

## ***Supplemental Data Sheet 2: APACS-Data Tables and Cut-offs***

### **A test for the Assessment of Pragmatic Abilities and Cognitive Substrates (APACS): Normative data and psychometric properties**

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### **Supplementary Tables 1. Descriptive Statistics of APACS results**

The tables report the means, standard deviations, median, minimum, maximum, kurtosis, skewness, first quartile, and third quartile for APACS scores in the normative data group of 119 participants, divided in four age and education groups.

#### **Supplementary Table 1.1. Descriptive statistics for the first age and education group**

N = 35 Age < 55; Education ≤ 13									
<b>Task or composite score</b>	<b>Mean</b>	<b>SD</b>	<b>Median</b>	<b>Min</b>	<b>Max</b>	<b>Kurtosis</b>	<b>Skewness</b>	<b>Q1</b>	<b>Q3</b>
<i>Interview</i>	43.46	1.20	44	39	44	5.10	-2.40	43.5	44
<i>Description</i>	47.57	1.27	48	43	48	5.53	-2.64	48	48
<i>Narratives</i>	53.40	1.90	54	46	56	4.52	-1.87	53	55
<i>Figurative Language 1</i>	14.77	0.55	15	13	15	3.76	-2.20	15	15
<i>Humor</i>	6.51	0.70	7	5	7	-0.30	-1.04	6	7
<i>Figurative Language 2</i>	27.69	3.32	28	16	30	4.04	-2.10	27.5	30
<i>Pragmatic Production</i>	0.99	0.02	1	0.94	1	0.56	-1.52	0.99	1
<i>Pragmatic Comprehension</i>	0.95	0.05	0.96	0.77	1	4.51	-2.05	0.93	0.98
<i>APACS Total</i>	0.97	0.03	0.97	0.86	1	4.42	-2.09	0.96	0.99

**Supplementary Table 1.2. Descriptive statistics for the second age and education group**

N = 30 Age < 55; Education > 13									
Task or composite score	Mean	SD	Median	Min	Max	Kurtosis	Skewness	Q1	Q3
<i>Interview</i>	43.8	0.55	44	42	44	4.91	-2.49	44	44
<i>Description</i>	47.4	1.4	48	44	48	1.64	-1.86	48	48
<i>Narratives</i>	54.1	2.22	55	48	56	1.43	-1.46	53.25	56
<i>Figurative Language 1</i>	14.9	0.31	15	14	15	4.58	-2.53	15	15
<i>Humor</i>	6.83	0.46	7	5	7	6.41	-2.64	7	7
<i>Figurative Language 2</i>	28.6	1.94	30	23	30	0.49	-1.23	28	30
<i>Pragmatic Production</i>	0.99	0.02	1	0.95	1	0.93	-1.55	0.99	1
<i>Pragmatic Comprehension</i>	0.97	0.03	0.98	0.92	1	-0.95	-0.67	0.96	0.99
<i>APACS Total</i>	0.98	0.02	0.99	0.95	1	-0.8	-0.8	0.97	1

**Supplementary Table 1.3. Descriptive statistics for the third age and education group**

N = 40 Age ≥ 55; Education ≤ 13									
Task or composite score	Mean	SD	Median	Min	Max	Kurtosis	Skewness	Q1	Q3
<i>Interview</i>	43.42	1.17	44	39	44	4.51	-2.23	43	44
<i>Description</i>	47.5	1.72	48	38	48	20.48	-4.4	48	48
<i>Narratives</i>	51.6	3.97	52.5	37	56	2.48	-1.4	49	55
<i>Figurative Language 1</i>	13.95	1.34	14	9	15	3.16	-1.72	13.75	15
<i>Humor</i>	5.85	1.48	6	0	7	4.14	-1.84	5	7
<i>Figurative Language 2</i>	25.52	3.4	26	16	30	0.4	-0.95	24	28
<i>Pragmatic Production</i>	0.99	0.02	1	0.9	1	6.46	-2.42	0.99	1
<i>Pragmatic Comprehension</i>	0.88	0.1	0.91	0.52	1	2.97	-1.66	0.87	0.95
<i>APACS Total</i>	0.94	0.06	0.95	0.71	1	5.31	-2.03	0.92	0.97

