Content Validation of Patient-Rated Outcome measures using the Item Perspective Classification (IPC) Framework

User Guide v3.1

Available: https://sites.google.com/site/ipcframework/

ICF linking rules inside!

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Foreword

Content validity is “the degree to which elements of an assessment instrument are relevant to, and representative of, the targeted construct for a particular assessment purpose” (Haynes, Richard, & Kubany, 1995). In the field of clinical measurement, content validity has often been superficially addressed both during development and validation of measures. Methods for generating items contained in Patient Reported Outcome Measures (PROs) are sparsely described for most PROs, but often involve selecting items from existing measures, and/or generating new ones commonly based on interviewing patients/clinicians. This content is then operationalized into an item that undergoes field testing. The details of the field testing process and how it retains content validity are often neglected when reporting on the development of the new measure. For that reason it is often unclear what philosophy/conceptual framework, rationale or structure guided the content aspect of the item reduction phase of instrument development. Typically, item reduction reporting focuses on statistical considerations. Better assessment and reporting of content validity would enhance the development and validation of PROs.

Regardless of how content validity is built into PRO development in the future, it is clear that many existing measures have undergone limited structured assessment of their content validity. Many PROs have titles or named subscales that imply the construct being assessed, but have not undergone a rigorous process to describe the content; or assessed the match between items and the target construct. Expert review is often used to assess content validity and focuses on a method of inquiry that asks experts to evaluate whether the items reflect the scope and nature of the construct that is meant to be evaluated. Advances in cognitive interviewing (Beatty, 2011; Ojanen V, 2006; Willis, 1999) and consensus methodologies (Fink, Kosecoff, Chassin, & Brook, 1984; Jones & Hunter, 1995) have provided tools to increase the rigor of assessment of content validity; but remain infrequently reported in PRO development or validation publications.

As an instrument developer/evaluator I have also been guilty of insufficient description and analysis of content validity when I developed or evaluated measures. In part, this has been due to a lack of processes for rigorous description or analysis of content. Certainly, the traditions in clinical measurement analyses have influenced this behavior. Therefore, I welcome advancements in how we approach content validity in development, description, and analysis of item content.

A substantial development in our approach to analyzing the content of PRO has been the developments within The International Classification of Functioning Disability and Health (ICF) to provide a common language for health and disability. In particular, the development of linking rules to code the content of items has provided a mechanism for more structured description of the content of PROs (Cieza et al., 2002; Cieza et al., 2005). Our understanding of the content of PROs has been greatly advanced using linking methodology (Fayed, Cieza, & Bickenbach, 2011). Clinical measurement

studies have used linking to compare item content/emphasis between different PROs; or to compare PRO content to qualitative information about the construct derived directly from patients. Doing so has provided a greater appreciation for the variability in content between different PROs, even when designed for the same condition. ICF linking provides a method for defining item content; but is not able to deal with other aspects of item description.

I have been fortunate to be involved in the development and refinement of a classification system initiated by Derek Rosa that evaluates the content of PRO items from a different perspective. This classification system focuses on the nature of the appraisal performed by the PRO respondent. The system first evaluates whether a rational or emotional response is required to the item. So at the outset that even the simplest level of classification it focuses on a perspective that is distinct from that provided by ICF. Another important contribution of his classification system is that it allows us to classify the interaction between different elements of content that are not specifically considered with ICF linking. Through the iterations of developing and field testing this classification system we have gained an appreciation for how it complements ICF linking and have provided suggestions for how these could be combined. The IPC system described in this User Guide is different from, but complementary to the ICF and together they provide a means for attaining detailed descriptions of item content. This should provide developers, clinical measurement scientists and measure users with a more descriptive, rigorous, repeatable way of clarifying item/measure content. As such, it advances the field on content validation.

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Preface

The inspiration of the Item Perspective Classification (IPC) framework was derived from the need to have a universal reference framework for classifying and comparing the content of patient rated outcome measures (PROs). The foundation of the framework was derived from philosophical literature by Pirsig (1974, 1975) & McWatt (2005). These authors propose an evolutionary theory that describes how individuals appraise 'value' or 'quality' in life. The IPC framework applies theoretical principles in a way that helps us to understand the perspective of patients when responding to questions that pertain to their health and well-being.

The IPC framework organizes fundamental cognitive tasks that are completed when individuals produce 'appraisals of concepts that are amenable to evaluation'. This is relevant because PROs typically elicit appraisals of concepts that are amenable to a patient's evaluation (i.e. most PROS are considered to be 'questionnaires'). The IPC framework can be used for any patient-rated assessment whether self-reported, or interview-based; and is used to classify the following fundamental qualities of questionnaire items including:

i) The type of *appraisal* elicited
ii) Concept domains utilized
iii) Nature & existence of *relationships* that occur among 2 or more concepts

'*Item Perspective*' is the umbrella term used to describe the data generated from classifying items using the IPC framework. The extent to which item perspective varies among items, scales and questionnaires may be of interest to investigators who seek to validate the content of PROs. This User Guide presents a method for systematically classifying the perspective of item content; and proposes a way to utilize 'item perspective' in conjunction with an established method of determining content validity using the International Classification of Functioning, Disease and Health (ICF) framework.

Table of Contents

Introduction

Patient rated outcome (PRO) measures are designed to identify clinically-important problems that are difficult or impossible to detect using biometric assessments (Aaronson & Snyder, 2008; Doward & McKenna, 2004; Valderas & Alonso, 2008). PRO data are most often collected using standardized questionnaire formats that allow for systematic investigation of a patient's perspective with respect to aspects of their health & well-being (Rothrock, Kaiser, & Cella, 2011). PROs can be used for diagnostic purposes, monitoring, decision making, or simply to facilitate communication between patients and clinicians (Greenhalgh, 2009).

Clinically-important *constructs* that are quantified by PRO measures include:

• Quality of life • Health-related quality of life • Physical function • Social function
• Patient satisfaction • Pain • Depression • Anxiety • Self-efficacy

The task of selecting the 'best' PRO measure among a pool of candidate questionnaires can be difficult for many reasons including:

i) Literature may suggest that a group of candidate questionnaires appear to perform equally well, making it difficult to select one over another on the basis of comparative clinical measurement properties (Coons, Rao, Keininger, & Hays, 2000). Clinical measurement property analyses typically do not deal directly with content. Scales with disimilar content may posess similar measurement properties.

ii) A group of candidate questionnaires may have little published data about how they perform; and the context & scope of evaluations can vary across available studies. Thus, intra & inter-questionnaire comparisons may be difficult or impossible to make based on review of their published clinical measurement properties.

iii) The questionnaire determined to have the '*best*' clinical measurement properties may not perform equally well across contexts; and thus the applicability to a specific context or may be limited. That is, questionnaires may perform differently depending on the match between the content and the context in which it is administered.

Although content validity of questionnaires has been addressed to a limited extent in the validation of many measures, most clinical research or outcome evaluation does not specifically provide a rationale for the match between the content of questionnaires and a particular context. Without appropriately structured analysis of content it can be difficult to compare questionnaires on the basis of relevance to context. From a 'generic' perspective when selecting an outcome measure for a patient or group of patients one might begin with asking oneself the following question:

"*Based on a theory about the construct I want to measure, to what extent is the content presented by items relevant for my needs?*"

Answering this question ascertains content validity – an under-reported clinical measurement attribute that is important for determining the applicability of a questionnaire (Cieza & Stucki, 2005; Rothman et al., 2009). Threats to content validity occur when words, concepts or items do not adequately reflect a construct of interest for any of the following reasons:

- They are not relevant to the construct of interest
- They are variably defined/perceived
- They are not transferable across different subjects, contexts, or cultures
- There is a mismatch between questions & responses
- They exclude important content
- They present grammatical errors, complex language or unclear terminology

Methods for detecting threats to content validity can be divided into '*field*' and '*bench*' methods (Table 1):

Table 1. Overview of content validation methods

Field	Bench
Cognitive Interviews Investigators instruct respondents to think out loud as they complete questionnaires in order to detect conceptual or linguistic problems (Willis, 1999). Results are analyzed using prespecified methods.	'**ICF**' - *International Classification of functioning, Disability & Health* Investigators identify important concepts in questionnaires and subsequently classify them using descriptive alphanumeric codes (Cieza et al., 2002; Cieza et al., 2005).
Focus Groups Investigators use experts or target samples to: i) generate relevant content or ii) determine relevance, comprehensiveness & scope of content	'**IPC**' – *Item Perspective Classification framework* Investigators classify multidimensional qualities of questionnaire items including: i) the type of appraisal presented ii) the fundamental domain of concepts being appraised iii) types of relationships that occur among multiple concepts
Forward & Back Translation Investigators determine linguistic/conceptual equivalence of content among respondents from different cultures, languages or ethnicities.	

'*Field*' content validation methods are an important aspect of assessing the content validity of measures, especially when developing or validating scales as part of clinical measurement research . These methods can, however, can be labor intensive, time consuming and require the involvement of participants and research staff (Acquadro, Conway, Hareendran, & Aaronson, 2008; Willis, 1999) and thus are often inappropriate for selecting an existing outcome measure. Further, most field testing does not have

specific methodology for classifying the results of the data acquired. Thus, '*Bench*' methods may provide additional perspective for clinical measurement research; but also allow an individual investigator or clinician to determine the content validity of a scale for their specific purpose in a relatively short period of time, without necessitating subject recruitment or sizeable research teams.

This User Guide only provides consideration of the two '*bench*' methods presented in Table 1. These methods can be performed alone at your desk, or using multiple raters.

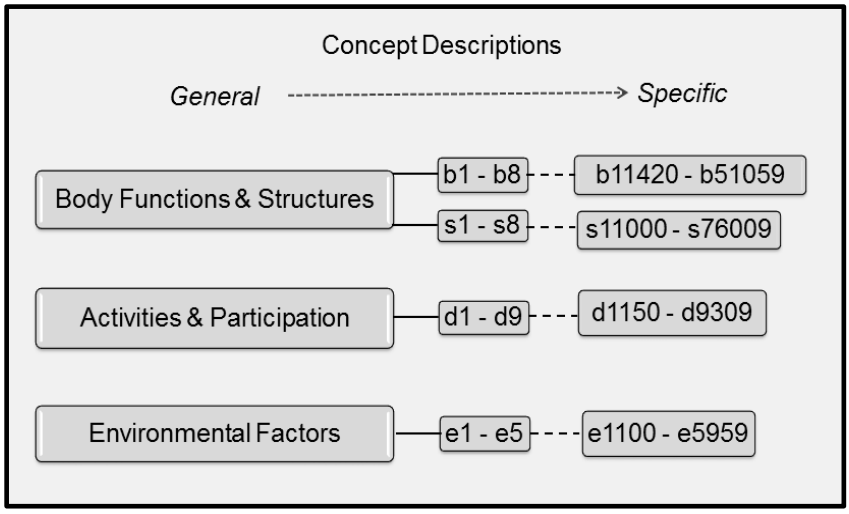
The '*bench*' methods presented (ICF, IPC) both involve the classification of questionnaire content using descriptive codes that exist within a standardized taxonomical framework. The information conveyed by these codes is useful for detecting threats to content validity, although the ICF & IPC differ in approach and the type of information they classify.

ICF Framework

The ICF is an international interdisiplinary framework used to communicate, describe, categorize & measure concepts that pertain to the functioning, disability and health of individuals & populations (Madden, 2007; World Health Organization, 2012b). Use of the ICF for classifying & comparing concepts presented by PROs has been well established in the research community (Fayed et al., 2011). The ICF classification process involves the identification of important concepts within a questionnaire, and the linking of these important concepts to applicable 'descriptive' ICF categories (Cieza et al., 2005). This allows for the communication & analysis of questionnaire content.

