The Measurement of Engagement in Later Life: Integrating Rasch measurement and Guttman Facet Theory

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Traditional Personal Engagement Definition

According to Kahn (1990):

• Personal engagement **represents** "the simultaneous employment and **expression** of a **person's 'preferred self'** in ways that promote deep connections to one's work (whatever form that might take, paid or unpaid) and to other people.

• Such engagement **leads** to **active, full, and satisfying involvements** rather than obligatory, passive, or emotionally anemic ones.

•We **become** personally engaged when we find that it is **meaningful and safe** to express our full selves and when we are **psychologically ready** to do so.

Matz-Costa Definition of Productive Engagement

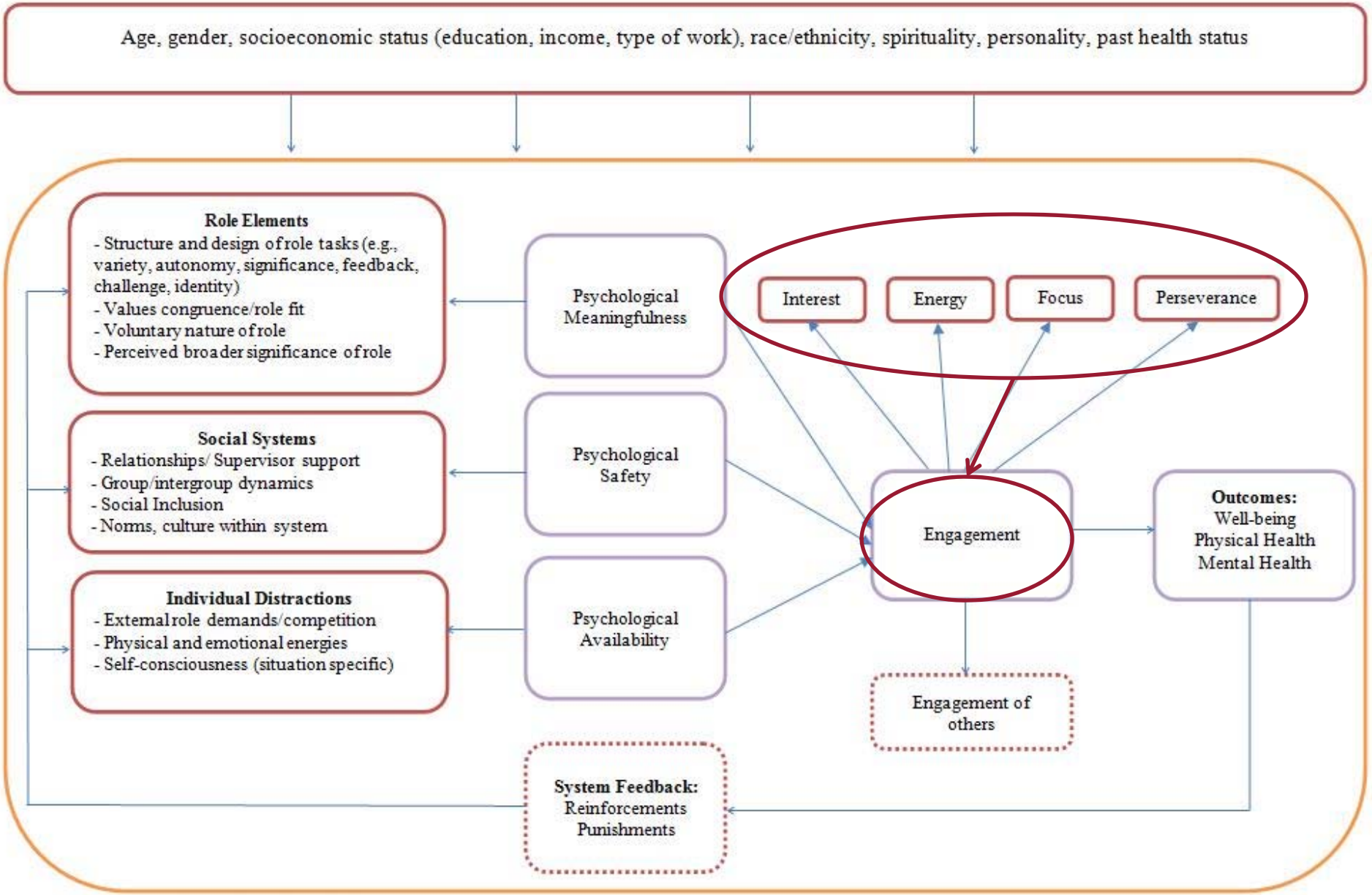
•A **positive**, **enthusiastic**, and affective connection with a role that both **motivates** individuals to invest their valuable resources and simultaneously **energizes** them.

•Operationalized as **persistence, energy, focus**, and **interest** experienced while enacting a role.

Assumptions:

1. **Highly correlated** characteristics.
2. They range from **lower to higher** levels.
3. They define a common, or **invariant,** construct that cuts across different **adult roles**.

Conceptual Model (Matz-Costa et al, 2014)



Purple = Latent constructs

Productive Engagement in Later Life

Paid Employment	Caregiving
Currently working for pay	Currently involved in helping a friend or relative age 18 or older who has trouble taking care of themselves : physical or mental illness, disability, or for some other reason

Volunteering	Informal Helping
Did volunteer work in the last 4 weeks for any of the following: a religious organization; school or educational organization; political group or labor union; senior citizen organization; a national or local organization, including United Fund, hospitals, and the like.	Provided unpaid help in the last 4 weeks to someone who does not reside with them (excluding ill/disabled), including: providing transportation or run errands; helping with housework or car work; providing childcare.

How can we measure engagement?

Classical Test Theory(CTT)

- "**Traditional**" approach since 1904
- Based on notion of "**true score**"

  X = T + E
- Emphasis is on use of "**total score X**"—items are highly correlated "replications"
- Typical procedures are Cronbach alpha, test-retest reliability, factor analysis (SEM)
- Simple summed items, often using Likert scoring—SA to SD, right/wrong, T/F

Item Response Theory (IRT)

- "**Modern**" approach since 1970's
- Based on probability notion of "**expected response**" for a person to an item
- Emphasis on meaning and interpretation of **individual items**—broad range of content covering the construct
- Many **different** statistical models for determining "expected responses"
- A particularly powerful model for item/scale development is the **Rasch measurement model**.