**Supplementary Table 1.4. Descriptive statistics for the fourth age and education group**

N = 14 Age ≥ 55; Education > 13									
Task or composite score	Mean	SD	Median	Min	Max	Kurtosis	Skewness	Q1	Q3
<i>Interview</i>	43.21	1.31	44	40	44	0.29	-1.31	43	44
<i>Description</i>	46.93	1.86	48	42	48	1.05	-1.50	46.25	48
<i>Narratives</i>	53.14	2.85	54	45	56	1.98	-1.52	52.25	55
<i>Figurative Language 1</i>	14.43	0.85	15	13	15	-1.16	-0.84	14	15
<i>Humor</i>	6.14	1.35	6.50	2	7	3.44	-1.98	6	7
<i>Figurative Language 2</i>	27.36	2.47	28	22	30	-0.40	-0.84	26.25	29
<i>Pragmatic Production</i>	0.98	0.03	0.98	0.9	1	1.83	-1.54	0.98	1
<i>Pragmatic Comprehension</i>	0.93	0.07	0.95	0.72	1	1.63	-1.48	0.9	0.97
<i>APACS Total</i>	0.95	0.05	0.96	0.81	1	2.43	-1.7	0.95	0.98

## Supplementary Tables 2. Thresholds for determining significant changes

The following tables allow to determine if a significant change occurred in APACS scores. A separate table is provided for each APACS task and composite score. The utilization of these tables assumes that two measurements from an individual (1<sup>st</sup> measurement and 2<sup>nd</sup> measurement) are available. To determine if a significant change occurred, first find the observed value at 1<sup>st</sup> measurement in the central row of the table (values in bold typeface). Then, check the column corresponding to this value in the table. The upper row reports the threshold for a significant improvement. The lower row reports the threshold for a significant worsening. If the observed score at second measurement *falls outside* these thresholds, then a significant change occurred. If the observed value falls within these thresholds (threshold values included), no change occurred. Specifically, it is estimated that at second measurement less than 5% of the population will exceed the upper thresholds and less than 5% of the population will fall below the lower thresholds.

The thresholds for significant change were determined by means of the method by Crawford & Garthwaite (2006). The range of values reported for each test is the range observed in the overall normative sample (119 participants). Gray cells indicate values extrapolated from the regressions used to define significant changes. Gray cell values are not actually observed in the smaller sample used to build the tables (19 participants) and they should be used with caution. In some cases the thresholds could not be calculated (for example if the predicted value exceeded the range of possible score values). In such cases a hyphen is reported.

If the tables cannot be used to test a specific change (for example if the observed score of a patient is not reported in the table), it is possible to build a new table by collecting data on a small control sample and applying the method (and accompanying software) by Crawford and Garthwaite (2006).

**Note 1)** In some cases the lower threshold at second measurement can be higher than the observed value at first measurement. This can happen if a practice effect is expected.

**Note 2)** The Test-Retest interval used to build these tables is 2 weeks. When used for Test-Retest intervals longer than two weeks, these tables might be over-corrected for practice effect.

**Supplementary Table 2.1. Thresholds for significant changes for the Interview task.**

<b>Interview</b>						
Upper Threshold (2 <sup>nd</sup> meas.)	42	42	43	43	44	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>39</b>	<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>
Lower Threshold (2 <sup>nd</sup> meas.)	39	40	41	42	43	43

**Supplementary Table 2.2. Thresholds for significant changes for the Description task.**

<b>Description</b>											
Upper Threshold (2 <sup>nd</sup> meas.)	39	40	41	42	43	44	45	47	-	-	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>38</b>	<b>39</b>	<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>
Lower Threshold (2 <sup>nd</sup> meas.)	34	35	36	38	39	40	41	43	44	45	46

**Supplementary Table 2.3. Thresholds for significant changes for the Narratives task.** No Upper threshold is available as a consequence of the test-retest reliability calculated from the sample (n=19).