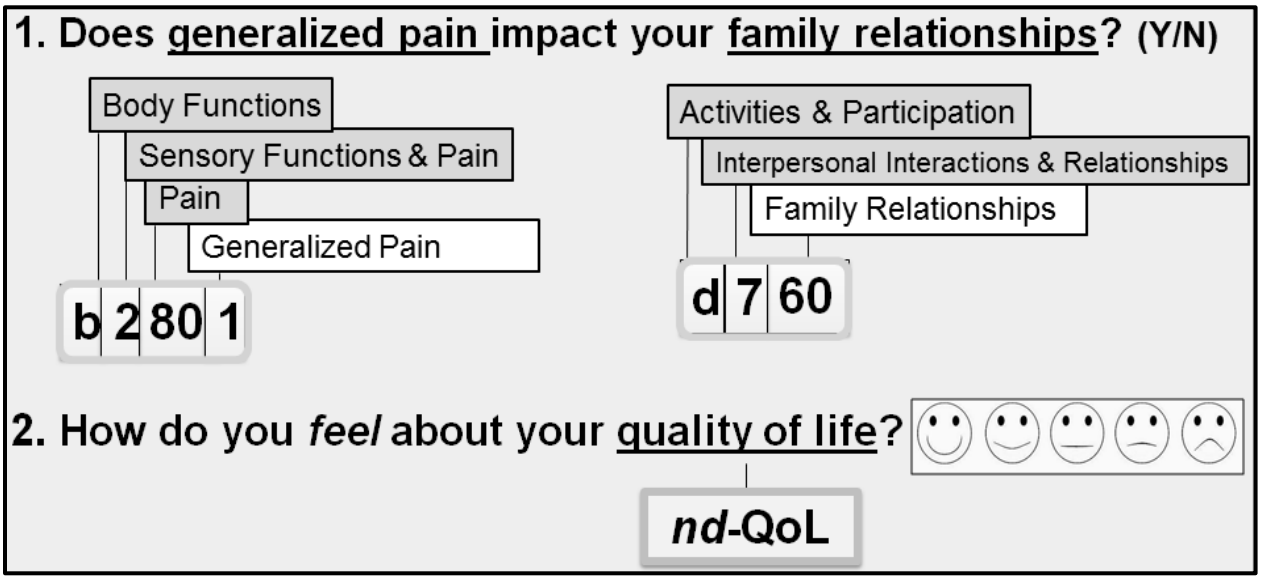
ICF categories (denoted using standardized alphanumeric codes) are organized in a hierarchical framework under the following 'comonent parts' of functioning, disability & health (World Health Organization, 2012a): • Body functions • Body structures • Activities & participation • Enviornmental factors (See Figure 1).

Figure 1. ICF content classification structure



Specific ICF categories that full under the heirarchy of the 'component parts' presented along the top row (Figure 1) classify concepts that are health-related, clinically-relevent and well described. Individual ICF categories are identified using alphanumeric codes that reflect their location within the hierarchy of the framework in descending order from 'general' to 'more specific'. These codes are used to classify and describe important concepts presented by questionnaires (see Figure 2 below). The data generated allow for the comparative analysis of clinically-relevent concepts presented within PRO measures (Cieza & Stucki, 2005).

Figure 2. Classifying concepts using the ICF



While ICF codes are useful for classifying specific and well-defined concepts, the following fundamental qualities of PRO items are difficult to classify using the framework:

- The manner in which concepts are to be appraised (*i.e*. objectively/rationally vs. subjectively/emotionally) (Fayed & Kerr, 2009)
- The existence & nature of relationships that occur among two or more concepts that are presented within a single item (Cieza et al., 2005; Cieza & Stucki, 2005)
- Concepts that are 'higher-order', unspecific or poorly defined (Cieza et al., 2002; Cieza & Stucki, 2005) *e.g. 'quality of life' (QoL) is not defineable (nd) using existing ICF codes (see Figure 2 above).*

*Collectively, these limitations constitute loss of data pertaining to **'Item Perspective'.**

IPC Framework

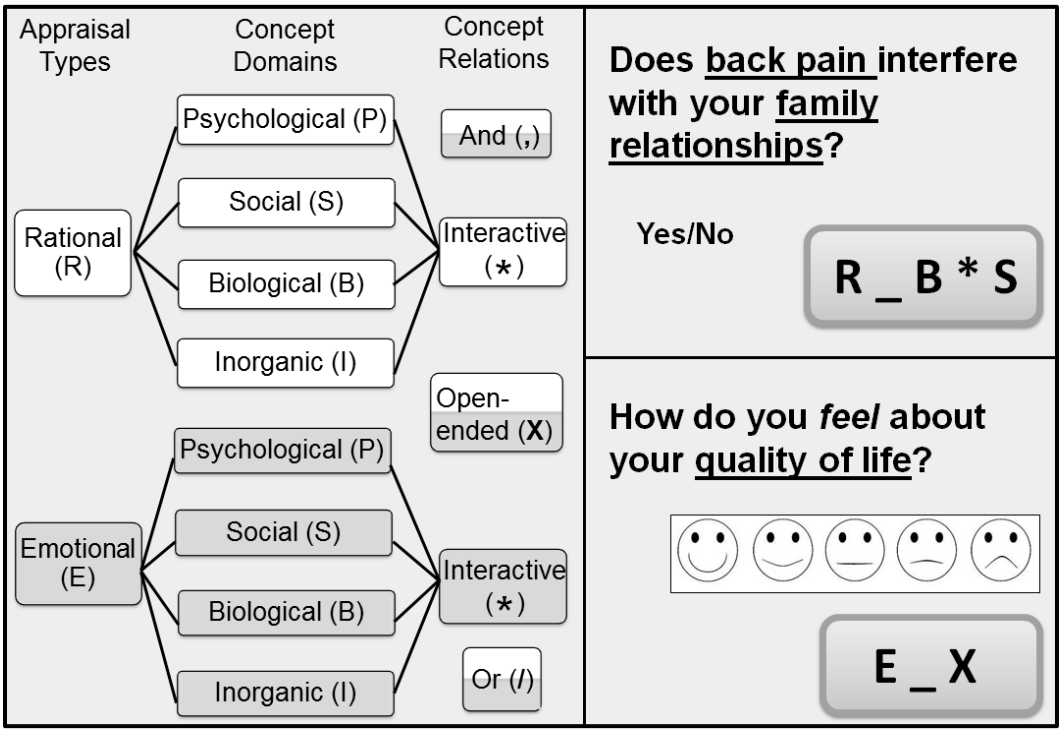
Using the perspective of a respondent who is presented with a question about aspects of his/her health or functioning, the IPC framework (Figure 3) is used to classify the cognitive tasks completed when formulating a response. A 3-step coding procedure is used to assign a taxonomical code to individual questionnaire items reflecting:

- The type of appraisal presented by an item (rational vs. emotional)
- The fundamental domains of concepts presented
- The existence and nature of relationships that occur between multiple concepts presented within the confines of a single item

*This collective information is referred to as **'Item Perspective'**

Each questionnaire item is regarded as a stimulus, in the form of a question or task, to which a respondent formulates an appraisal of the concepts presented within it. The cognitive tasks completed when making 'appraisals of concepts' provides the structure of the IPC framework (see Figure 3). IPC categories will vary in clinical importance depending on the theoretical attributes of the construct under investigation.

Figure 3. Overview of the Item Perspective Classification (IPC) framework

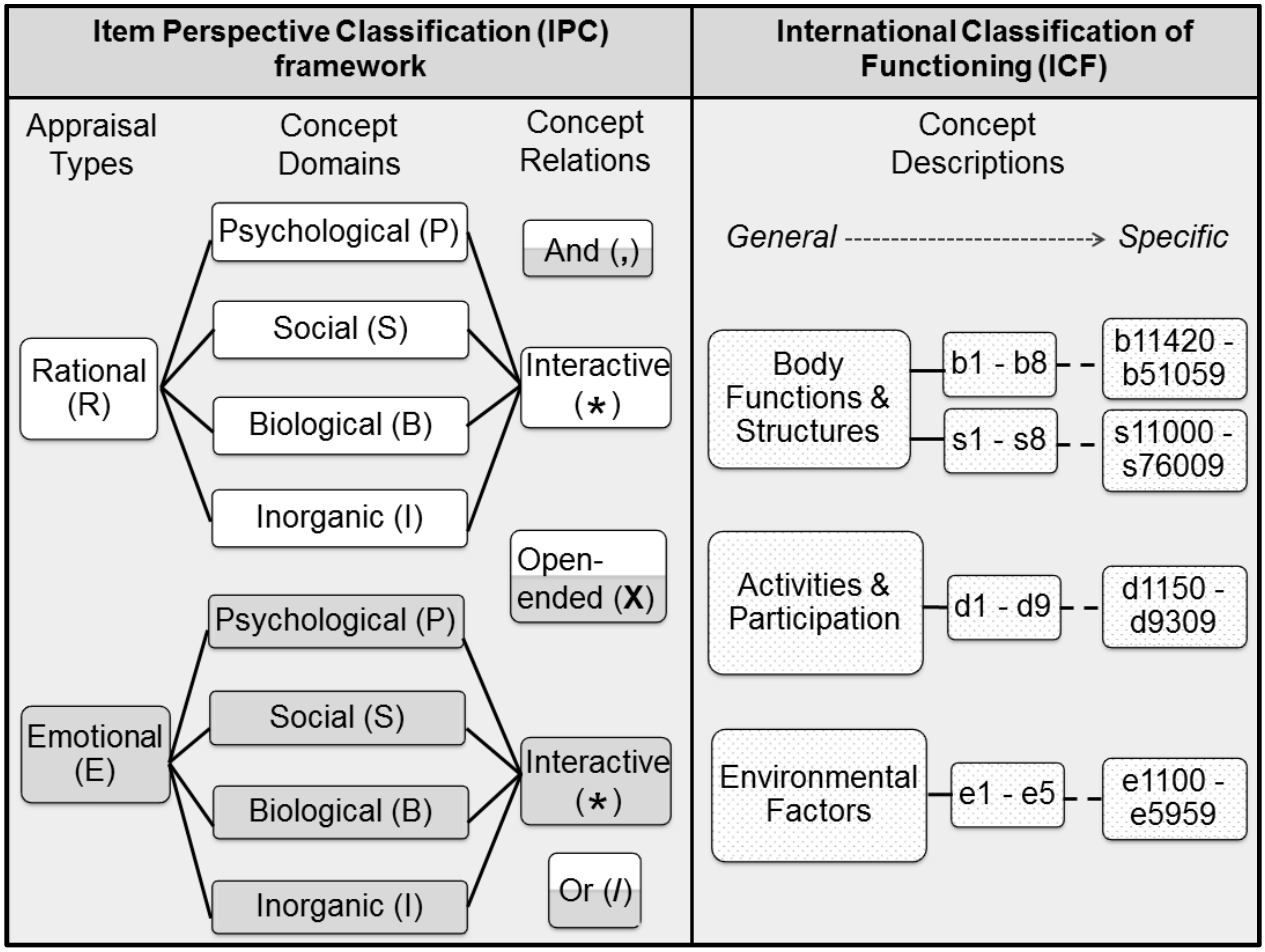


The IPC framework classifies items using the following steps: 1) Determining the type of appraisal presented by the item, 2) Identifying concepts and the fundamental domains to which they belong, & 3) Identifying the types of relationships that occur between multiple concepts.

"Full item codes" that combine data derived from IPC & ICF frameworks generates full item codes that describe:

i) Specific descriptions of concepts presented
ii) The manner in which concepts are appraised, and the existence/nature of relationships that occur among them

Figure 4. Juxtaposition of IPC (*left*) & ICF (*right*) frameworks



The IPC item classification process begins with the assignment of codes that classify the appraisal type presented, a general description of concepts based on fundamental attributes (concept domains), and the existence/nature of relationships that occur between two or more concepts. Next, ICF classifications are selected to define & describe the concepts classified using the IPC. This results in the formulation of a combined IPC+ICF classification code for each item. These standardized codes convey a comprehensive amount of information, and can be used for the purpose of determining content validity of measures.