Rasch Measurement Principles

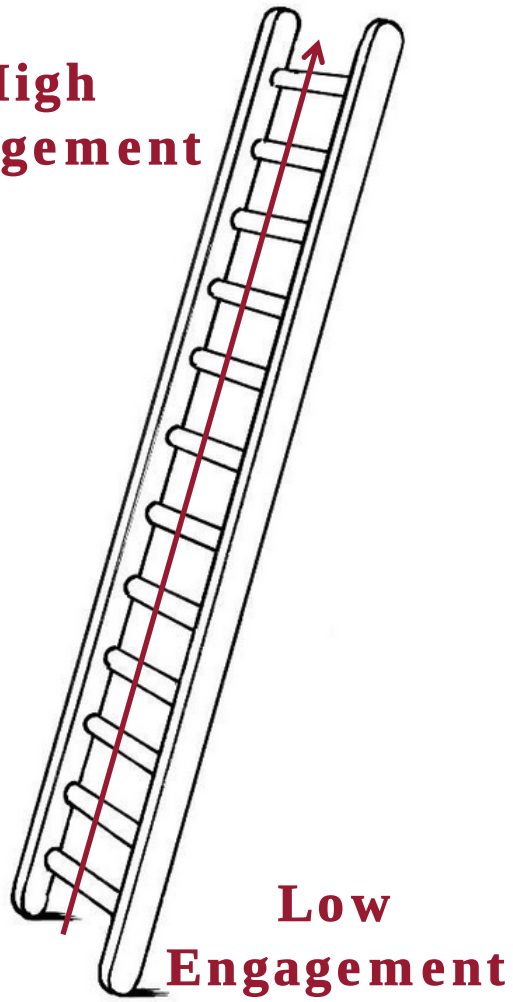
When measuring a construct, items should define a construct with these characteristics:

Variation: wide range of beliefs, attitudes, opinions, abilities to cover upper and lower levels of the construct.

Unidimensional: address a single, common attribute defining the construct.

Hierarchical: difficulty progression from "easier-to-harder" to endorse/accomplish/pass/achieve items or tasks.

Continuum: form a uniform continuum of difficulty across this hierarchical, unidimensional variation.



Ludlow LH, Matz-Costa C, Johnson C, Brown M, Besen E, & James JB (2014). Measuring engagement in later life activities: Rasch-based scenario scales for work, caregiving, informal helping, and volunteering. *Measurement and Evaluation in Counseling and Development*. 47(2), 127-149.

Facet Theory (L Guttman)

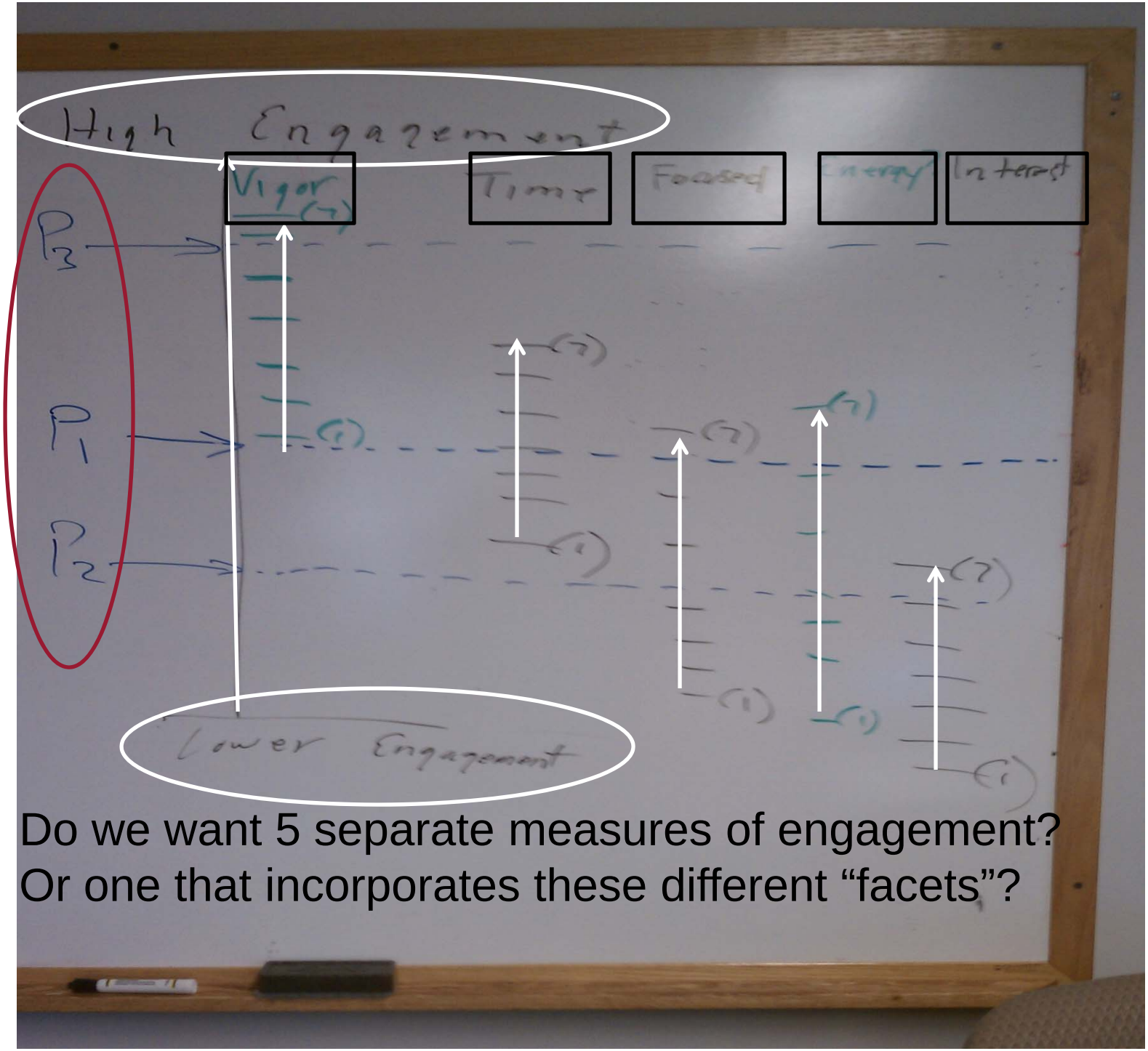
Methodological approach to **reveal** how we form beliefs, attitudes, **perceptions** such as "engagement".

Understanding what the perception/**construct** means then leads to **ways to measure** it.

Each such perception/construct/**variable** is based on many influences: factors, dimensions, indicators, or components.

- Each of these influences is called a "**facet**".
- Each facet is made up of different levels/**elements**.

How do we combine the **Rasch** principles with **Guttman's FT** for measurement of the construct?



Do we want 5 separate measures of engagement?
Or one that incorporates these different "facets"?

Sentence mapping: facets to items/scenarios

- A visual, grammatical device to link the elements of the facets.
- All possible combinations of one element from each facet are formed.
- We have 4 facets, each with 3 levels for a total of 3 x 3 x 3 x 3 = 81 combinations
  - These combinations of facet elements yield sentences (items).
  - These sentences become **scenarios**.

Choosing/constructing Scenarios (a)

All 81 combinations are impractical, how do you choose?