<b>Narratives</b>											
Upper Threshold (2 <sup>nd</sup> meas.)	-	-	-	-	-	-	-	-	-	-	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>37</b>	<b>39</b>	<b>41</b>	<b>43</b>	<b>45</b>	<b>47</b>	<b>49</b>	<b>51</b>	<b>53</b>	<b>55</b>	<b>56</b>
Lower Threshold (2 <sup>nd</sup> meas.)	48	49	49	50	51	52	52	53	53	53	53

**Supplementary Table 2.4. Thresholds for significant changes for the Figurative Language 1 task.**

<b>Figurative Language 1</b>							
Upper Threshold (2 <sup>nd</sup> meas.)	12	12	13	14	14	-	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Lower Threshold (2 <sup>nd</sup> meas.)	11	12	12	13	14	14	15

**Supplementary Table 2.5. Thresholds for significant changes for the Humor task.**

<b>Humor</b>								
Upper Threshold (2 <sup>nd</sup> meas.)	4	5	5	5	6	6	-	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Lower Threshold (2 <sup>nd</sup> meas.)	-	1	2	3	4	5	5	6

**Supplementary Table 2.6. Thresholds for significant changes for the Figurative Language 2 task.**

Figurative Language 2															
Upper Threshold (2 <sup>nd</sup> meas.)	18	19	20	21	22	23	23	24	25	26	27	28	29	-	-
Observed value (1 <sup>st</sup> meas.)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Lower Threshold (2 <sup>nd</sup> meas.)	10	12	13	14	16	17	18	20	21	22	24	25	26	27	28

**Supplementary Table 2.7. Thresholds for significant changes for the Pragmatic Production score.**

<b>Pragmatic Production</b>												
Upper Threshold (2 <sup>nd</sup> meas.)	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	-	-	-	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>0.9</b>	<b>0.91</b>	<b>0.92</b>	<b>0.93</b>	<b>0.94</b>	<b>0.95</b>	<b>0.96</b>	<b>0.97</b>	<b>0.98</b>	<b>0.99</b>	<b>1</b>	
Lower Threshold (2 <sup>nd</sup> meas.)	0.87	0.88	0.89	0.9	0.91	0.93	0.94	0.95	0.96	0.97	0.98	

**Supplementary Table 2.8. Thresholds for significant changes for the Pragmatic Comprehension score.**

<b>Pragmatic Comprehension</b>											
Upper Threshold (2 <sup>nd</sup> meas.)	0.74	0.76	0.79	0.82	0.84	0.87	0.9	0.93	0.96	0.99	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>0.5</b>	<b>0.55</b>	<b>0.6</b>	<b>0.65</b>	<b>0.7</b>	<b>0.75</b>	<b>0.8</b>	<b>0.85</b>	<b>0.9</b>	<b>0.95</b>	<b>1</b>
Lower Threshold (2 <sup>nd</sup> meas.)	0.53	0.58	0.63	0.67	0.72	0.76	0.81	0.85	0.89	0.93	0.96

**Supplementary Table 2.9. Thresholds for significant changes for the APACS Total score.**

<b>APACS Total</b>							
Upper Threshold (2 <sup>nd</sup> meas.)	0.82	0.85	0.88	0.91	0.94	0.97	-
<b>Observed value (1<sup>st</sup> meas.)</b>	<b>0.7</b>	<b>0.75</b>	<b>0.8</b>	<b>0.85</b>	<b>0.9</b>	<b>0.95</b>	<b>1</b>
Lower Threshold (2 <sup>nd</sup> meas.)	0.73	0.77	0.82	0.86	0.9	0.94	0.98

## Supplementary Tables 3. APACS cut-offs

The following tables report cut-offs for all APACS scores. A separate table is provided for each task and APACS composite score. The cut-offs were calculated with the method by Crawford and Garthwaite (2006), using regression analyses taking into account age, education and gender<sup>1</sup>. Since no effect of gender was found, tables are not split for gender. The tables report the cut-offs for different age and education combinations. An observed value *below* the cut-off indicates an impaired performance. Specifically, it is estimated that less than 5% of the population will obtain a score below the cut-offs reported in the tables.