User guidelines are presented for the purpose of:

1) Classifying items using the IPC framework (pg. 11-26)
2) Appending ICF categories to IPC classifications (pg. 27-31)
3) (Addendum) Appending concept *forms* to IPC codes (pg. 38-43)

Guidelines for classifying items using the IPC framework

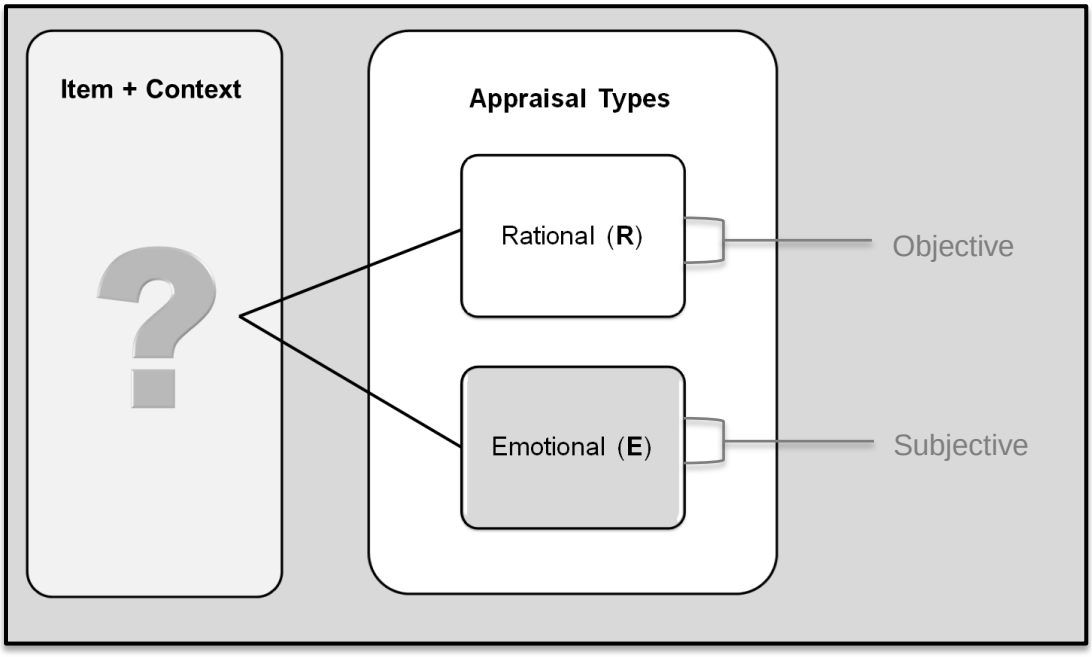
In preparation: Determine *item context*

Respondents cannot perceive any item in isolation. An item's approach and perspective are not only determined by the declared purpose of a questionnaire, but also its context in relation to the stem and response options presented. The declared purpose of a PRO measure may affect how an individual responds to an item, particularly if it is designed for 'condition-specific' purposes. The location of an item in a questionnaire (in relation to other items contained within it) may also affect the manner in which one responds to an item. These types of contextual factors should always be considered when classifying items using the IPC framework.

Step #1: Determining appraisal type

Items elicit either: i) an objective *rational* appraisal ('**R**') or ii) a subjective *emotional* appraisal ('**E**') (see Figure 5). In order to be classified as an 'emotional' appraisal **(E),** the item must present an inquiry about a respondent's emotions or feelings at the present time.

Figure 5: The two appraisal types that can be presented by items



Any inquiries into emotions/feelings that have occurred *'in the past'* or *'in general'* are classified as rational appraisals (**R**) since they require retrieval of memories pertaining to previous psychological states (a rational process, **R**), whereas emotions (**E**) occur only at the "cutting edge of reality" (FitzGerald, 1999; McWatt, 2005). Appraisals of anticipated *future* emotions or feelings are also classified as *rational* appraisals (**R**) (FitzGerald, 1999).

Important rule: If an item does not inquire about a respondent's current mood, emotions, or feelings toward someone or something, it is classified as being a rational appraisal (**R**) by default.

The following is an example of an appraisal classified as being emotional (**E**):
"I am currently happy: 1=Not at all, to 4=Very much".

In contrast, here is an example of a rational appraisal (**R**) - where a respondent is prompted to provide information about their feelings in the ***past***:
"During the past 2 weeks, I felt happy: 1=Not at all, to 4=All the time".

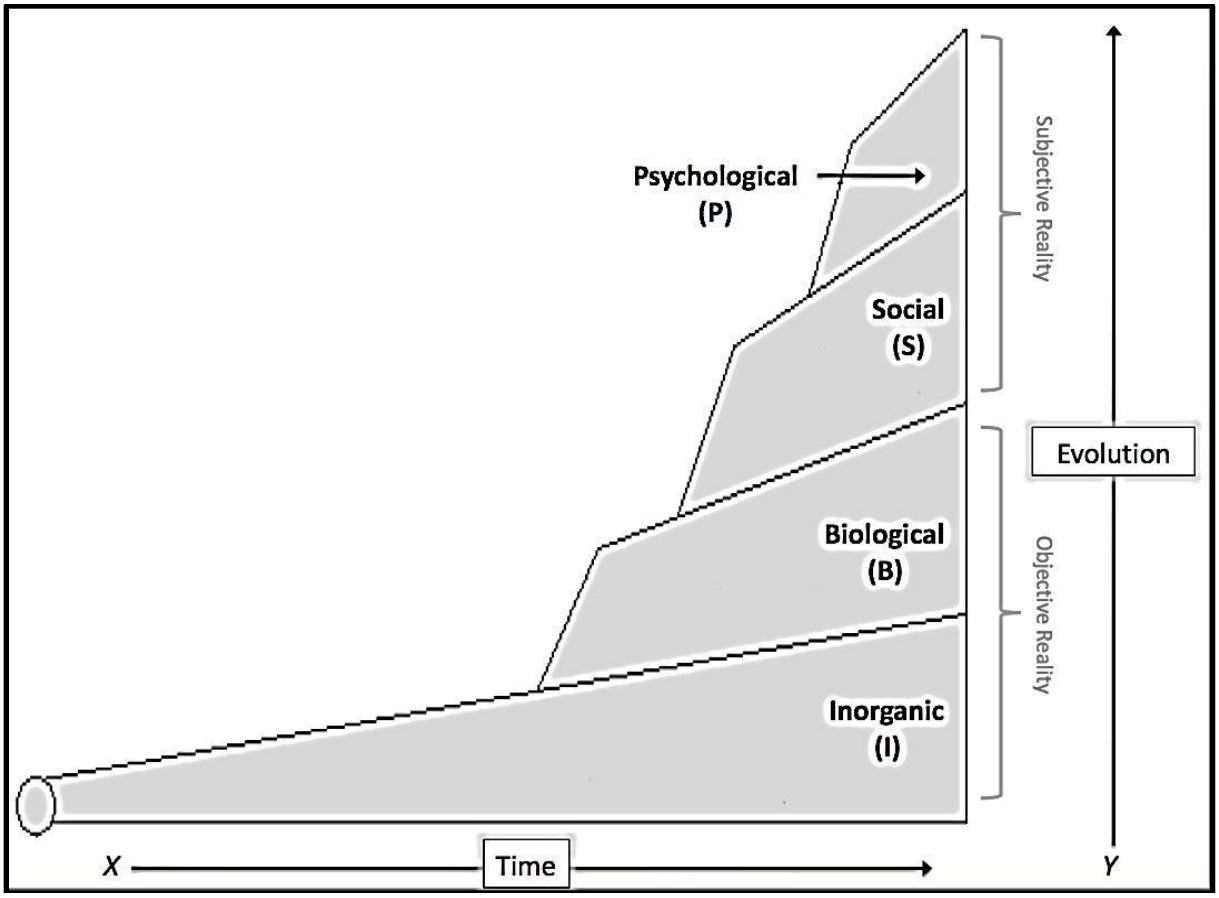
The item: "*How much body pain are you currently experiencing? (1=None to 4=A lot)*" would also be classified as a rational appraisal (**R**) as it does not appear to assess 'emotional' or 'psychological' pain; whereas the item: "*I am currently emotionally distressed by my body pain*" would be classified as an emotional appraisal (**E**) because it clearly assesses a respondent's mood/feelings toward something (body pain) at the ***present*** time.

Step #2: Identifying concept domains

The four fundamental concept domains may represent all evolutionary levels of reality that are amenable to human perception (McWatt, 2005). These domains are used to classify concepts according to where they exist within a proposed framework of natural order (Figure 6). Concepts are classified as being Inorganic (**I**), Biological (**B**), Social (**S**) or Psychological (**P**).

Concept domains are ordered hierarchically to reflect the hypothesis that *inorganic* matter gives rise to (and supports) biological organisms, *biological* organisms self-organize and interact with one another in a manner that gives rise to *social* behaviors, and *psychological* functioning occurs as a result of increasing complexity in social behavior (McWatt, 2005). Domains are thought to possess discrete & clearly defined conceptual boundaries, yet are inter-dependent since higher-level domains become increasingly reliant on lower-level ones over time (Berg, 2008).

Figure 6. Concept domains & their hierarchical order

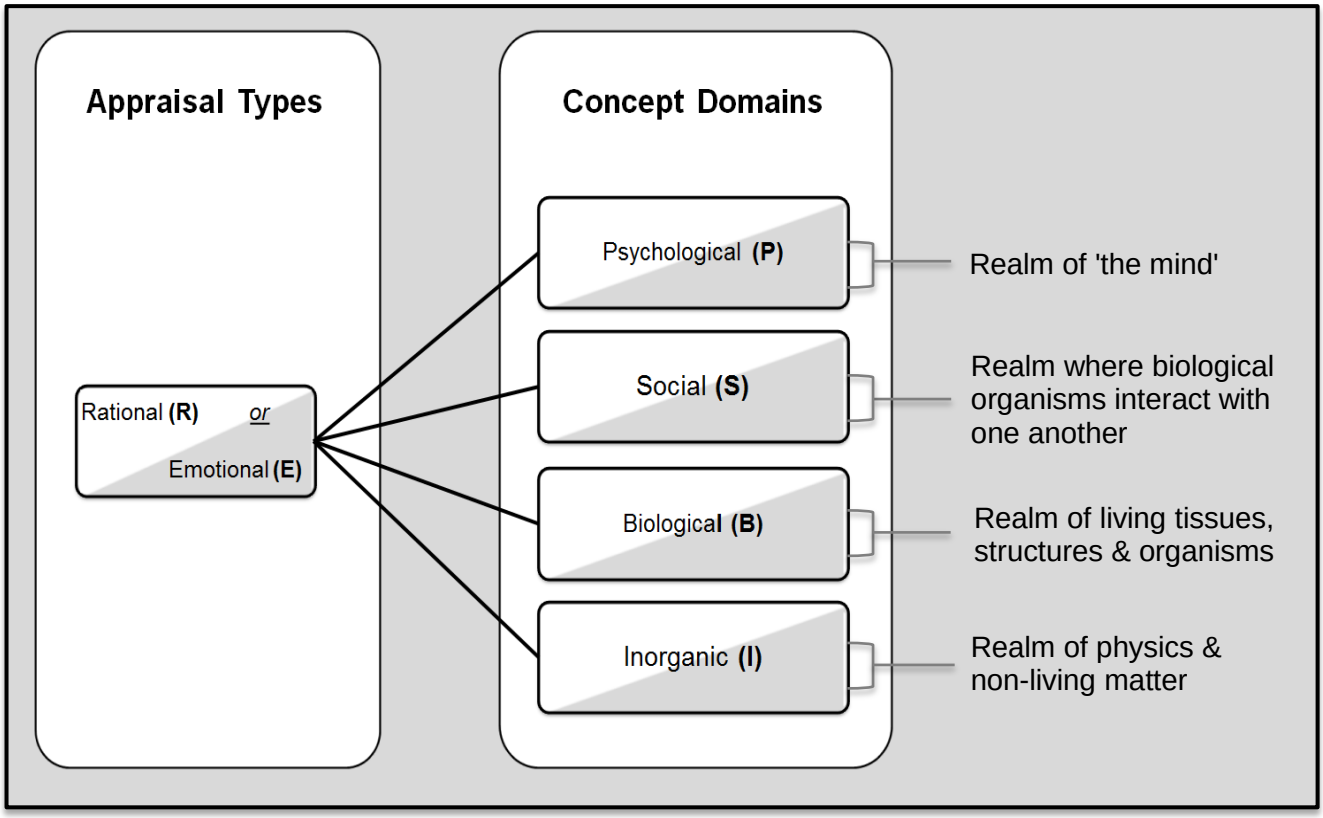


Adapted from Berg (2008) & McWatt (2005)