- Randomly select from the 81 combinations of I_i,F_i,E_i,P_i.
- **Extreme groups contrast** procedure (B Bloom).

We chose the following scenario combinations ("proof-of-concept")

3 primarily from **extreme positive** (I3, F3, E3, P3),
3 primarily from **extreme negative** (I1, F1, E1, P1),
3 primarily from **middle** (I2, F2, E2, P2).

Construction had overlap in levels, such as 3,3,3,3, then 3,2,3,3 and 2,2,2,1 and 1,1,1,1 etc but no obvious "impossibles"—3,1,3,1.

Constructing Scenarios (b)

Our "exemplar" sentence map template

Level	Interest	Focus	Energy	Perseverance
3	(fascinated)	(difficult to tear away)	(gets energized)	(gives all)
2	(somewhat	(pays attention)	(some energy)	(keeps at it)
1	(does not care)	(completely checked out)	(does not invest)	(almost always gives up)

1. Exemplar words/phrases were initially chosen
    a. Each scenario was written as two sentences with the same presentation ordering of the facets.
    b. Each scenario across all roles uses the same element-level language
    - This maintains construct consistency.
2. Synonyms of each were constructed
    a. Each scenario within a role uses a unique word/phrase for its elements.
    - This avoids any form of element "biasing" redundancy.

How did we think about the "level/difficulty" of the scenarios?

Level	Interest	Level	Focus	Level	Energy	Level	Perseverance	Person	total
3	Identifies strongly	3	Difficult tear self away	3	Gets Energized	3	Gives All	Anan (9)	12
3	Fascinated	3	Intensely focused	3	Invests much energy	2	Persists when difficulties arise	Melissa (7)	11
3	Enthusiastic	2	Pretty focused	3	Goes above and beyond	2	Deals with challenges	Tina (1)	10
2	Interested	2	Mind wanders occasionally but pays attention	2	Does what it takes	2	Handles difficulties	Clair (6)	8
2	Somewhat interested	2	Generally focuses	2	Does what is required	2	Keeps at it when difficulties arise	Stan (2)	8
2-1	Indifferent	1	Often thinks other things	2	Little desire do more than required	2	Forces self keep going when difficult	Elyssa (4)	7
1	Tired of work	1	Thinks about other things	2	Does not invest much energy	1	Does not go out of way when difficulties arise	Jackie (8)	5
1	Unenthusiastic	1	Usually thinking about other things	1	Does not go out of way	1	Gives up when any effort required	Larry (5)	4
1	Does not care	1	Completely checked out	1	Does not invest any energy	1	Almost always gives up when any effort required	Jaime (3)	4

This "**total**" defined our "***a priori***" expected ordering for the scenarios for all the engagement roles

Scenarios (using Work as the "Role")

What response format?

On a typical day , are you…
- o **Much more engaged than X**
- o **More engaged than X**
- o **About as engaged as X**
- o **Less engaged than X**
- o **Much less engaged than X**

"comparative engagement scenario task"

9) Anan **identifies strongly** with his work (in a positive way) and sometimes gets so wrapped up in what he is doing that it is **difficult to tear himself away**. He **gives all** of himself to his work and finds that he **gets energized** from doing so.

7) Melissa is **fascinated by** her work and is usually **intensely focused** on whatever she's working on. She is willing to **invest much energy** in order to do a good job and she **persists** when difficulties arise.

1) Tina feels **enthusiastic** about her work and is **pretty focused** on the task at hand. She **goes above and beyond** what is required and when challenges arise, she **deals with them**.

6) Clair is **interested** in her work and **pays attention** to whatever she's working on. She **does what it takes** and handles difficulties when they arise, though her **mind wanders** occasionally.

2) Stan is **somewhat interested** in his work and **generally focuses** on whatever he's working on. He **does what is required** and **keeps at it** when difficulties arise.

4) Elyssa feels **indifferent** about her work and often **thinks about other** things. She has **little desire** to do more than is required and has to **force herself** to keep going when things get difficult.

8) Jackie is **tired** of her work and usually thinks about how much she would **rather be doing something else**. She does **not invest** much energy in what she does and **doesn't go out of her way** when difficulties arise.

5) Larry feels **unenthusiastic** about his work and is usually thinking about **other things**. He **does not** go out of his way to get tasks done and tends to **give up** when any effort is required.

3) Jamie **does not care** about his work and is **completely checked out**. He **does not invest** any energy at all in what he does and **almost always gives up** when effort is required.

The Rasch Rating Scale Model

$$\pi_{nix} = \frac{e^{\sum_{j=0}^{x_{ni}} [\beta_n - (\delta_i + \tau_j)]}}{\sum_{k=0}^{m} e^{\sum_{j=0}^{k} [\beta_n - (\delta_i + \tau_j)]}}$$

From the probabilities for each possible response, we get the "expected response" for a person to a scenario.

π_{nix}, is the probability of person *n* on scenario *i* responding in category *x*;

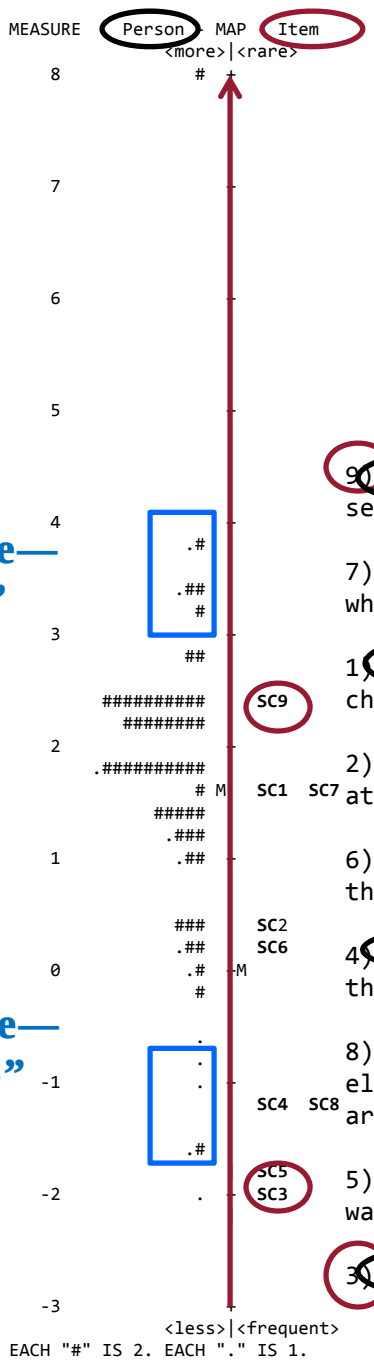
β_n is the parameter for an individual's "level of engagement",

δ_i is the location (scenario "difficulty") of scenario *i* on the engagement variable (how "hard" it is to say "much more engaged than X"), and

τ_j is the location ("threshold" parameter) of the k^{th} transition from one response category to the next for the *m*+1 rating categories.