**Supplementary Table 3.1. Cut-offs for the Interview Task.**

Interview – cut-offs													
Education	Age												
	20	25	30	35	40	45	50	55	60	65	70	75	80
5	42	42	42	42	42	42	42	42	42	42	41	41	41
8	42	42	42	42	42	42	42	42	42	42	41	41	41
13	42	42	42	42	42	42	42	42	42	42	41	41	41
18	42	42	42	42	42	42	42	42	42	42	41	41	41
23	42	42	42	42	42	42	42	42	42	42	41	41	41

**Supplementary Table 3.2. Cut-offs for the Description Task.**

Description – cut-offs													
Education	Age												
	20	25	30	35	40	45	50	55	60	65	70	75	80
5	45	45	45	45	45	45	45	45	45	45	45	45	45
8	45	45	45	45	45	45	45	45	45	45	45	45	45
13	45	45	45	45	45	45	45	45	45	45	45	45	45
18	45	45	45	45	45	45	45	45	45	45	45	45	45
23	45	45	45	45	45	45	45	45	45	45	45	45	45

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<sup>1</sup> Cut-offs for Description were calculated with the method by Crawford & Howell (1998b). Since no demographic variable was significant in the regression analysis, there is just a single cut-off for all combinations of age and education.

**Supplementary Table 3.3. Cut-offs for the Narratives Task.****Narratives – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	45	45	45	45	45	45	45	45	45	45	45	45	45
8	47	47	47	47	47	47	47	47	47	47	47	47	47
13	49	49	49	49	49	49	49	49	49	49	49	49	49
18	49	49	49	49	49	49	49	49	49	49	49	49	49
23	48	48	48	48	48	48	48	48	48	48	48	48	48

**Supplementary Table 3.4. Cut-offs for the Figurative Language 1 Task.****Figurative Language 1 – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	13	13	13	13	13	13	13	12	12	12	12	12	12
8	13	13	13	13	13	13	13	13	13	12	12	12	12
13	13	13	13	13	13	13	13	13	13	13	13	13	13
18	14	14	14	14	13	13	13	13	13	13	13	13	13
23	14	14	14	14	14	14	14	13	13	13	13	13	13

**Supplementary Table 3.5. Cut-offs for the Humor Task.****Humor – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	4	4	4	4	4	4	4	4	4	3	3	3	3
8	4	4	5	5	5	5	5	4	4	4	4	4	3
13	5	5	5	5	5	5	5	5	5	5	5	4	4
18	5	5	5	5	5	5	5	5	5	5	5	4	4
23	5	5	5	5	5	5	5	5	4	4	4	4	4

**Supplementary Table 3.6. Cut-offs for the Figurative Language 2 Task.****Figurative Language 2 – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	22	22	22	22	21	21	21	20	20	20	20	19	19
8	23	23	22	22	22	22	21	21	21	21	20	20	20
13	24	24	24	23	23	23	22	22	22	22	21	21	21
18	25	25	25	24	24	24	24	23	23	23	22	22	22
23	26	26	26	25	25	25	25	24	24	24	23	23	23

**Supplementary Table 3.7. Cut-offs for the Pragmatic production score.****Pragmatic Production – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95
8	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95
13	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95
18	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95
23	0.96	0.96	0.96	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95

**Supplementary Table 3.8. Cut-offs for the Pragmatic comprehension score.****Pragmatic comprehension – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	0.76	0.76	0.76	0.76	0.76	0.75	0.75	0.74	0.73	0.72	0.71	0.69	0.67
8	0.81	0.81	0.81	0.81	0.81	0.81	0.8	0.79	0.78	0.77	0.76	0.74	0.73
13	0.86	0.87	0.87	0.87	0.87	0.86	0.86	0.85	0.84	0.83	0.81	0.8	0.78
18	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.86	0.85	0.84	0.82	0.81	0.79
23	0.84	0.85	0.85	0.85	0.85	0.84	0.84	0.83	0.82	0.81	0.79	0.78	0.76

**Supplementary Table 3.9. Cut-offs for the APACS total score.****APACS Total – cut-offs****Age**

<b>Education</b>	20	25	30	35	40	45	50	55	60	65	70	75	80
5	0.87	0.87	0.87	0.87	0.87	0.86	0.86	0.85	0.85	0.84	0.83	0.83	0.82
8	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.88	0.88	0.87	0.86	0.85	0.84
13	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.9	0.9	0.89	0.88	0.87
18	0.92	0.92	0.93	0.92	0.92	0.92	0.92	0.91	0.91	0.9	0.89	0.88	0.87
23	0.9	0.9	0.91	0.9	0.9	0.9	0.9	0.89	0.89	0.88	0.87	0.86	0.85