Questionnaire items almost always present appraisals that are anchored to at least one concept domain (see Figure 7). For example, the item: "*I am currently happy about my social life* (*Yes/No*)" is classified as an emotional appraisal (**E**) anchored to a concept classified under the social domain (**S**) thus is assigned the code '**E_S**':

Appraisal: '**E**_' (Presence or absence of happiness)
Concept domain: '**S**' (Social life)

Figure 7. Anchoring appraisals to concept domains*



**See Appendix A-D for examples of specific concepts classified under each of the domains presented above*

Unanchored appraisals. It is possible that the only examples of 'unanchored' appraisals are ones that assess a respondent's emotions/feelings at the present time, unrelated to anything else. For instance, the item: "*I currently feel happy (Yes/No)*" is simply coded '**E**' as it is unanchored to any concept domain:

Appraisal: '**E**' (Presence or absence of happiness)
Concept domain: N/A

In contrast, consider the item: "*I currently feel happy about my psychological health* (*Yes/No*)" that presents an emotional appraisal anchored to a concept classified under the psychological domain (**E_P**):

Appraisal: '**E_**' (Presence or absence of happiness)
Concept domain: '**P**' (Psychological health)

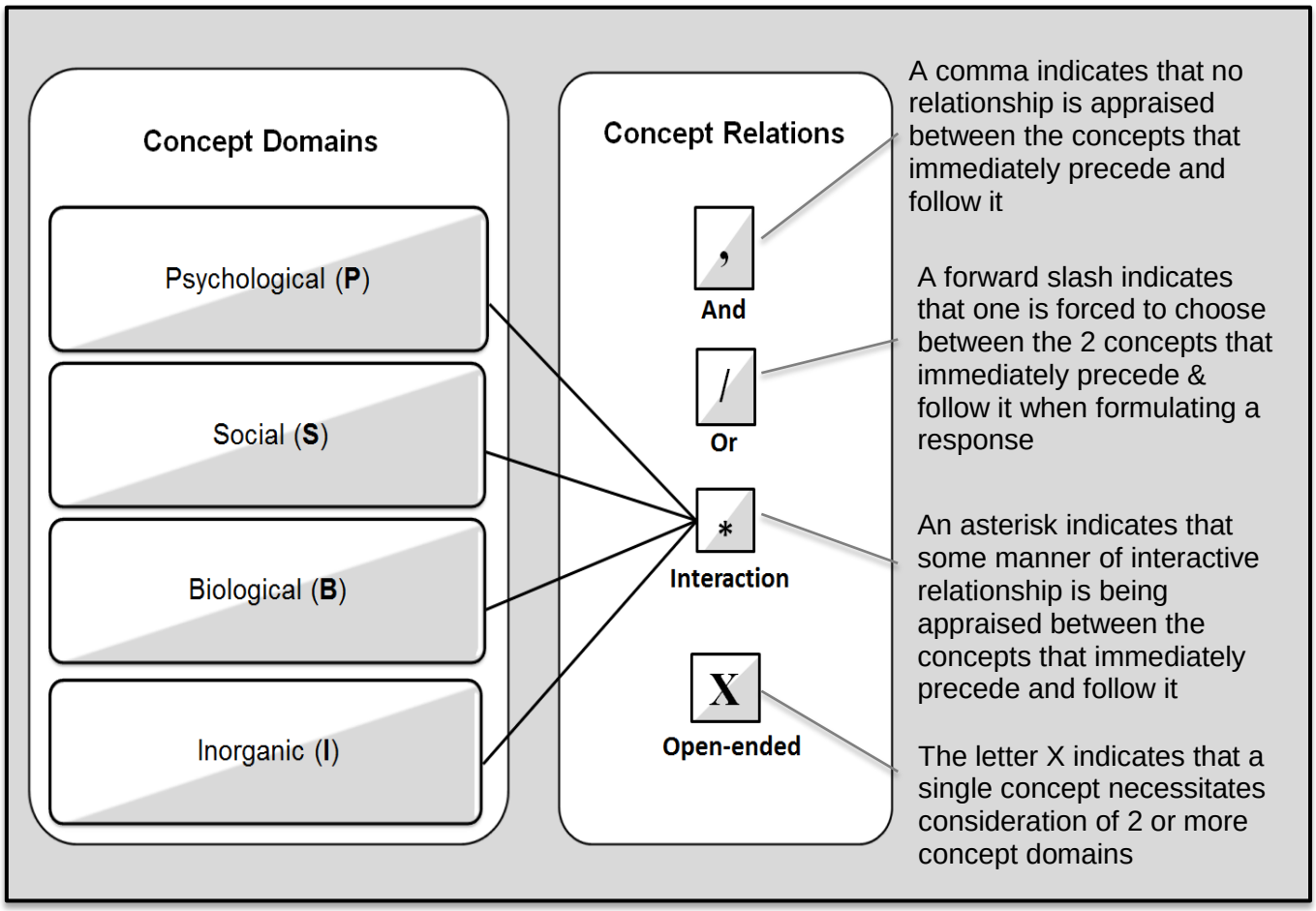
Unanchored *rational* appraisals may never be encountered, as they wouldn't make much sense; for example the item: "*How often?* (*1=Never to 4=All the time*)" would simply be classified as an unanchored rational appraisal (**R**):

> **Appraisal**: '**R**' (Frequency from *never* to *all the time*)
> **Concept domain:** N/A

Step #3: Identifying concept relationships

Common symbols are used to identify the types of relationships that may exist among multiple concepts presented within a single item (Figure 8).

Figure 8. Classification of *relationships* that exist among concepts



Dynamic/interactive relationships (∗). Items often present appraisals of dynamic or 'interactive' relationships (∗) that occur between two or more concepts (McWatt, 2005). For example, the item: "*Over the past 2 weeks, to what extent has your physical health impacted your psychological health*? (*1=Not much to 4=Very much*)" is coded '**R_B∗P**' to represent a rational appraisal (**R**) of a dynamic relationship (∗) between biological & psychological concepts:

> **Appraisal:** '**R**_' (To what extent in the past two weeks from *not much* to *very much*)
> **Concept domains:** '**B*P**' (physical health * psychological health)

Dynamic relationships (∗) are listed in order of cause & effect whenever possible, such that a rational appraisal of how *physical health* affects *social life* is classified as '**R_B∗S**' as opposed to 'R_S∗B' (which would imply that a rational decision was made about how social life affects physical health).

Items may also investigate a dynamic relationship between two distinct concepts with identical IPC classifications. For example, consider the item: "*Physical pain* (**B**) *prevents me from being able to lift my arm above my head* (**B**) (*1=Not at all to 4=All the time*)". This item presents a rational appraisal of an interactive relationship between two concepts both classified under the biological domain, thus is classified accordingly as: '**R_B*B**'.

Multiple unrelated concepts (,). Items that present >1 concept do not always establish relationships among them. For example, consider the item "*During the past week, my physical health* ***and*** *social life have been 1=Lousy to 4=Excellent".* This item does not assess any particular relationship between physical health (a biological concept, '**B**') and social life (a social concept, '**S**'); nor does the item force an individual to choose between one concept and the other when formulating a response. Such an item is classified with the use of a comma (**,**) instead of an asterisk (∗) to indicate that it presents a rational appraisal of two *unrelated* concepts: '**R_B,S'**.

Forced choice (*/*). Questionnaire items sometimes force a respondent to choose between two or more concepts upon which to form the basis of his/her appraisal. This type of situation often results from presentation of the word "or". For example, consider the item: "*Over the past 2 weeks, how would you rate your physical health* ***or*** *emotional health? (1=Poor 4=Excellent*)". Use of the word 'or' forces a respondent to choose between two different item perspectives, and the item is classified accordingly using a forward slash ('***/***') indicating that no relationship is assessed among the concepts that immediately precede and follow it, and that the item essentially presents a forced choice between two perspectives.

> Interpreting IPC codes that reflect a *forced choice* (***/***) between item perspectives:
> Example 1: **R_B/S** ⟶ Possible Perspectives: **R_B** or **R_S**
> Example 2: **R_B/S*P** ⟶ Possible Perspectives: **R_B*P** or **R_S*P**

Condensing examples of concepts. Items often present multiple concepts with identical IPC classifications through the provision of examples. For instance, consider the item: "*During the past week, I have been able to complete my 'instrumental daily activities' such as: feeding myself, toileting, and standing up from a sitting position* (*Yes/No*)". The three underlined concepts are all classified as biological concepts (**B**), but the item does not assess any particular relationships occurring among them; nor does it force an individual to choose between one concept and another when formulating their answer.

An item like this is problematic since we cannot be certain about which specific concept/concepts a respondent may consider in the formulation of their answer. After looking closely at the sample item above, one may only conclude that any concept(s) that a respondent chooses to use for the basis of their answer will be perceived as being some sort of 'instrumental daily activity' - a concept that is presented above as biological (**B**). Accordingly, multiple examples of concepts that fall under an identical IPC category are accounted only once (i.e. '**R_B**').

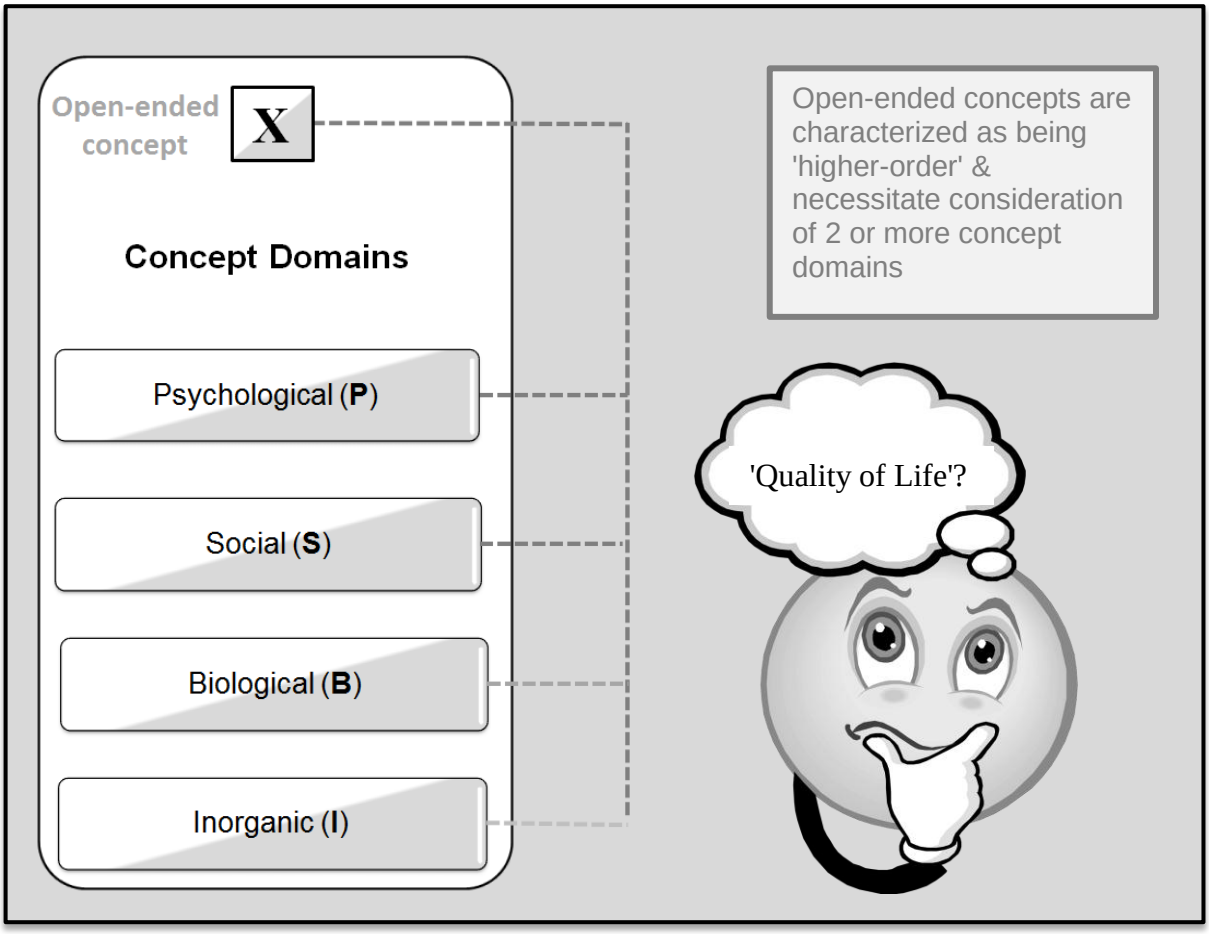
Multiple examples of concepts that fall under *different* IPC categories are also condensed in a similar manner. For instance, consider the following item: "*Over the past two weeks, I have been self-reliant in 'daily activities' such as feeding myself* (**B**)*, toileting* (**B**) *and using public transport* (**S**) *or driving my own car* (**S**) *(1=Not at all to 4=Totally self-reliant*)". The concept of 'daily activities' cannot be classified using a single domain since the item presents it as a biological concept and/or a social concept through the provision of multiple examples. Accordingly, the item would be classified '**R_B,/S**' condensing these examples of 'daily activities' and reflecting three possible perspectives: 'R_B,S', 'R_B', or 'R_S'. Complicated item coding such as this may be reflective of poorly focused/worded items.