"Variable Map"

Work



Higher level of engagement

High scoring people—many "much more"

Low scoring people—fewer "much more"

Lower level of engagement

Harder scenarios—fewer "much more"

9) Identifies strongly with "X"…gets so wrapped up it is difficult to tear self away…gives all of self to and gets energized from doing so.

7) Fascinated and intensely focused…willing to invest much energy…persists when difficulties arise.

1) Enthusiastic and pretty focused…goes above and beyond and deals with challenges

2) Somewhat interested and generally focused…does what is required and keeps at it when difficulties arise.

6) Interested and pays attention…does what it takes and handles difficulties, though mind wanders occasionally.

4) Feels indifferent and thinks about other things…little desire to do more than is required…forces self to keep going when things difficult.

8) Tired and usually thinks about how much rather be doing something else…does not invest much energy and doesn't go out of way when difficulties arise.

5) Unenthusiastic and usually thinking about other things…does not go out of way…gives up when effort is required.

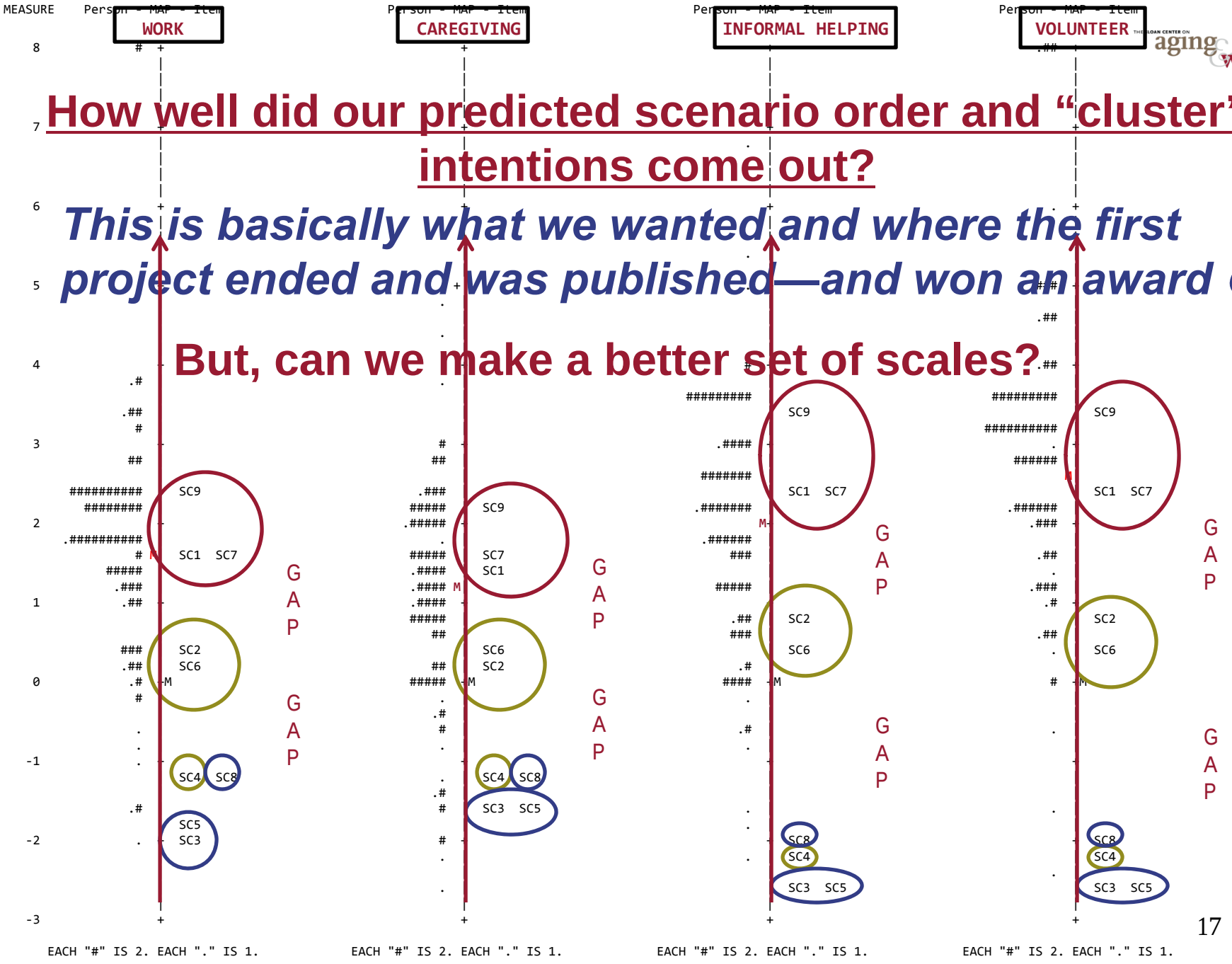
3) Does not care…completely checked out…does not invest any energy…gives up

Easier scenarios—many "much more"

How well did our predicted scenario order and "cluster" intentions come out?

This is basically what we wanted and where the first project ended and was published—and won an award ☺

But, can we make a better set of scales?



Revision Plan

Objectives:

1. Remove gaps in scenario distributions through slight "tweaks" to scenario difficulties.
2. Extend construct definition range of hardest and easiest scenarios.
3. Create "practice" scenario—remove "start-up" effect.

Process:

1. Extensive facet element re-wording discussions.
2. Three sets of scenario revisions, 3 Amazon MTurk samples, and 3 Rasch analyses for confirmations of changes.
3. Full scale Qualtrics sampling design and final Rasch confirmation analysis.

Revision examples (1)

Based on the sentence mapping template:

To make PESC9 **harder** (but still a 12—a slightly stronger emphasis), the Interest element went from ***identifies strongly*** to ***fascinated***, Focus from ***sometimes gets so wrapped up*** to ***gets so absorbed***, Energy from ***gets energized*** to ***gets energized by giving all***, Perseverance from ***gives all*** to ***readily embraces challenges***.

We were, however, unsure about the intended stronger effect of ***fascinated*** in PESC9 so an **alternative** PESC9 was constructed with the Interest element changed from ***fascinated*** to ***inspired*** while everything else remained the same.

