Thank you

Co-author on this project
- Andrew T. Jebb

Friendly reviewers
- Lauren Kuykendall
- Vincent Ng
- James LeBreton
Continuum Specification: Outline

• Importance of Constructs and Continuum
• Potential Issues with Neglecting Construct Continuum
• Continuum Specification
  – Definition
  – Operationalization
  – Response Process
• Conclusion
• Areas for Future Research
Continuum Specification: Outline

• Importance of Constructs and Continuum
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• Areas for Future Research
• Constructs are core building blocks for organizational science

• Constructs and construct validity evidence is heavily emphasized (Bagozzi, Yi, & Phillips, 1991; Binning & Barrett, 1989; Clark & Watson, 1995; Cronbach & Meehl, 1955; Messick, 1995, 1999)

• Think about all the procedures that we use to assess and validate our constructs
  – Hinkin’s work on Scale Development
    • A review of scale development practices in the study of organizations (1995): >1900
    • A brief tutorial on the development of measures for use in survey questionnaires (1998): >1750
  – CFA, Reliability, Alpha
Many constructs themselves are defined by a continuum—Varying magnitudes of the attribute (e.g., the low, moderate, and high).

This continuum is the basis of psychological scaling, as described by Thurstone (1928) “we may frankly represent this linearity in the form of a unidimensional scale” (p. 538).

Despite importance, we do not explicitly think about the construct continuum—Influences all phases of construct validation, from developing operational measures to the accumulation of validity evidence.
Importance of Continuum

Constructs, Construct Validation, Continuum

- Example 1: Tests of curvilinearity

*Do measures capture the full range of the phenomenon?*
Importance of Continuum

Constructs, Construct Validation, Continuum

- Example 2: Seeking to understand bipolarity between constructs
Importance of Continuum

Constructs, Construct Validation, Continuum

• Example 2: Seeking to understand bipolarity between constructs

_Do constructs overlap conceptually?_
Example 3: Validation of new constructs

**Positive Psychology / Positive Organizational Scholarship**

*Bright and Dark Traits*
Importance of Continuum
Application to potential substantive questions

• **Social psychology**: Are happiness and sadness bipolar or bivariate (Diener, 1999; Greenwald, 2012)?

• **Vocational psychology**: Are realistic and social interests contrary to each other or span a single continuum (Tay, Su, & Rounds, 2011)?

• **Organizational psychology**: Are counterproductive work behaviors the opposite of organizational citizenship behaviors (Dalal, 2005)?

• **Clinical/Positive psychology**: Are positive traits distinct from established personality traits (Haslam, Bain, & Neal, 2004)? Are abnormal or maladaptive traits extremes of normal traits (Samuel & Widiger, 2008)?
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Psychological scaling was closely tied to psychophysical scaling that used “just noticeable differences” between stimuli along a continuum to identify units of measurement (Coombs, 1951; Thurstone, 1927)
Neglect of the Construct Continuum

- Cumbersome scaling techniques (Thurstone, 1928)
  - 100 items from various regions of the continuum
  - 300 raters to sort the items
  - Calculation of agreement indices among raters
  - Elimination of ambiguous items
  - Obtain a final set of twenty evenly spread along continuum
Neglect of the Construct Continuum

Construct Continuum

- Likert-type scaling (1932): Use item response options to (subjectively) scale the continuum
Neglect of the Construct Continuum

Construct Continuum

• Due to Likert-type scaling, we no longer explicitly consider the construct continuum in our definitions and operationalizations of constructs...

• But is this a good thing?
Neglect of the Construct Continuum

Construct Continuum

• Undefined (or under-defined) lower regions or poles
  – *Construct definition:* identify the target attribute and how it manifests in behavior (Podsakoff, Mackenzie, & Podsakoff, 2016)

  – Most definitions focus on *defining the presence or high end* but not focusing on circumscribing the lower end... there is asymmetry in defining the construct
Neglect of the Construct Continuum

Construct Continuum

- Undefined (or under-defined) lower regions or poles
  - Perfectionism: “setting of excessively high standards for performance accompanied by overly critical self-evaluations” (Frost et al., 1993)
  - What does a lower score mean? Consequential validity: “value implications of score interpretation...as well as the actual and potential consequences of test use” (Messick, 1995)
Neglect of the Construct Continuum

Reverse-worded items

- Reverse worded items are usually included to prevent acquiescence or response biases (Cronbach, 1950)

- To what extent are reverse-worded items conceptually part of the construct we are interested in?