Open-ended concepts (X). Open-ended concepts are characterized as being 'higher-order' phenomena that cannot conceivably be classified using a single concept domain (see Figure 7). These concepts often possess vague or unclear definitions, and may be perceived differently among respondents. Concepts are considered to be open-ended (**X**) if they meet the following criteria:

i) They necessitate consideration of *2* or more concept domains simultaneously (McWatt, 2005)

ii) They cannot conceivably be classified using single concept domain

Figure 9. Identifying open-ended concepts



Examples of concepts that are classified as 'open-ended' (**X**) include:

- Quality of life, overall well-being, overall health
- Life as a whole, life in general
- Spiritual or aesthetic experiences (McWatt, 2005)

The following item presents a rational appraisal of an open-ended concept (**R_X**): "*Over the past 6 months, how would you rate your quality of life? (1=Very poor to 4=Excellent)*":

Appraisal: '**R_**' (Rating over the past six months from *very poor* to *excellent*)
Concept domain: '**X**' (Quality of life)

Supplemental Classification Guidelines

Ensuring brevity in classification. Capturing the 'fundamental essence' of each item is important for maintaining brevity and accuracy in classification. For example, consider the item: "*To what extent are you able to see well enough to play sports* without *corrective lenses?* (*1=No ability* to *4=No problem*)". This item, of course, has less to do with corrective lenses (potentially classified as an inorganic concept '**I**') as it does with 'uncorrected vision' (classified as '**B**') and how it interacts with one's ability to carry out leisure activities (playing sports: a social concept '**S**'). Thus, this item is simply classified as '**R_B∗S**' as opposed to 'R_B∗S∗I'. Items that may initially appear to involve the appraisal of >2 concepts should be reconsidered to ensure that only the 'fundamental essence' of the item is reflected through its classification.

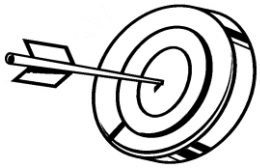
Alternatively, consider the item: "*Do you require your 'prescribed' corrective lenses to be able to see well enough to play sports?* (*Yes/No*)". This item presents a rational appraisal of a dynamic relationship between a biological concept (the ability to see, **B**), an inorganic concept (corrective lenses, **I**) and a social concept (playing sports, **S**) thus justifying its classification using three concept domains: **R_B∗I∗S**. Note that the act of 'prescribing' glasses/contact lenses (an additional social concept, **S**) may be related to the above inquiry in an *indirect* manner but is not considered to be fundamental to the essence of the item, thus should be left unaccounted for when assigning a classification using the IPC framework.

Accounting for time & recall period. Items frequently elicit responses within the context of a particular timeframe (*i.e. 'within the last 2 weeks', in the past 30 days etc*.). This '*recall period*' of past states or events is typically presented within questionnaire instructions, stems or response categories. *Recall period* is not classified using the code '**I**' (time is an inorganic concept) since it is considered only within the confines of the 'appraisal'. For example, the item *"In the last 2 weeks, how much difficulty did you have in standing unassisted (1=None to 4=A lot)*" is classified as: '**R_B**' as opposed to 'R_I∗B':

> **Appraisal**: '**R**_' (Amount of difficulty in the last two weeks from *none* to *a lot*)
> **Concept domain**: '**B**' (Standing unassisted)

Some time-related items, however, present clear rationale for assignment of the concept domain '**I**'. This occurs in situations where 'time' is determined to be a concept that is fundamental to the essence of the item, but not accounted for by the appraisal/recall period. For example, consider the item: *"In the last 2 weeks, how much difficulty did you have in your ability to stand unassisted for 30 minutes* (*1=None to 4=A lot*)". This item presents a rational appraisal of a dynamic relationship between thirty minutes of 'time' (an inorganic concept) and the ability to stand unassisted (a biological concept) thus is classified as '**R_I∗B**':

> **Appraisal**: '**R**_' (Amount of difficulty in the last two weeks from *none* to *a lot*)
> **Concept domains**: '**I*B**' (Relationship between 30 minutes of time and standing unassisted)



Troubleshooting

Classification Problems Related to Vague/Unclear Concepts.

Assigning a concept to a single domain is difficult when its attributes are difficult to clearly delineate. Take *religion* for example: organized religion is something socially constructed (**S**), religious beliefs are psychologically developed (**P**), a building of worship is something inorganic (**I**), and a spiritual experience may be considered to be an open-ended concept (**X**). Items that inquire about sex are sometimes social in nature (**S**), but it can also be framed as a biological function (**B**). Concepts that involve *activities of daily living* may be considered to be social (**S**) if they fulfill societal functions, but can also be considered to be biological (**B**) if they simply pertain to an individual's physical ability to carry out a given activity.

Some of the most difficult concepts to classify appear to transcend multiple domains; yet do not meet the requirements for being classified as 'open-ended' (**X**). For instance, *'overall health*' may be a term that elicits one's consideration of multiple concept domains simultaneously (i.e.'biopsychosocial' health) thus may be classified as an open-ended concept (**R_X**). In contrast, consideration of the concept '*health*' alone may not elicit consideration of multiple domains if it is perceived narrowly as 'physical health' (**B**). One's perception of the term '*health*', however, may not necessarily exclude 'social health' (**S**) or 'mental health' (**P**). Similarly, '*pain*' may refer to a biological concept (**B***,* i.e. nociception), but may not necessarily exclude conceptualization as 'cognitive or emotional pain' (**P**). Linking unclear concepts to the most appropriate domain can be difficult, thus two strategies for dealing with classification uncertainty are reviewed.

Two methods for dealing with concept domain uncertainty

Method A. An evidence-based method for determining the most suitable domain to assign to a vague/unclear concept involves the review of published factor analyses. For example, the item: "*Which face comes closest to expressing how you feel about your health?* (☹ 1 😟 2 😐 3 😐 4 😐 5 🙂 6 🙂 7)" was found to load onto a 'Physical Functioning' factor (**B**) within a condition-specific quality of life questionnaire (Spagnola et al., 2003). This may suggest that '*health*' is best conceptualized as a biological inquiry (**B**) within the context of this questionnaire, as opposed to conceptualizing it as social health (S), psychological health (P), or overall health (X).

Similarly, the item "*Which face comes closest to expressing how you feel about the amount of pain you have?* (☹ 1 😟 2 😐 3 😐 4 😐 5 🙂 6 🙂 7)" also loaded on the same 'Physical Functioning' factor previously cited (Spagnola et al., 2003). This finding may instill a degree of certainty that *pain* is best conceptualized as 'physical pain' (**E_B**) as opposed to 'psychological pain' (**E_P**). A closer look at this Physical Functioning factor reveals that all of its items present concepts that pertain to the biological domain ('**B**'). Thus, one may be confident that the concepts '*health*' and '*pain*' belong to the 'biological' ('**B**') domain within the context of this questionnaire.

When using Method A, one must be aware that narrowly defined scales may fail to convey information about the conceptual relationships presented by items contained within it. For example, the item: "*During the past week, has your physical condition affected your social activities?*" was found to belong to a 'Social' (**S**) factor (McLachlan, Devins, & Goodwin, 1999). This narrowly defined factor is problematic because it does not elicit detail about the nature of relationships that exist among multiple concepts presented within this item (physical condition * social activities).

Vaguely-defined factors are also problematic. For example, a factor called 'Participation' may include items presenting concepts that pertain to: environmental barriers to participation (**I**), one's physical ability to participate (**B**), social participation (**S**), or one's psychological capacity for participation (**P**). Similarly, a factor called "Environment" may present items that pertain to either the physical environment (**I**) or social environment (**S**) (Skevington, Lotfy, & O'Connell, 2004). Thus, using Method A for dealing with concept domain uncertainty has the potential to generate false or restrictive item classifications. Method A also utilizes the perspective of an 'investigator', rather than that of a 'respondent', which may yield invalid results using the IPC framework.

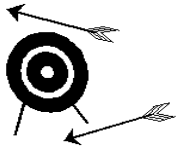
Method B (recommended). The recommended approach for dealing with unclear/vague concept domains is to use an informed 'best guess' by using the perspective of a respondent and answering each item within the context of the current measure and its intended target audience. Item context includes consideration of the purpose of the questionnaire, the characteristics of the sample population, the overall theme of the content, the wording of each item, bracketed/subscaled content and the provided stems & response categories. Ask yourself: "*What is this item fundamentally asking me here*"? Since the foundations of the IPC framework are based on the respondent's perspective, this is believed to be the most valid way for classifying vague/unclear concepts. Raters may elect to agree on the tool purpose, target audience, concept target of the scale/subscales before proceeding with individual item classification as a means of improving rater consistency.

Key Message: One's perception of a concept should be formulated in reference to the declared purpose(s) of the questionnaire, the instructions provided, and the language used to present the concept.

If classification uncertainty persists, a table of helpful questions is presented to assist in the determination of appropriate concept *domain* classifications (Table 2).

Table 2. Helpful questions for classifying unclear concepts

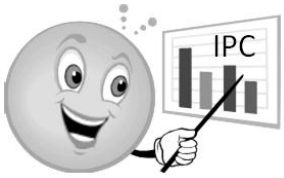
Conceptual Conundrum	Helpful Question	Interpretation of Answer
Biological vs. Social Domain	Does the concept primarily pertain to the *physical capacity* for carrying out a social activity?	If yes, it is Biological (**B**)
	Does the concept primarily pertain to participation in social activities rather than the physical ability to carry them out?	If yes, it is Social (**S**)
Biological vs. Psychological Domain	Is the concept a part of the nervous system that one could (hypothetically) touch?	If yes, it is Biological (**B**)
	Can the concept be assessed using EEG or fMRI devices?	If yes, it is Biological (**B**)
	Can the concept be detected using EMG/sensory testing?	If yes, it is Biological (**B**)

Identifying classification error 

Classification error may be attributed to the characteristics of respondents, the questionnaire being evaluated, or insufficiencies with the IPC framework (see Table 3).