Revision examples (2)

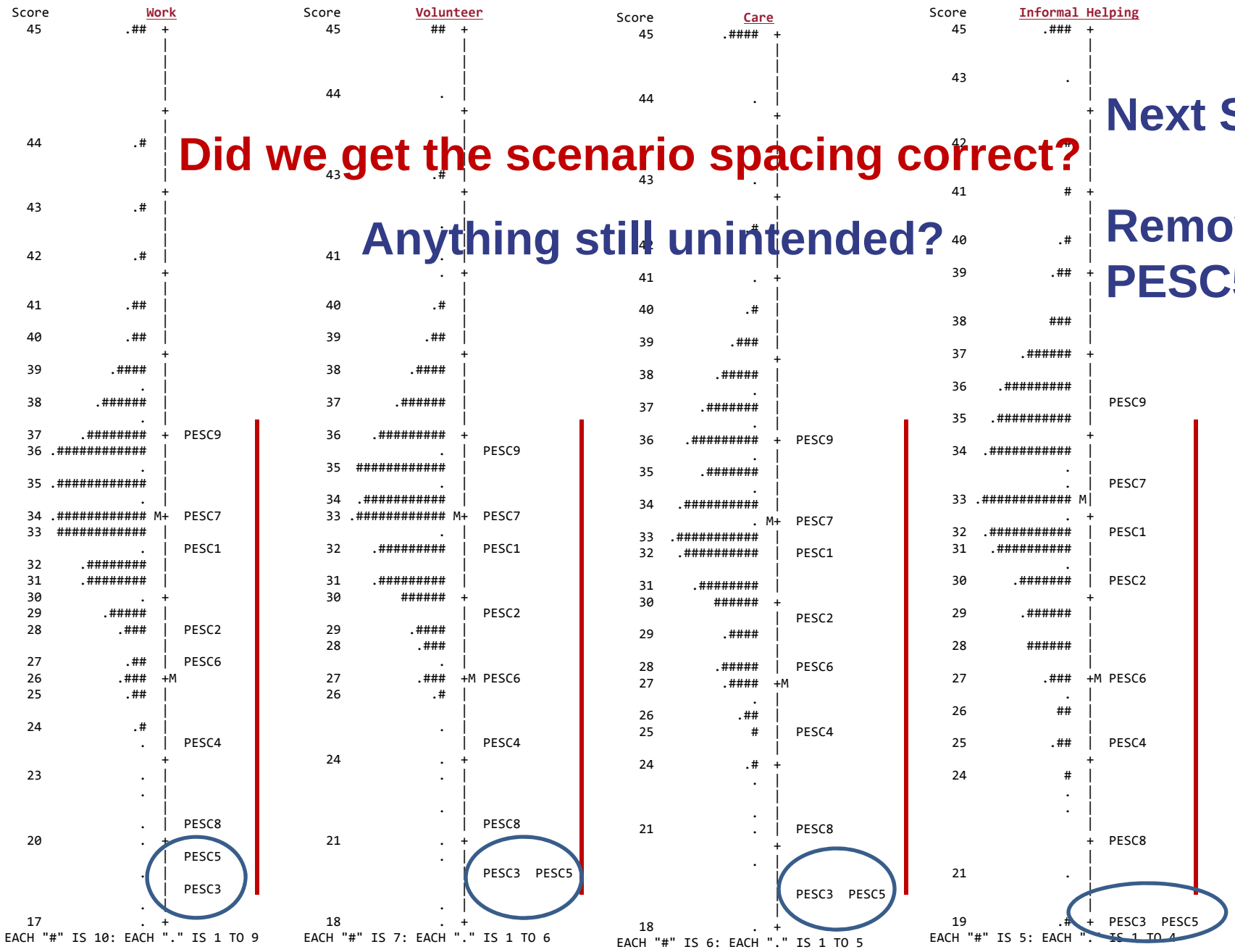
To make PESC2 **harder** (from 8 to 9), the Interest level went from ***somewhat interested*** (2) to ***very interested*** (3).

To make PESC3 **easier** (but still a 4—a slightly easier emphasis),
Interest went from ***does not care about*** to ***not interested in***,
Focus from ***completely checked out*** to ***becomes easily distracted***,
Perseverance from ***almost always gives up*** to ***always gives up***.

To remove the "**start-up effect**" found in the original research, a new scenario was written as the first item. It was written at the moderate level of "8". The practice item for work is:

> *Tom is somewhat interested in his work and tries to maintain focus on whatever he's doing. He does what is required and generally keeps going when problems occur.*

Result of Revised PEP-Scenarios for Four Roles



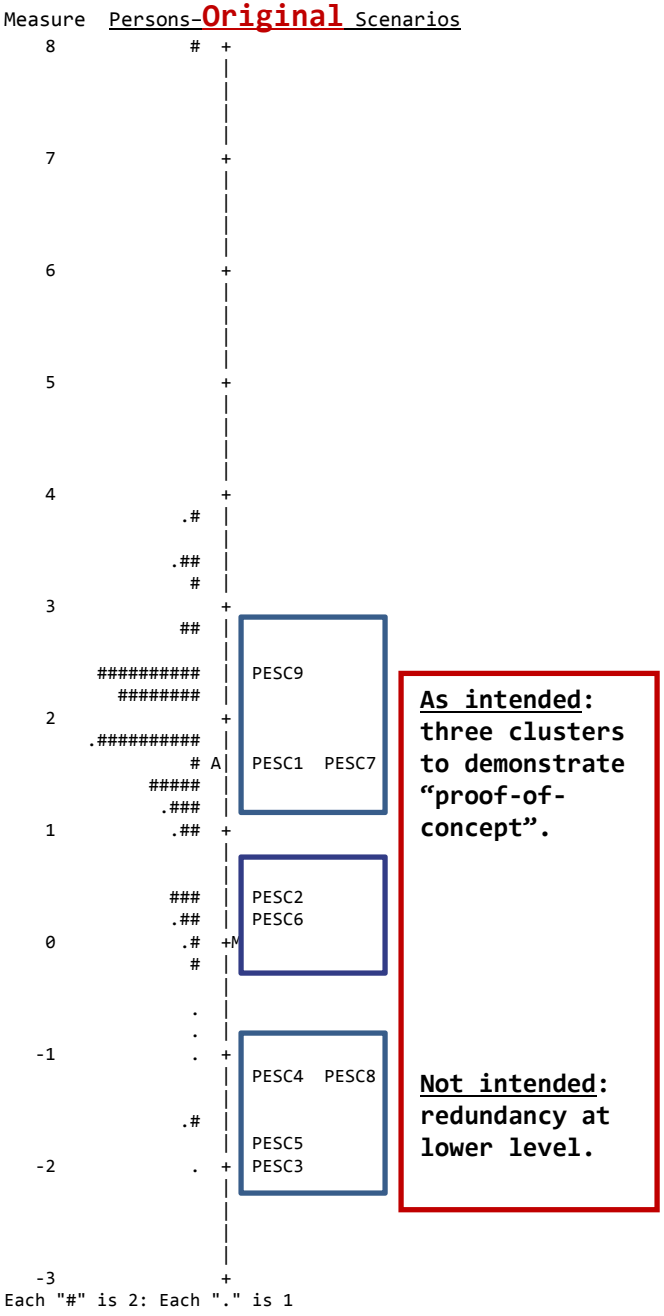
Did we get the scenario spacing correct?

Anything still unintended?

Next Step?