- Example: Rosenberg Global Self-Esteem scale (GSE; 1986), which consists of both positively- and negatively-worded statements
Neglect of the Construct Continuum

Construct Continuum

• Distinctions and dimensions among constructs
  
  – Are constructs distinct from each other or part of a broader continuum?

\[
\begin{align*}
\text{N(0,1)} & \\
100,000 \text{ simulees} & \\
61 \text{ items} & \\
\end{align*}
\]

Low-High \( r = .28 \)

Moderate-High \( r = .65 \)
Neglect of the Construct Continuum

Construct Continuum

• Distinctions and dimensions among constructs
  
  – Are constructs distinct from each other or part of a broader continuum?
  
  – Important as we seek integrative nomological networks among constructs for incremental theory building
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Continuum Specification

Definition

- Continuum specification: “Explicit definition and operationalization of the construct continuum”

- Strategic and integral part of construct validity and construct validation

- Useful for enhancing our understanding of construct redundancy and construct discrimination
  - Whether two semantically opposing constructs are bipolar opposites
  - Whether a measure comprises extreme trait values that would exhibit curvilinear effects on outcomes
  - Building and validating measures of extreme traits (e.g., toxic personality traits; virtuous characteristics)
Continuum Specification

Components

- Continuum definition
  - Operationalization
    - Indicator Choice
      - Validity evidence (e.g., dimensional analysis, incremental validity)
    - Response Format
  - Item Response Process
Continuum Specification

Components

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Construct polarity: Bipolar, Unipolar, Mixed
Continuum Specification

Mixed Construct Poles

Tay, Su, & Rounds (2011)

Illustrative Correlation Matrices That Produce the Same Multidimensional Scaling Configurations

<table>
<thead>
<tr>
<th>Interest</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation pattern 1: Bivariate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Realistic</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Investigative</td>
<td>.75</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Artistic</td>
<td>.50</td>
<td>.75</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Social</td>
<td>.00</td>
<td>.50</td>
<td>.75</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Enterprising</td>
<td>.50</td>
<td>.00</td>
<td>.50</td>
<td>.75</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>6. Conventional</td>
<td>.75</td>
<td>.50</td>
<td>.00</td>
<td>.50</td>
<td>.75</td>
<td>—</td>
</tr>
</tbody>
</table>

| Correlation pattern 2: Bipolar |
| 1. Realistic      | —    |      |      |      |      |      |
| 2. Investigative  | .00  | —    |      |      |      |      |
| 3. Artistic       | −.50 | .00  | —    |      |      |      |
| 4. Social         | −1.00| −.50 | .00  | —    |      |      |
| 5. Enterprising   | −.50 | −1.00| −.50 | .00  | —    |      |
| 6. Conventional   | .00  | −.50 | −1.00| −.50 | .00  | —    |
### Continuum Specification

**Mixed Construct Poles**

Tay, Su, & Rounds (2011)

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![Hexagon with dimensions labeled: Conventional, Investigative, People-Things, Artistic, Data-Ideas, Social.]

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<td></td>
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<tr>
<td>4. Social</td>
<td>.16</td>
<td>.27</td>
<td>.38</td>
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<td>.16</td>
<td>.30</td>
<td>.49</td>
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<td>.27</td>
<td>.21</td>
<td>.08</td>
<td>.31</td>
<td>.52</td>
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Meta-analytic matrix ($N = 1,008,253$)
Continuum Specification

Mixed Construct Poles

Tay, Su, & Rounds (2011)
Continuum Specification

**Components**

- Construct polarity: Bipolar, Unipolar, Mixed
- Construct gradation
- Subpopulation

**Continuum definition**

- Operationalization
  - Indicator Choice
  - Response Format
    - Validity evidence (e.g., dimensional analysis, incremental validity)
      - Item Response Process
• Apart from specifying the polarity of the construct ...

• What do the *gradations along the continuum* represent? Or – what is the nature of the continuum?