Table 3. Possible sources & causes of classification error

Sources of Error	Causes of Error
Respondents	Inability to accurately reflect one's thought process when carrying out the classification process (Drennan, 2003)
	Presumptions that there are problems with the questionnaire or the content being classified (Drennan, 2003)
	Using the thought process of a researcher, rather than the perspective of a respondent (Drennan, 2003)
Questionnaires	Presentation of concepts that can be interpreted in multiple ways (Collins, 2003)
	Linguistic or contextual problems that affect a respondents' understanding of the meaning and use of words (Drennan, 2003)
	Lexical problems that prompt respondents to answer more than one question at a time (Drennan, 2003)
Framework	Insufficiencies with the IPC framework that allow for invalid item classifications (Collins, 2003)



Presenting Data

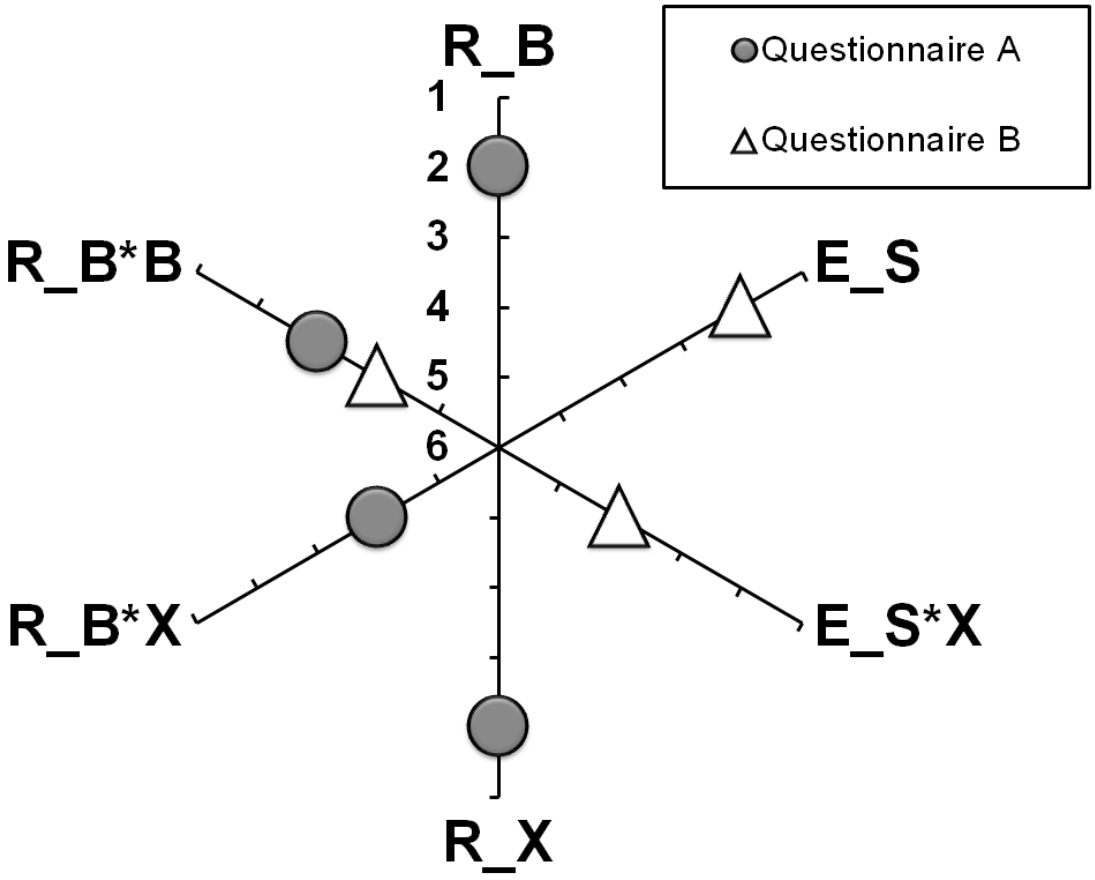
There are a number of ways to display data generated from the IPC classification process allowing for the comparison of content among measures. The following sample table & figure formats can be used for the purposes of documenting and presenting data in a manner that allows for the analysis of item perspective both among and within questionnaires. All data presented are fictitious, and do not necessarily reflect the profiles of any existing PRO measures.

Table 4. Presenting raw IPC data using a frequency table

Classification	Questionnaire A	Questionnaire B	Questionnaire C	Questionnaire D
E			1	1
E_B		1	2	
E_P/S				1
R_B,P				1
R_B*B	1	3	4	5
R_B*S	5	3		2
R_B	1	4	5	6
R_I	1			
R_S	6	4		3
R_X			1	

*Values represent the number of questionnaire items assigned to each of the IPC classifications presented. For example, there are no items in sample Questionnaire #A that present an emotional appraisal (**E**). In contrast, Questionnaire #C contains three items that present emotional appraisals, of which two are anchored to biological concepts (**E_B**) and one is 'unanchored' to any concept domain (**E**).*

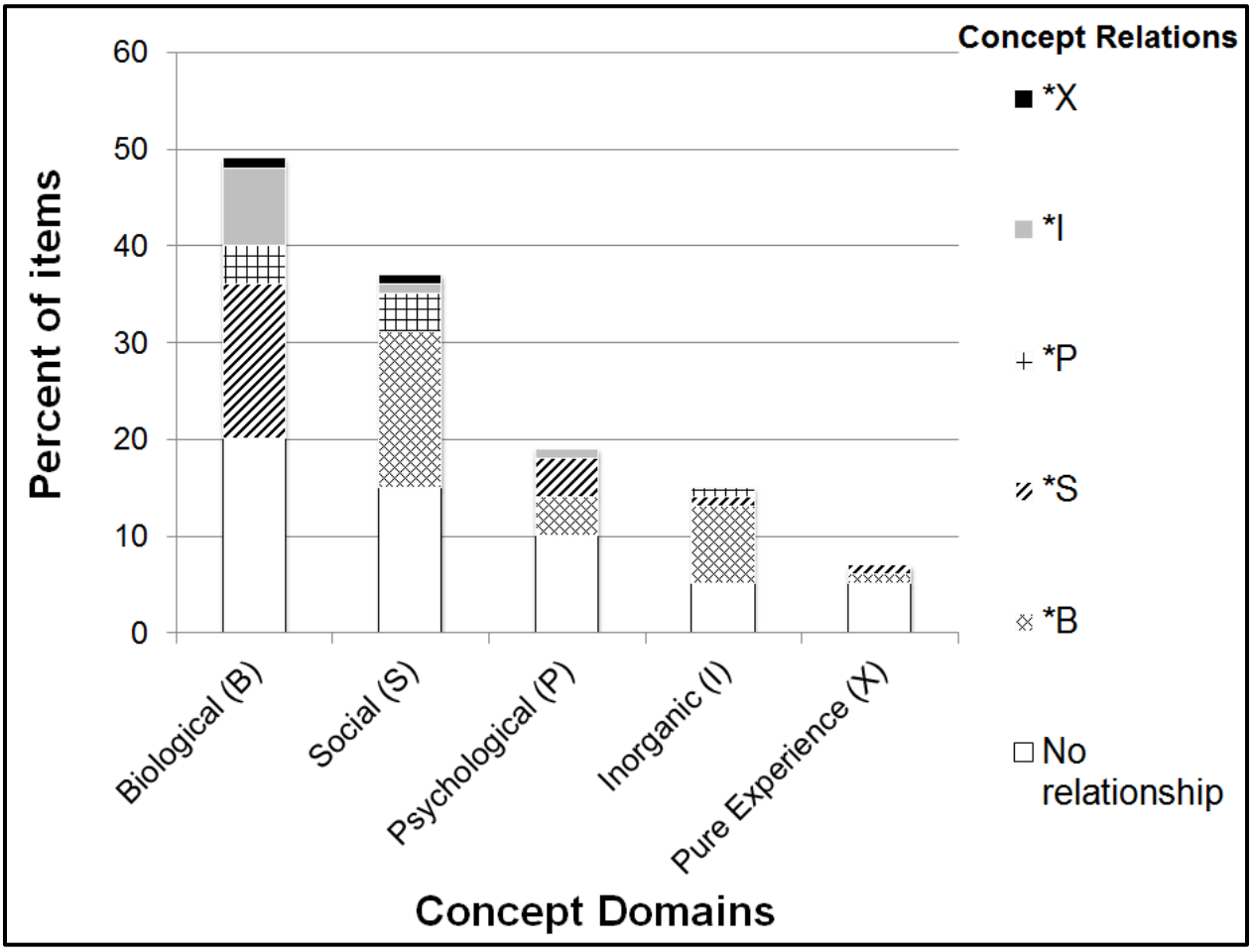
Figure 10. Presenting raw IPC data using a radar plot



*Data plots represent the number of questionnaire items assigned to each of the IPC item classifications listed along the perimeter. For example, 2 items in questionnaire A (represented by shaded circles) are classified as rational appraisals of biological concepts (**R_B**), and it contains no items that present emotional appraisals (**E**). In contrast, questionnaire B (represented by triangles) contains 6 items that present appraisals that are emotional in nature.*

*Radar plots allow a reader to easily detect similarities and differences in concept density (number of concepts per item), and concept dimensionality (number of different IPC codes classified and the number of times each was utilized). Content overlap is easily identified - questionnaires A and B both contain items that present rational appraisals of dynamic/interactive relationships that occur among 2 biological concepts (**B*B**).*

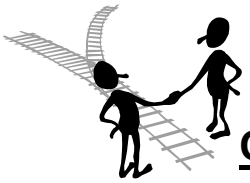
Figure 11. Presenting concept domains & relationships using stacked columns



Items may present one or more concepts classified under each domain. An investigation of how often each domain is utilized, and the manner in which concepts are related to one another may be of importance.

*In the above figure, column heights represent the percentage of pooled items possessing IPC codes that are characterized by each of the concept domains. That is, the percentage of items that present concepts classified under each domain is represented by the height of each column. For example, nearly 50% of items present appraisals anchored to biological concepts (**B**). Among items that present appraisals of biological concepts, 20% are 'solitary' indicating that no relationship is assessed between the biological concept in question and another concept. In contrast, about 15% of items that present appraisals of biological concepts actually assess dynamic/interactive relationships between biological concepts and social concepts. Less than 10% of all items involve an appraisal of open-ended concepts.*

***The data presented do not account for appraisal type. Items that present two or more concepts that are unrelated (,) or force a respondent to choose between two or more concepts (/) are also not considered in the data presented. The direction of dynamic/interactive relationships (i.e. cause & effect) is also not accounted for in the data presented.*



Guidelines for appending ICF Categories to IPC Codes

Overview

While the IPC framework is useful for classifying multidimensional characteristics of items, it is limited in its ability to categorize *specific attributes* or *detailed descriptions* of concepts presented. That is, IPC codes provide only a 'general' description of concepts presented within each item, thus imposing limitations in its ability to differentiate between similar, yet discernible concept attributes. Since the ICF is an especially useful framework for classifying concepts using specific hierarchical descriptive codes (Cieza et al., 2002; Cieza et al., 2005; Fayed et al., 2011) this section of the User Guide provides instructions for assigning ICF codes to IPC classifications resulting in combined IPC+ICF codes. Doing so results in the generation of *composite item codes* that convey information pertaining to item perspective & specific definitions/attributes of concepts presented.

Using the ICF for classifying & comparing the content of PROs is an established practice in the research community, although there is a wide variation in how the linking process is carried out (Fayed et al., 2011). Using the *IPC* to prepare data for subsequent ICF classification is warranted because:

i) The IPC framework provides concept descriptions in the absence of any applicable ICF classification (as many as 28% of concepts in a single questionnaire may not be definable by existing ICF codes (Fayed & Kerr, 2009))

ii) The IPC framework provides syntax necessary for identifying & describing any relationships that occur between two or more concepts (this may not be accounted for using conventional ICF linking rules (Cieza et al., 2005))

iii) Consensus regarding the amount of contextual information to be taken into account when coding with the ICF may be difficult to achieve (Cieza et al., 2005; Fayed et al., 2011), and the IPC framework addresses this by considering content derived from *items in their entirety* for subsequent classification using the ICF.

