuals, it is communicative and interactive, a dynamic process involving social interactions that support individual wellbeing (Brymer et al., 2020). Despite evidence of deterioration, humans are driven to connect with others, to feel a sense of attachment and belonging to the social group. This sense of relatedness with others is described as a basic psychological need (Baumeister and Leary, 1995; Deci and Ryan, 2000), and improvements in connectedness have been shown to improve public mental health (McNamara et al., 2013) year-on-year (Saeri et al., 2018). Individuals with stronger relationships have even been shown to have a 50% increased likelihood of survival over an average of 7.5 years follow-up (Holt-Lunstad et al., 2010). The theory of social wellbeing (Keyes, 1998, 2002; Westerhof and Keyes, 2010) is linked to the sense that society: is meaningful and understandable (social coherence); provides an opportunity for growth (social actualisation), is something that one belongs to and is accepted by (social acceptance and integration) and that one can meaningfully contribute to (social contribution). Accordingly, our focus extends beyond personal relationships, including concepts such as social capital, social cohesion and social identity. Social capital refers to connections between similar individuals (e.g., family and close friends; i.e., bonding social capital), people from diverse backgrounds (e.g., neighbours, members of sporting clubs, work colleagues; i.e., bridging social capital) and relationships characterised by power differences (e.g., the employee—employer relationship or that between citizen and government; i.e., linking social capital) (Putnam, 2000; Uphoff et al., 2013). Social capital protects against stress (Umberson and Montez, 2010) and is associated with positive emotions (Diener and Oishi, 2005) and wellbeing (Williams, 2006), especially in those with lower socioeconomic status (Uphoff et al., 2013). The related concept of social cohesion refers to the extent to which a geographical space achieves “community” through the sharing of values, cooperation and interaction (Beckley, 1995) Voluntary social participation promotes social cohesion in the community, creating a context for positive social relationships and eliciting feelings of belongingness and acceptance (De Vries et al., 2013; Elliott et al., 2014; Fonseca et al., 2018). Volunteering has been described as the “single most reliable way to momentarily increase ones well-being” (Seligman, 2012). Social identity theory provides a useful context for appreciating these effects on the wellbeing of individuals. Those who strongly identify with their community have display higher levels of wellbeing (McNamara et al., 2013). Social identity provides meaning and purpose to one's life, facilitating feelings that one can collectively cope with the challenges. This sense of community is fostered through

the promotion of social relational emotions, such as gratitude, compassion and awe, which may be linked to capacity for psychological connections to nature (Petersen et al., 2019), the topic that we turn to next.

THE ENVIRONMENT DOMAIN AND WELLBEING

Globalisation, urbanisation, and technological advancements has meant that humans have become increasingly disconnected from nature (Hartig et al., 2014; Chawla, 2015). This continues despite research showing that contact with nature improves wellbeing (Greenleaf et al., 2014; Capaldi et al., 2015; McMahan and Estes, 2015). Connection with nature contributes a small to medium effect to hedonic ($r = 0.20$) and eudaimonic ($r = 0.24$) wellbeing (Pritchard et al., 2019), and may reflect another fundamental psychological need (Richardson et al., 2020a). Researchers have even argued that one should consider spending up to 2 h per week in nature to experience wellbeing (White et al., 2019). Here in lies a conundrum: on the one hand, connection to the natural environment appears to be critically important for wellbeing, yet on the other, the impacts of climate change raises important ethical issues relating to focusing on the former, while ignoring the latter. It is interesting therefore to see emerging literature highlighting associations between nature connectedness and pro-environmental behaviours, in addition to wellbeing (Martin et al., 2020; Richardson et al., 2020b). Pro-environmental behaviours have been linked to psychological wellbeing (Verdugo, 2012) (Ganglmair-Wooliscroft and Wooliscroft, 2016; Venhoeven et al., 2016), positive emotion (O'Brien, 2008; Cloutier et al., 2014; Helliwell, 2017), and eudaimonic well-being (Venhoeven et al., 2013, 2016), social wellbeing (Prati et al., 2016) and community connectedness (Kweon et al., 1998). Furthermore, sustainability has been specifically linked to wellbeing, an idea that characterises the “positive psychology of sustainability” (Verdugo, 2012; Corral-Verdugo et al., 2015; Corral-Verdugo and Frías-Armenta, 2016), with researchers highlighting the positive psychological consequences of pro-ecological, altruistic, frugal and equitable behaviour (Corral-Verdugo et al., 2011, 2015). While our framework places the individual within the context of their social and natural ecologies, consistent with recent developments in wellbeing science (Lomas, 2015; Nielsen and Ma, 2018), there is also a need to consider factors that impact on wellbeing that lie well beyond the control of individuals. We turn our attention to such factors next.