• Three current proposals ...
  – *Intensity*
  – *Frequencies*
  – *Duration*
Continuum Specification

Components

- Continuum definition
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- Reverse-worded items
- Unipolar vs. bipolar response formats
Continuum Specification

Response Formats

Russell & Carroll (1999)

Sad

Happy
Continuum Specification

Response Formats

• *Choice of numbers for response options* (Schwarz et al., 1991)

1  2  3  4  5  6  7  8  9

-4 -3 -2 -1  0  1  2  3  4
Continuum Specification

Components

Continuum definition

Operationalization

Indicator Choice

Response Format

Validity evidence (e.g., dimensional analysis, incremental validity)

Item Response Process

Construct polarity: Bipolar, Unipolar, Mixed

Construct gradation

Subpopulation

Reverse-worded items

Unipolar vs. bipolar response formats

How people respond to scale items
Continuum Specification

Item Response Process

Maximal Performance Behaviors

- What is $7 \times 24$?
- Lift a 30 pound weight

Self-reported Typical Behaviors

- I felt happy over the past 7 days
- I am a happy person
## Continuum Specification

### Item Response Process

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### Trait

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Continuum Specification

Item Response Process

Maximal Performance Behaviors

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<tr>
<td>Response Process</td>
<td>-Psychological or physical strain</td>
<td>-Perceived correspondence</td>
</tr>
<tr>
<td></td>
<td>-Hurdle Algorithm</td>
<td>-Matching Algorithm</td>
</tr>
</tbody>
</table>
Continuum Specification

Distinctions in measurement models

- Thurstone (1927a, 1927b, 1928, 1945); Coombs (1964)
  - Two different methods for measuring different classes of behaviors

- Maximal performance behaviors: Dominance models (e.g., Factor Analysis) which follows a hurdle algorithm

- Self-reported typical behaviors: Ideal point models which follows a matching algorithm
  - Attitudes (Thurstone, 1928)
  - Personality (Stark et al, 2006)
  - Vocational Interests (Tay et al, 2009)
  - Affect/Emotions (Tay, 2011)
Continuum Specification

Components

- Construct polarity: Bipolar, Unipolar, Mixed
- Construct gradation
- Subpopulation

- Reverse-worded items
- Unipolar vs. bipolar response formats

Validity evidence (e.g., dimensional analysis, incremental validity)

- Item Response Process

- How people respond to scale items
“Bipolarity says that when you are happy, you are not sad and that when you are sad, you are not happy” – Russell & Carroll (1999, p. 25)

Evidence against bipolarity:

- Individuals **coendorse both happiness and sadness**
- **Two factors are recovered in factor analysis**

These are **artifacts of how individual respond to scale items as self-reported behaviors** (i.e., item response process):

Continuum Specification

Item Response Process

'Most co-endorsements'

'Very Slightly or Not at All Happy'

'Moderately Happy'

'Extremely Happy'

Least co-endorsements
Mutual Exclusion
• When considering the item response process
  – We rethink our assumptions that bipolarity requires mutual exclusion

  “Bipolarity says that when you are happy, you are not sad and that when you are sad, you are not happy” – Russell & Carroll (1999, p. 25)
IMPLICATIONS

• Validity evidence and Dimensionality assessment
IMPLICATIONS

- Need to develop new measurement models
N(0,1)
100,000 simulees
61 items

Low-High r = .28

Moderate-High r = .65
Continuum Specification

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Continuum definition

Operationalization

- Indicator Choice
- Response Format

Validity evidence (e.g., dimensional analysis, incremental validity)

Item Response Process

How people respond to scale items
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Conclusion

• Methodology is not merely a tool but a way of thinking ...

• Greenwald (2012) “There is nothing so theoretical as a good method”

• Through the procedures of continuum specification, we are able to give rigorous definitions of the constructs themselves
  – More accurate operationalizations
  – More accurate tests of construct relations ... or at least the start of being aware and need more research on this issue...
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Future Research

• Require development of guidelines to help researchers theoretically establish the polarity and gradation of constructs

• Methodological research and procedures to develop ways for assessing part-whole relationships

• Dimensionality analyses for ideal point response processes as we seek to assess bipolar constructs (or even unipolar constructs)
Thank you