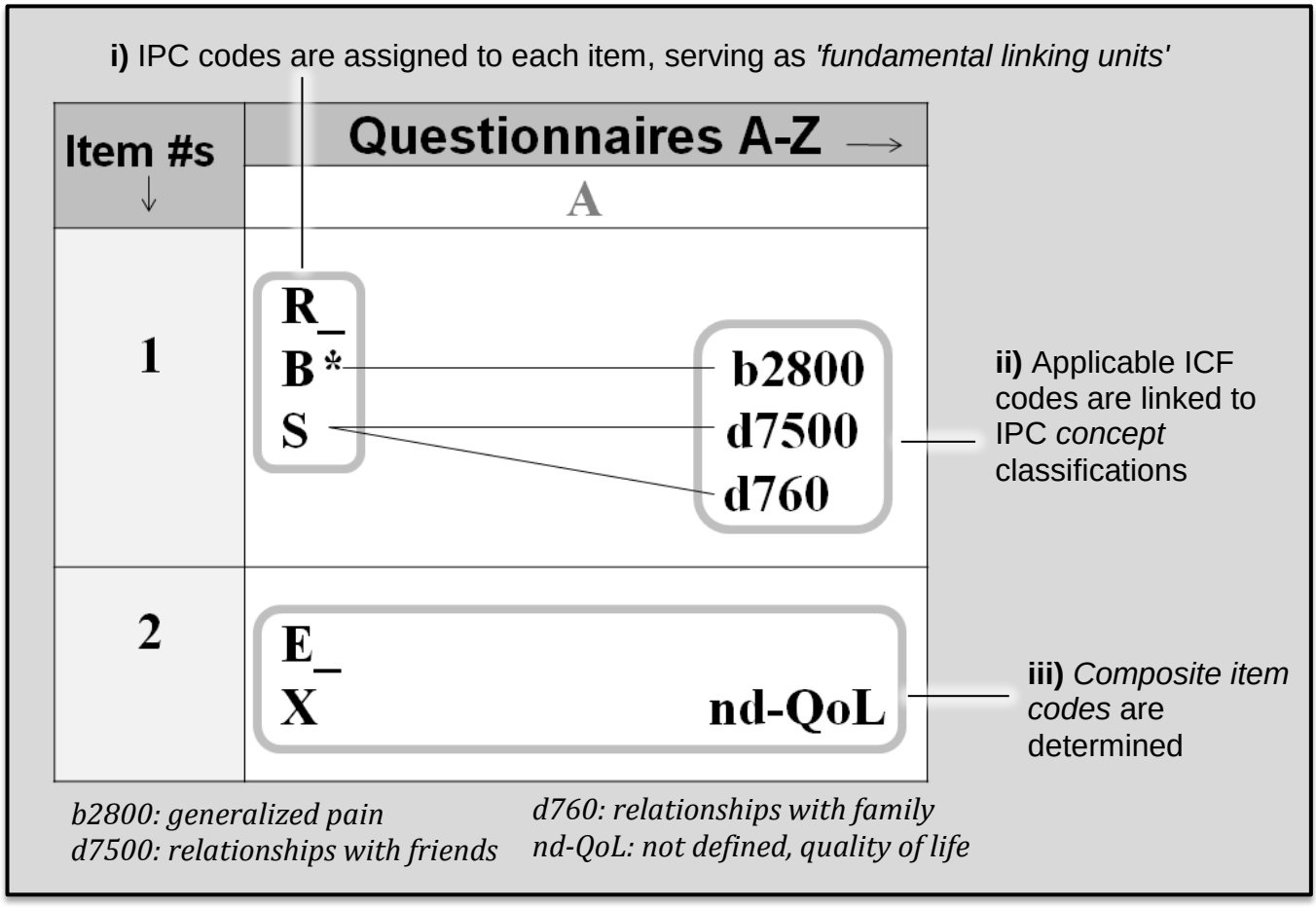
iv) Inconsistencies in determining exactly which concepts are important to classify using the ICF may occur (Fayed et al., 2011), and the IPC framework is a useful tool for helping to determine this using a standardized coding process.

Procedure

The process of determining applicable ICF codes begins with classifying all items using the IPC framework (data generated may be recorded using the format depicted in Table 10 below). Resultant IPC codes serve as *fundamental linking units* to which ICF classifications are subsequently appended. This results in the formulation of a *compound item code* that conveys information pertaining to: i) appraisal type, ii) concept

domains, iii) the ordering of concepts, iv) concept descriptions, and iv) relationships between concepts (see Figure 12).

Figure 12. Process of assigning & organizing IPC+ICF codes



Each cell in the sample table above contains a 'left-justified vertical column', and a 'right-justified vertical column'. IPC codes are presented along the left-justified vertical column serving as fundamental linking units to which ICF categories are subsequently appended along a right justified vertical column. Item #1 in 'Questionnaire A' presents a rational appraisal regarding the impact of generalized pain on relationships with friends & family, represented by the compound item code: '**R_B**b2800***S**d7500d7600'.

The applicability of an ICF category should be determined in relation to:

> **i**) The breadth of content conveyed by each concept being classified
>
> **ii**) The structure & scope of the ICF framework
>
> **iii**) The definitions provided for each ICF category & their applicability in describing the concept in question

Important Considerations for ICF Coding

A) Unspecific concepts. Items that present *unspecific/general* examples of a concept may be appropriately classified using '<u>unspecified</u>' ICF categories (*i.e*. ending in '**9**' at the 3rd or 4th ICF level). Doing so indicates that respondents are prompted to make an appraisal about a concept 'in general' or in an 'unspecific way' and may choose to base their answer on any number examples of the concept presented.

> ***Example****:* Cell 'C2' in Appendix E contains an item that presents an appraisal of 'housework' - both as an *unspecific/general* concept and as *specific* tasks

B) Specific concepts. An item that presents a concept which is described by the ICF, but **<u>not</u>** assigned its own unique code may be considered to be '<u>specified</u>' (*i.e*. ending in '**8**' at the 3rd or 4th ICF level). Such coding reflects the fact that respondents are prompted to make an appraisal of a *specific* concept that is described vaguely or 'in general' by a lower-level ICF code, but is not assigned its own descriptive category at a higher-level.

> ***Example****:* Cell 'B2' in Appendix E contains an item which presents a highly specific social concept (**S**) that belongs under the ICF category **d640** (housework), but is not assigned its own unique 4th level category within the framework. Thus the concept is coded: **d6408** (doing housework, other specified) which suggests that it is a specific housework activity that is not assigned its own ICF code.

C) Unclassifiable concepts. In cases where 'vague', 'unclear' or 'higher-order' concepts escape accurate classification using the ICF, shorthand descriptive abbreviations are used to classify them. Such abbreviations include the prefix '**nd**' to indicate that a concept is 'not defined' or not amenable to classification using existing ICF codes. For example, one may use the code **nd-gh** to represent *'not defined, general health*' or **nd-qol** to represent '*not defined, quality of life*' since neither of these concepts can be classified using an existing ICF code.

These shorthand descriptive abbreviations do not necessarily imply that there are problems with the ICF framework; rather they suggest that 'vague' 'unclear' or 'higher-order' concepts encountered may refer to *many* categories contained in the ICF yet to none concretely (Cieza & Stucki, 2005). Such concepts are characterized as being related to different ICF categories to varying degrees and indeed, one or a few categories in particular may form the basis of a respondent's appraisal depending on individual characteristics and item context. Thus, it is often inappropriate to classify

such concepts using an existing ICF category, or multiple categories describing the concept of interest. Other concepts that are difficult to classify may belong to a 'personal factors' ICF category which has not yet been colonized with alphanumeric codes and concept definitions. In any case, it may often be difficult to classify concepts using existing alphanumeric ICF codes thus necessitating the use of shorthand descriptive abbreviations in place of any existing code.

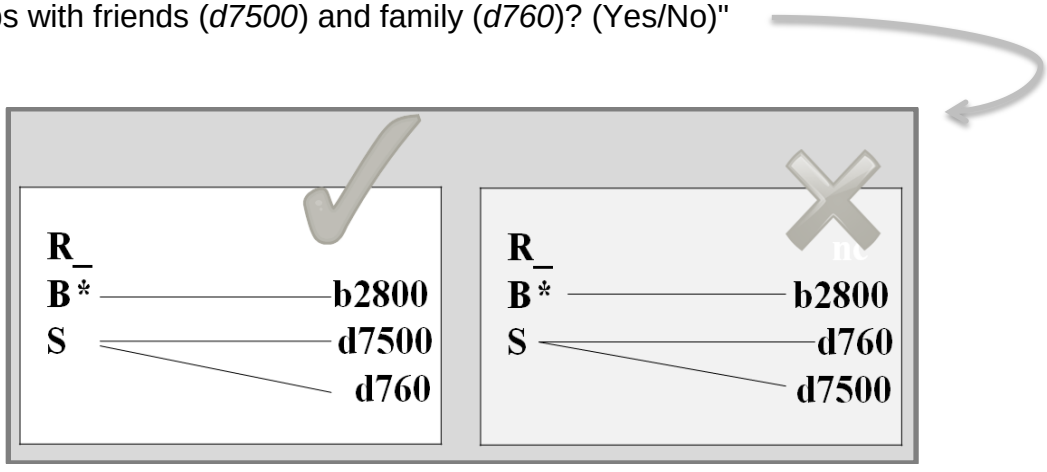
> ***Example**:* Cells 'C3' & 'D2' in Appendix E contain concepts that are not defined (***nd***) by an existing alphanumeric ICF code, thus is assigned a shorthand descriptive abbreviation.

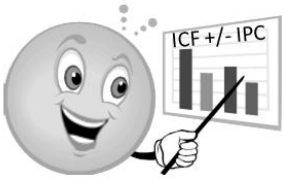
D) Absence of concepts. *Unanchored* emotional appraisals (**E**) may be appropriately classified using ICF code: **b152** (emotional functions). This is the only case where ICF codes can be appropriately used to define and classify an *appraisal.*

> ***Example***: Cell 'D3' in Appendix E contains an item that presents an *'unanchored' emotional appraisal* which is appropriately classified using ICF code **b152**.

E) Ordering of concepts. If two or more ICF codes are appended to a *single* IPC concept classification, these codes should be presented in the order that they appear within the item.

Example: "Does generalized body pain (*b2800*) negatively impact your social relationships with friends (*d7500*) and family (*d760*)? (Yes/No)"





Presenting ICF Data

(With & without IPC codes)

Compound item codes (IPC + ICF classifications) can be presented using frequency tables and radar plots (i.e. using the same formats as **Table 4** and **Figure 10** on pg. 24-25 through replacement of 'IPC-only' classifications with *compound item code*s).

ICF codes may also be *disaggregated* from the confines of IPC classifications, with the IPC framework serving merely as a method for identifying exactly which concepts are important to classify using the ICF. Use of the IPC to prepare data may be especially useful in cases where ICF codes are of primary interest *but* problems with data collection exist including:

i) Inter-rater disagreement regarding the amount of *contextual information* to consider when classifying item content occurs (Cieza et al., 2005; Fayed et al., 2011)

ii) Inconsistencies occur between raters in identifying exactly which concepts are most important to classify (Fayed et al., 2011)

Disaggregated ICF data (i.e. ICF codes separated from the confines of the IPC structure) can be displayed using a frequency table like the one presented in Table 5 below:

Table 5. Frequency table of *disaggregated* ICF codes

ICF Code	Questionnaire 1	Questionnaire 2	Questionnaire 3	Questionnaire 4
b1342	1		3	2
b280	2	3		1
d4105	1		1	1
d450		2	3	
e1101	3	2	1	

b1342: Maintenance of sleep, b280: Sensation of pain, d4105: Bending, d450: Walking, e1101: Drugs

The frequency table above is useful for determining the frequency of concept utilization &content overlap among sampled questionnaires, but fails to convey information pertaining to the manner in which concepts are appraised (i.e. rational vs. emotional) and does not provide syntax required for determining the existence/nature of relationships that exist between two or more concepts presented within items. In cases where these types of attributes are of interest, it is useful to generate compound item codes that consider both concept definitions & item perspective using the IPC framework.

Appendix A: Examples of *inorganic* concepts

- Quantum forces, gravity, electromagnetism, time (Berg, 2008; McWatt, 2005)
- Strong & weak nuclear forces that create atoms, chemical processes that create molecules according to atom binding rules (Berg, 2008)
- Light waves, radiation, heat

- Atoms, particles, molecules and material substances of all types (McWatt, 2005)
- Chemicals (McWatt, 2005)
- Clothing, medicine, shelter, assistive devices
- Food (everything dead is considered to be inorganic) (Berg, n.d.)