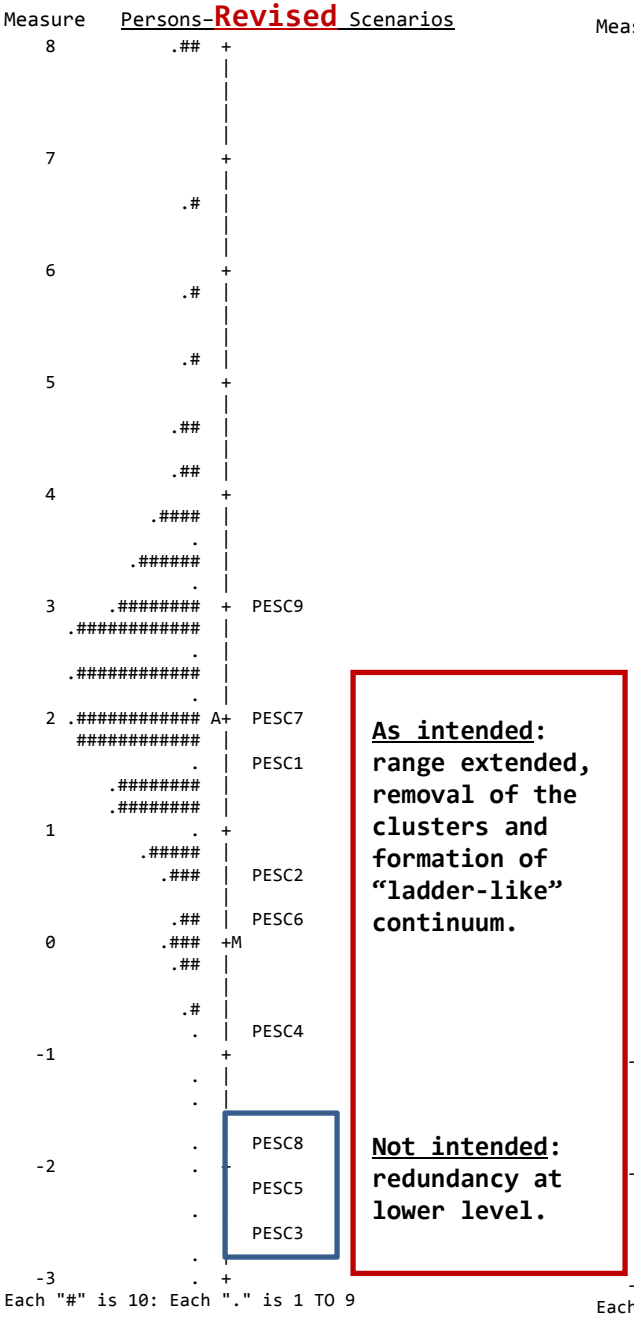
Remove PESC5.

Summary of the PEP Revision Process and Results



As intended: three clusters to demonstrate "proof-of-concept".

Not intended: redundancy at lower level.



As intended: range extended, removal of the clusters and formation of "ladder-like" continuum.

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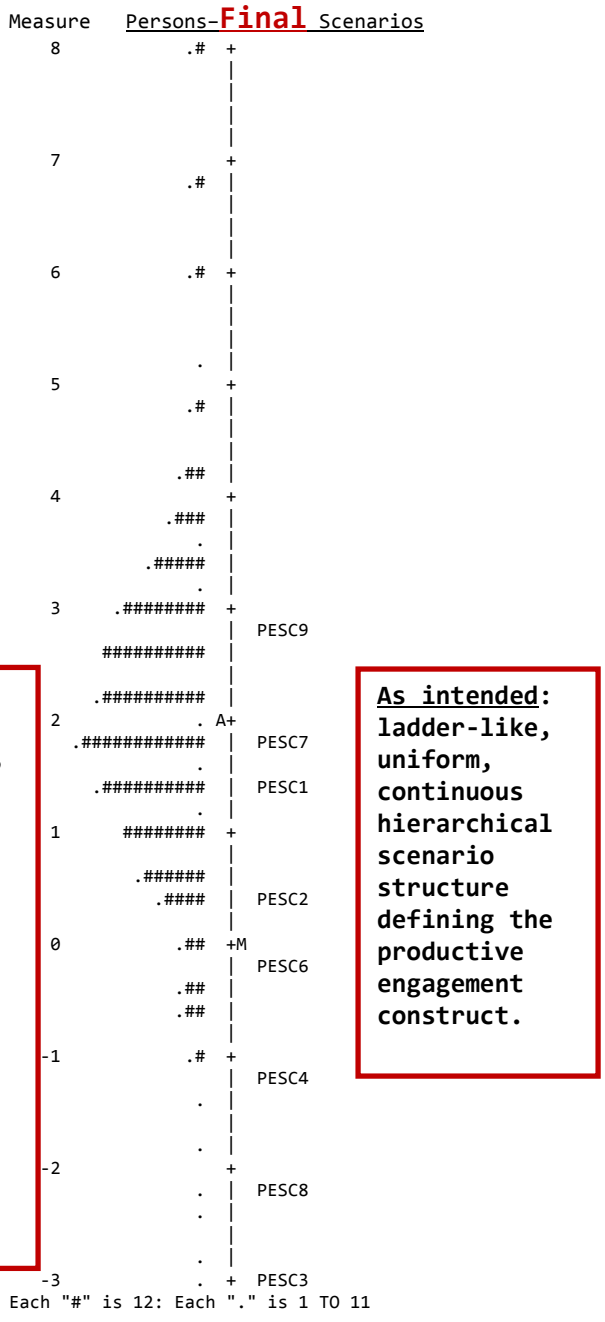

As intended: ladder-like, uniform, continuous hierarchical scenario structure defining the productive engagement construct.