SOCIO-CONTEXTUAL FACTORS AND WELLBEING

A wide range of socio-contextual factors either facilitate or restrict the experience of wellbeing. Epidemiological studies demonstrate an association between proximity to green spaces and reductions in all-cause mortality including circulatory disease, ischemic stroke and depression (Mitchell and Popham, 2008; Wilker et al., 2014; Helbich et al., 2018). Yet, the

advantages to health and wellbeing derived from proximity to green spaces are undermined by inequality with greater efforts needed to increase green space proximity for people of colour and lower income groups (Saporito and Casey, 2015). Inequality is perhaps one of the most discussed issues impacting on the wellbeing of populations. The most economically disadvantaged in society are disproportionately impacted by major societal challenges including increasing burden of chronic disease, societal loneliness and anthropogenic climate change (Cesare et al., 2013; Niedzwiedz et al., 2016; Otto et al., 2017). However, economic inequality also has adverse impacts on the entire population, contributing to multiple health and social problems, causally impacting on a variety of outcomes including educational attainment, obesity and homicide (Pickett and Wilkinson, 2015). Accordingly, improving economic inequality is fundamental to improving population wellbeing (Wilkinson and Pickett, 2010, 2019), and is a strategy featuring prominently in initiatives such as the Green New Deal (GND) (Galvin and Healy, 2020). Unlike narrow economic solutions, such as carbon taxes and emissions trading schemes, a GND would involve major societal and economic transformation driven by respect for human rights, social equity and societal wellbeing.

Culture is another important socio-contextual factor which has been shown to influence the way in which emotion and wellbeing is experienced and appraised (Diener and Suh, 2000; Ahuvia, 2002; Steptoe et al., 2007). While “individualistic” cultures prioritise positive emotions and personal wellbeing (Diener and Suh, 2000; Ahuvia, 2002; Steptoe et al., 2007), “collectivist” cultures place greater emphasis on emotional stability than on positive affect (Lu, 2001; Ng et al., 2003). Accordingly, wellbeing in individualistic cultures is more strongly associated with self-esteem and a sense of personal achievement, while wellbeing in collectivistic cultures is more strongly associated with avoiding social conflict and achieving interpersonal goals (Uchida and Oishi, 2016). Recent work has examined the impact of socio-contextual factors on vagal function (Kemp et al., 2016; Yang and Immordino-Yang, 2017) reporting that the vagus may support the capacity for emotional regulation associated with racial discrimination (Kemp et al., 2016) while other research has reported that healthy vagal functioning may predispose bicultural individuals to adopt a cultural identity that emphasises calmness (Yang and Immordino-Yang, 2017).

The discipline of psychology has focused mostly on western, educated, industrialised, rich and democratic (WEIRD) samples (Henrich et al., 2010), with as many as 78.2% of publications in positive psychology (up to 2018) associated with Western countries (Hendriks et al., 2018). While all people have fundamental needs including the need for happiness, meaning and self-determination, the expression and attainment of those universal values may be culture-bound (Wong, 2013). There is a growing appreciation for cultural differences in wellbeing, leading to new pluralistic measures (Lambert et al., 2020) that include a combination of hedonia, eudaimonia, social wellbeing, and the roles of culture, community, nature, and governance. We now turn our attention to the topic of how positive change might be sustained.