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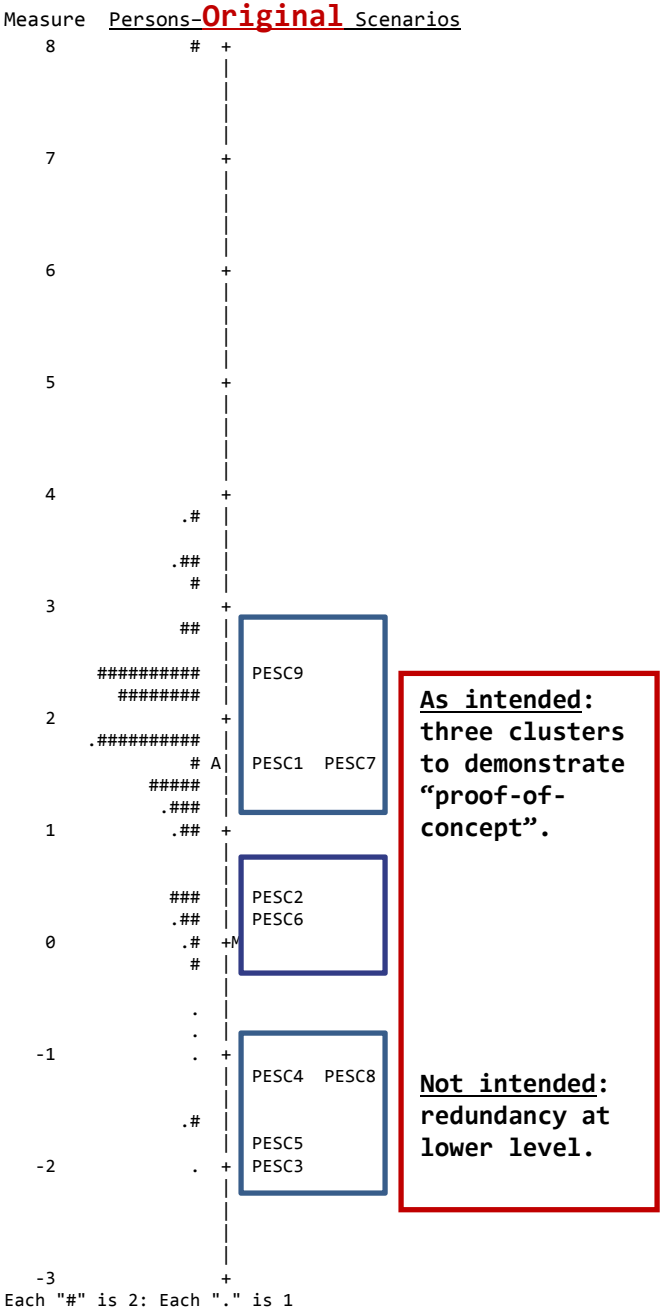

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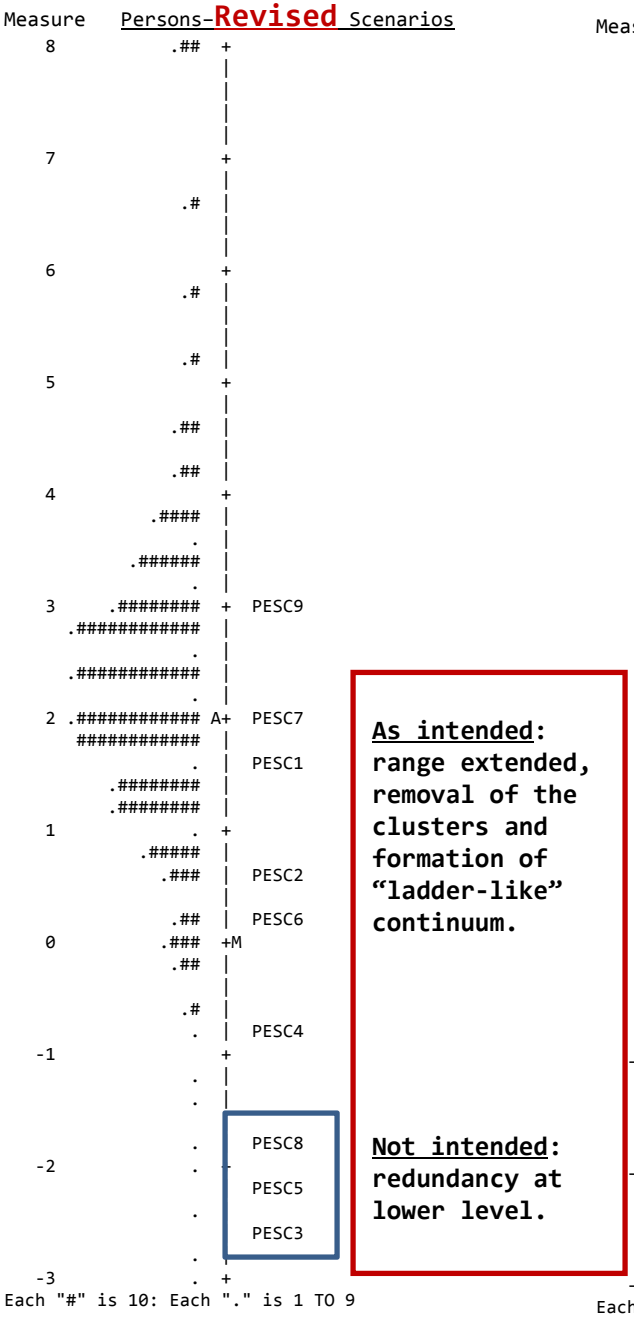