SUSTAINING POSITIVE CHANGE

There is an inherent disconnect between what people know and what they actually do; known as the intention-behaviour gap (Sheeran, 2002). This represents a major barrier to translating evidence surrounding well-being activities into sustained practice (Francis et al., 2012). Emotions act as an important mediator in the intention-behaviour gap and emotionally based interventions may increase the efficacy of behaviour change interventions (Mohiyeddini et al., 2009). According to the upward spiral model of lifestyle change (Cappellen et al., 2017), positive affect experienced during health behaviours increases non-conscious motives for those behaviours, while vagal nerve functioning provides a biological resource for positive change. A review of 100 behaviour change theories identified five overarching, interconnected themes relating to effective behavioural change strategies (Kwasnicka et al., 2016). Themes reflected the differential nature and role of motives, self-regulation, habits, psychological and physical resources, and environmental and social influences from initiation to maintenance. Subtle behavioural “nudging” has also been shown to successfully change behaviours at the societal level (Gill and Boylan, 2012; Marteau et al., 2012). However, nudging is underpinned by “libertarian paternalism,” which walks a fine line between upholding individual freedom and subliminal state manipulation of the “cognitively crippled.” An alternative approach involves “psychological boosting,” guided by a much more positive view of humanity described as “ecological rationality” in which non-rationality is viewed as an adaptive capacity to be valued (Gigerenzer, 2018; Hertwig et al., 2019; Fabian and Pykett, 2021). This approach develops capacity, empowerment and participation of individuals and may help in promoting societal and economic transformation through wellbeing public policy (Fabian and Pykett, 2021). Metrics such as the Happy Planet Index¹ now rank countries on the basis of a combination of wellbeing (life satisfaction), life expectancy, inequality of outcomes and ecological footprint, facilitating conversations, and driving actions to achieving sustainable development goals while promoting wellbeing of individuals as well as the communities and environments within which people live (Patrick et al., 2019). These metrics may help to facilitate a shift in focus from GDP to wellbeing as has been done in New Zealand, Iceland, Scotland, and Wales, the “so-called” economies of wellbeing (Fabian and Pykett, 2021).

DISCUSSION AND CONCLUSION

The framework we present emphasises core inter-related domains that span the individual, community and environment, encompassing major determinants of wellbeing. Our framework has also been inspired by and builds on recent developments (Kemp et al., 2017a; Kemp, 2019; Kern et al., 2019; Mead et al., 2019; Wong, 2019; Lomas et al., 2020), characterised as second and third wave positive psychology (Wong, 2019;

Lomas et al., 2020), which place importance on emotional balance, meaning and purpose, interconnectedness and interdisciplinarity. The framework presented here has already contributed to a better understanding of how to protect wellbeing during the COVID pandemic (Mead et al., 2020) and has led to the development of an innovative wellbeing science intervention, targeting a variety of populations including university students (Kemp et al., 2021) and people living with neurological disorders (Fisher et al., 2020), with a focus on acquired brain injury (Tulip et al., 2020; Wilkie et al., 2021).

By emphasising the inter-connectedness across domains and levels of scale, our framework encourages thinking about how to promote wellbeing while simultaneously ameliorating major societal challenges. Take for example, the challenge of climate change in which behavioural and lifestyle choices together with larger collaborative efforts will be essential for successful adaptation (IPCC, 2014). At an individual level, nature connection can be enhanced through nature-enhanced meditation (Ray et al., 2020), gardening (Blair et al., 1991; Okvat and Zautra, 2011), and physical exercise (Coon et al., 2011). At a community level, peaceful environmental activism (Klar and Kasser, 2009) and volunteering (Binder and Freytag, 2013; Binder and Blankenberg, 2016) offer ways to increase subjective wellbeing, community connectedness while promoting pro-environmental behaviours (Jackson, 2005; Okvat and Zautra, 2011; Ibáñez-Rueda et al., 2020). In the clinical setting “green care” interventions, such as care farming, horticultural therapy, wilderness therapy, ecotherapy, sustainable building etc., have been shown to improve wellbeing (Haubehofer et al., 2010; Whear et al., 2014; Wright and Wadsworth, 2014; Wendelboe-Nelson et al., 2019; Fisher et al., 2020; Tulip et al., 2020; Wilkie et al., 2021). Environmental modifications such as the commissioning of outdoor gym equipment (Cranney et al., 2016), provision of community gardens (Veitch et al., 2012), walking or bike trials and improved accessibility of parks or gardens (Fraser and Lock, 2011) have the potential to increase nature connectedness, pro-sustainable behaviours and positive health behaviours (diet and physical activity), contributing to improved population health and wellbeing (see (Shanahan et al., 2019) for a review). Corporate sustainability strategies have considerable scope to improve environmental outcomes, especially when employees are involved in the development of these strategies, while global initiatives such as the GND are needed to facilitate societal transformation (Boiral, 2005; Michailides and Lipsett, 2013). Finally, any initiatives must specifically consider socio-cultural values, which determine the way in which people use natural resources, the extent of their pro-environmental behaviours (Ringov and Zollo, 2007) as well as specific determinants of wellbeing (Diener and Suh, 2000; Ahuvia, 2002; Steptoe et al., 2007).

In conclusion, focusing on wellbeing across multiple domains at increasingly higher levels of scale offers underrealised potential to ameliorate social challenges, while also promoting wellbeing of individuals. The framework presented here may provide a foundation for thinking about how this might be achieved, while working towards a transdisciplinary science of wellbeing.

¹<http://happyplanetindex.org/>

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