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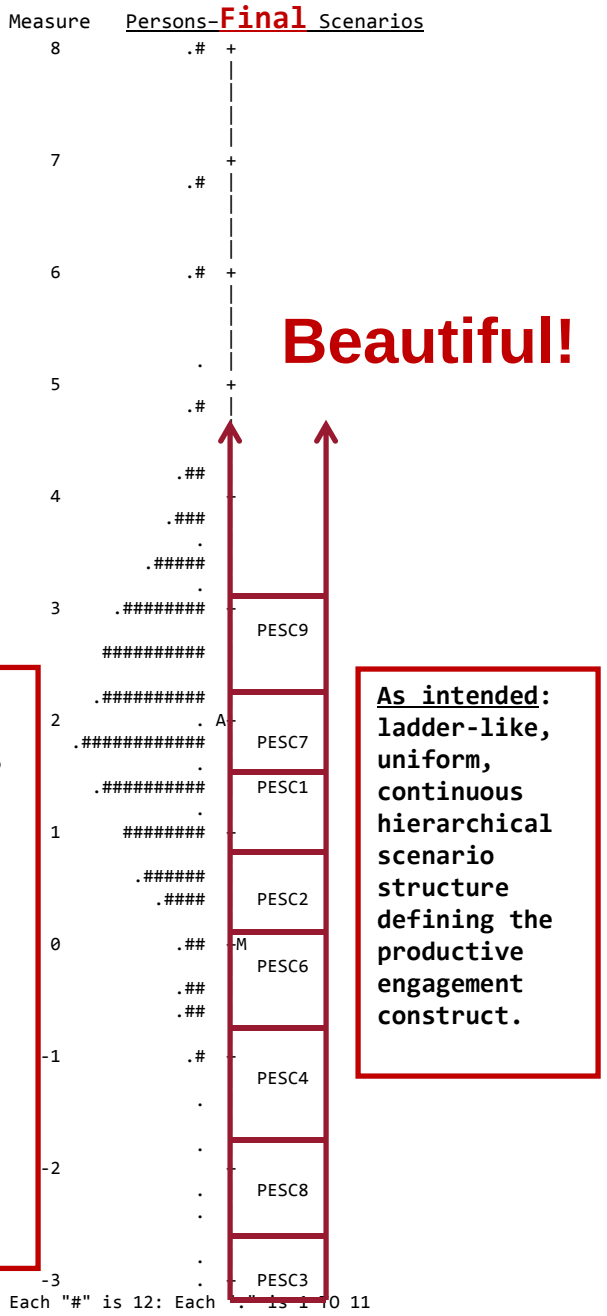
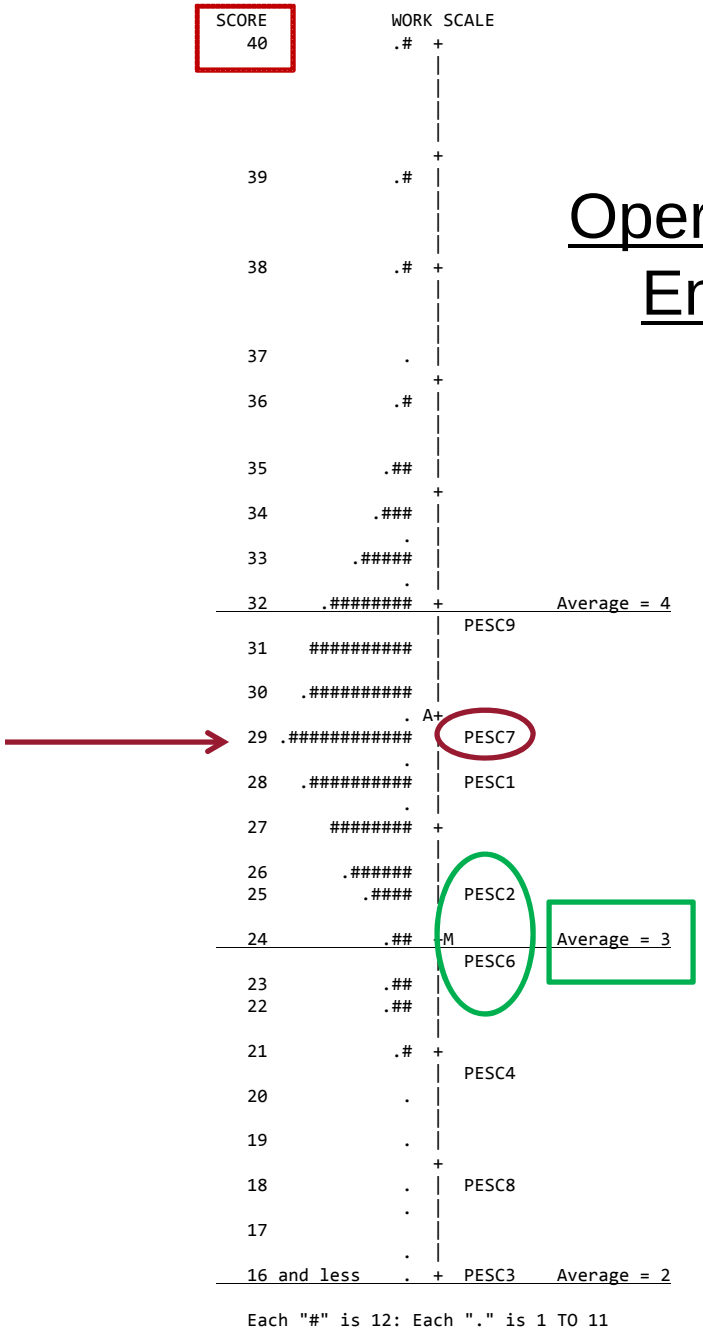


Beautiful!

As intended: ladder-like, uniform, continuous hierarchical scenario structure defining the productive engagement construct.



Operational Definition of Revised **Work** Engagement: What does it mean?

9.Inspired by work, gets so absorbed it is difficult to tear self away. Gets energized by giving all, readily embraces challenges.

7.Enthusiastic about work, intensely focused. Invests great deal of energy, persists when difficulties arise.

1.Really interested in work, pretty focused. Does more than required, when challenges arise they are dealt with.

2.Very interested in work, generally focused. Does what is required, keeps at it when difficulties arise.

6.Interested in work, pays attention though mind wanders occasionally. Does what it takes, handles difficulties.

4.Moderately interested in work, often thinks about other things. Some desire to do more than required, forces self to keep going.

8.Somewhat interested in work, doesn't pay much attention. Invests some energy, doesn’t go out of way.

3.No interest in work, does not focus. Does not invest any energy, always gives up.

More Precise Detailed Score Interpretation

Scenario Score	Engagement Level	Description of score	Scenario
40	Extremely highly engaged	You are "much more engaged than" every scenario presented.	
32-39	Very highly engaged	On average, you are "more engaged than" scenario 9 and "much more engaged than" the scenarios below this section.	9) Inspired by work … so absorbed it is difficult to tear self away … gets energized ….readily embraces challenges
28-31	Highly engaged	On average, you are "about as engaged as" or "more engaged than" scenarios 7 and 1, "more engaged than" or "much more engaged than" the scenarios below this section, but "less engaged than" the scenarios above this section.	7) Enthusiastic… intensely focused… invests great energy … persists when difficulties arise. 1) Really interested … pretty focused … does more than required … deals with challenges.
24-27	Moderately engaged	On average, you are "about as engaged as" scenario 2, "more engaged than" the scenarios below this section, but "less engaged than" the scenarios above this section.	2) Very interested … generally focused… does what is required … keeps at it.
20-23	Low engaged	On average, you are "about as engaged as" scenarios 6 and 4, "more engaged than" the scenarios below this section, but "less engaged than" the scenarios above this section.	6) Interested … pays attention … does what it takes … handles difficulties. 4) Moderately interested … thinks about other things … some desire to do more … forces self to keep going.
16-19	Extremely low engaged	On average, you are "about as engaged as" scenarios 8 and 3 "less engaged as" or "much less engaged than" almost every scenario.	8) Somewhat interested… doesn't pay much attention … invests some energy … doesn't go out of way. 3) No interest…does not focus…does not invest any energy…always gives up.
<16	Not engaged or disengaged	You are "much less engaged than" every scenario presented.	

Highlights

FT and sentence mapping process:

a. Targeted revision of facet elements
b. Iterative re-sampling for testing revisions
c. Testing of alternatively worded elements within same scenarios
d. Creation of “start-up” scenario at mid-level difficulty

Advantageous results:

a. Defensible construct definition of “productive engagement”
b. Orderly progression of engagement measurement along a continuum within each role
c. Practical raw score interpretation for immediate use
d. Invariance in meaning of “productive engagement” across roles
e. Removal of novelty “start-up” effect

References

Ludlow, LH, Matz-Costa C & Klein K (under review). Enhancement and Validation of the Productive Engagement Portfolio-Scenario (PEP-S) Scales.

Ludlow LH, Matz-Costa C, Johnson C, Brown M, Besen E, & James JB (2014). Measuring engagement in later life activities: Rasch-based scenario scales for work, caregiving, informal helping, and volunteering. *Measurement and Evaluation in Counseling and Development*. 47(2), 127-149.

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