- The environment
- Living conditions

The following is an example of an item classified as an emotional appraisal of an inorganic concept (**E_I)**: "*I am currently happy with my assistive device* (*1=Not at all to 4=Very much*)":

Appraisal: '**E**_' (Amount of current happiness from *not at all* to *very much*)
Concept domain: '**I**' (Assistive device)

Appendix B: Examples of *biological* concepts

- Any fundamental living force that combines molecules according to three-dimensional fitness and biological value (Berg, 2008)
- Primal functions that exist according to the "Laws of the jungle" (Johnston, 2010)
- Sensory functions such as sight, taste, smell, touch, hearing (Berg, 2008), proprioception & 'interoception' (i.e. nociception, hunger & sensation of internal organ movements)
- Movement, ambulation, relaxation & contraction of muscles
- Reproduction, growth, digestion, defecation
- Nerve impulse propagation & transmission

- Cells, cellular organs and cellular structures
- Bodies, body parts and body structures
- Bones, muscles, internal organs, sensory organs, neurons, blood vessels

- Physical health, health status
- Diseases, illnesses, health problems, health conditions
- Bodily systems
- Physical disability, physical capacity

The following is an example of an item classified as a rational appraisal of a biological concept ('**R_B**'): "*I am <u>able to swallow</u> without difficulty* (*Yes/No*)":

Appraisal: '**R_**' (Presence/absence of difficulty)
Concept domain: '**B**' (Swallowing ability)

Appendix C: Examples of *social* concepts

- Developing, maintaining or adjourning relations with others
- Communicating, conducting business, supporting others, shunning others, retaliating
- Fulfilling life roles, participating in social situations/roles (e.g. working, teaching, instructing, serving, sports, helping)
- Commerce or law enforcement activities

- Laws, manners, customs, restraints, catechisms, arts (Johnston, 2010), language (Berg, 2008)
- Popularity, reputation and communities (McWatt, 2005)
- Religious organizations, governments (Berg, 2008), businesses entities
- Nations, countries, townships (Berg, 2008)
- The 'titles' we give to individuals (i.e. family member, friend, citizen, job titles etc.)

- Social well-being, social health
- Social life, social problems

The following is an example of an item classified as a rational appraisal of a social concept ('**R_S')**: *I participate in <u>friendly conversations</u>* (*1=Never to 4=Very often*)":

Appraisal: '**R_**' (Frequency of participation from *never* to *very often*)
Concept domain: '**S**' (Friendly conversations)

Appendix D: Examples of *psychological* concepts

- Thinking (Johnston, 2010)
- Rationalizing, imagining, comparing, planning, predicting, concentrating, remembering
- Forming opinions, analyzing, perceiving, interpreting, learning, memorizing
- Perceiving the past & predicting the future

- Thoughts, memories, knowledge, logic, expectations, ideas
- Intellect (where information represents something other than itself) (Berg, 2008)
- Desire for truth, inspiration (Johnston, 2010), ambition, beliefs, and personal values
- Emotions, feelings and emotional states

- Mental well-being, psychological health, emotional health
- Psychological problems/disorders, emotional problems/disorders

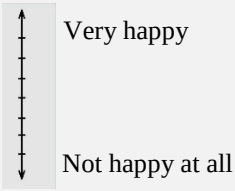
The following is an example of an item classified as '**R_P**' (a rational appraisal of a psychological concept): *"In the past 7 days, how often had you felt sad?* (*1=Not at all to 4=Very often*)":

Appraisal: '**R_**' (Frequency in the past seven days from *not at all* to *very often*)
Concept domain: '**P**' (Feeling of sadness)

In contrast, the following is an example of an item that is coded as an unanchored emotional appraisal **(E)** since it involves an appraisal of emotions occurring at the *present,* unrelated to anything else: *"I (currently) feel happy* (*1=Not at all, to 4=Very much*)*"*:

Appraisal: '**E**' Current level of happiness from *not at all* to *very much*
Concept domain: N/A

Appendix E: Sample items & assigned IPC+ICF codes

Item #	Fictitious Pain Questionnaires A-D			
	A	**B**	**C**	**D**
1	Over the past seven days, how often did you experience back pain? (1=No days to 7=Seven days) --- **R**_ **B** b28013	How much bodily pain are you experiencing? (A=None to D=A lot) --- **R**_ **B** b2800	In the past month, how much has bodily pain impacted your social relationships with friends & family? (1=None to 4=A lot) --- **R**_ **B*** b2800 **S** d7500 d760	How do you feel about your relations with friends & family? (☺ ☺ 😐 ☹ ☹) 1 5 --- **E**_ **S** d7500 d760
2	In the past month, how often have you experienced leg pain? (1=Never to 4=All the time) --- **R**_ **B** b28015	Does back pain prevent you from resetting the clock on your refrigerator to reflect daylight savings time? (Yes/No) --- **R**_ **B*** b28013 **S** d6408	Over the past week, how often has generalized pain caused problems in doing your housework such as: *laundry* or *taking out the trash*? (1=Never to 4=Always) --- **R**_ **B*** b2800 **S** d6409 d6400 d6405	Indicate your current level of happiness with your quality of life.  --- **E**_ **X** nd-qol
3	In a typical day, how frequently do you experience generalized pain? (1=Never to 5=Constantly) --- **R**_ **B** b2800	Do you feel pain in your lower limbs? (1=None to 10=A lot) --- **R**_ **B** b28015	Does your generalized pain have a negative impact on your psychological health? (Yes/No) --- **R**_ **B*** b2800 **P** nd-psyh	Do you currently feel depressed? (Yes/No) --- **E** b152

Legend:

b152: Emotional functions - feelings, affect etc.
b2800: Generalized pain
b28013: Pain in back
b28015: Pain in lower limb

d6400: Washing & drying clothes
d6405: Disposing of garbage
d6408: Doing housework, other specified
d6409: Doing housework, unspecified
d7500: Relations with friends
d760: Family relationships

Glossary

Acronyms

EEG: Electroencephalograph
EMG: Electromyography
fMRI: Functional magnetic resonance imaging
ICF: International Classification of Functioning, Disease & Health
IPC: Item perspective classification framework
PRO: Patient rated outcome

Abbreviations

B: Biological domain
E: Emotional appraisal
I: Inorganic domain
P: Psychological domain
R: Rational appraisal
S: Social domain

Symbols

*****: Dynamic/interactive relationship
/: Forced choice between concepts
,: Unrelated concepts
X: Open-ended concepts
_: Indicates that the preceding appraisal is 'anchored' to at least one concept domain.

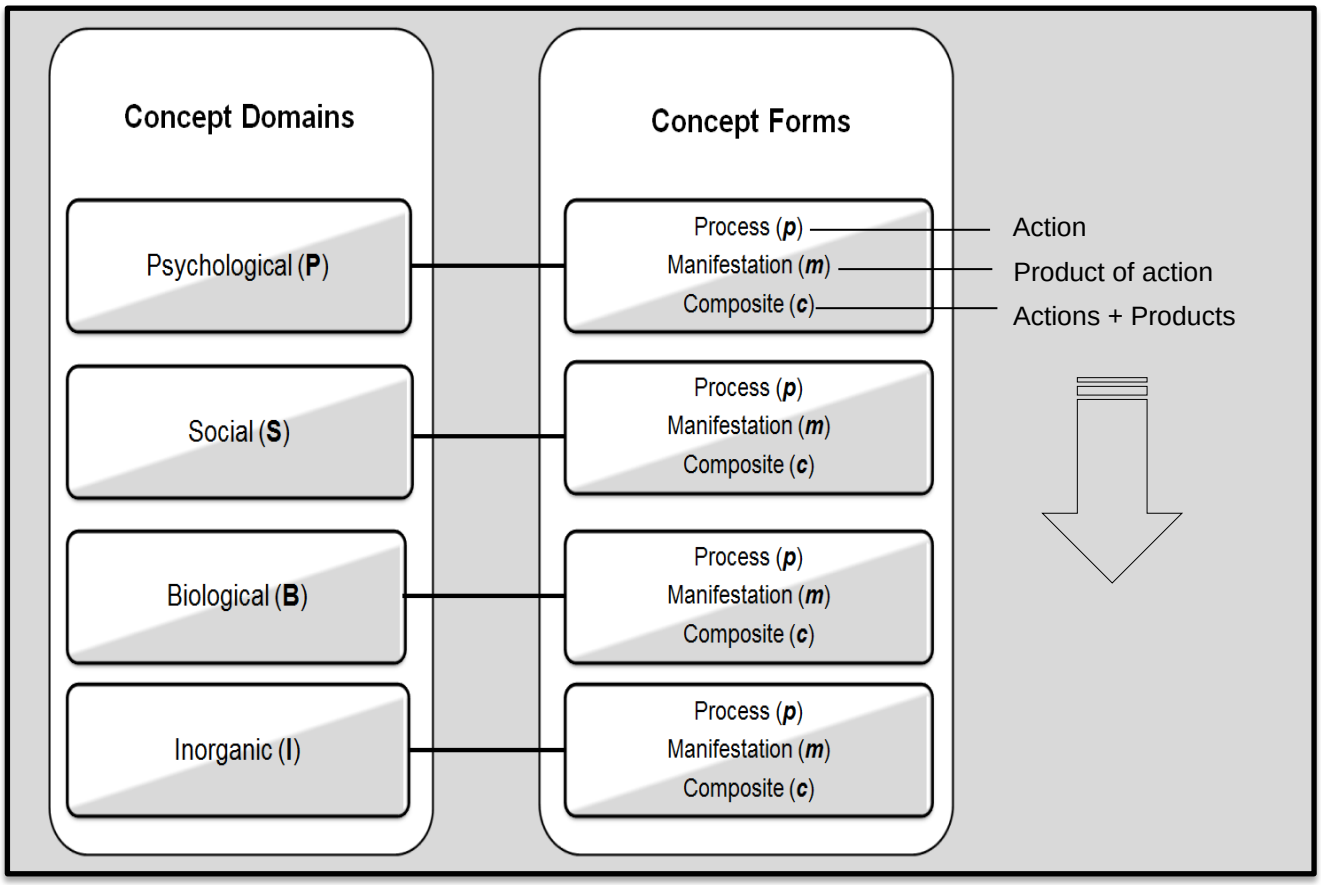
Addendum

Guidelines for appending concept *forms* to IPC codes

The process of compiling the contents of Appendix A-D (i.e. examples of specific concepts classified under each of the concept domains) necessitated frequent consideration of different ways to structure and present information. This process included consideration of the possibility that concept hierarchies exist within the confines of each concept domain. Such a structure could be used to group concepts based on similar attributes, and possibly provide 'added value' in terms of attaining increased depth of concept descriptions using the IPC.

A proposed 'intra-domain' hierarchical concept classification structure is presented in Figure 13. It was developed using the thoughts and opinions of the author using a systems perspective and in reference to content gleaned from works by Pirsig (1974, 1995) & McWatt (2005). The proposed 'concept forms' possess similar attributes regardless of their parent domain making them universally applicable. Concept forms are a new contribution to the theory of the IPC, and the usefulness of appending concept forms may depend on the amount of descriptive detail warranted and level of user-acceptance.

Figure 13. Appending concept domains with concept *forms*

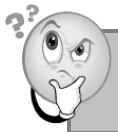


The types of concepts that constitute processes (***p***), manifestations (***m***) and composites (***c***) are identified under each parent *concept domain* to which they belong. Regardless of the parent domain, the following general statements regarding concept forms always remain true:

> i) Processes (***p***) are 'action-oriented' concepts that function to produce, maintain or destroy manifestations (***m***).
>
> ii) Composites (***c***) are concepts that necessitate consideration of both processes and manifestations (***c*** = ***p***+***m***) within the *same domain* (concepts that involve consideration of processes and manifestations in *different* domains are classified as 'open-ended' (**X**).

Manifestations (***m***) which are produced, destroyed or maintained by processes (***p***) differ slightly according to the concept domain to which they belong. Inorganic and biological manifestations are tangible, but one could not conceivably touch social or psychological manifestations. A list of helpful questions and answers is provided below to help determine the applicable concept form to append to concepts of interest.

Table 6. Helpful questions for classifying unclear concept *forms*



Conceptual Conundrum	Helpful Question	Interpretation of Answer
Process vs. Manifestation	Is the concept something that I could (hypothetically) touch?	If yes, it is a manifestation (***m***): either **I*m*** or **B*m***, depending on whether or not the thing you could touch is living. You cannot touch **S*m*** or **P*m***.
	Is the concept action-oriented?	If yes, it is a process (***p***)
	Does the concept include a suffix that determines it's tense? (i.e. 'ing' or 'ed')	If yes, it is a process (***p***)
	Can a suffix be reasonably added to the concept to change its tense?	If yes, it is a process (***p***)
Composite vs. Process or Manifestation	Does the concept necessitate consideration of both processes and manifestations within the same concept domain?	If yes, it is a composite (***c***)
Composite vs. Open-Ended	Does the concept necessitate the consideration of more than one concept domain?	If yes, it is an open-ended concept (**X**)

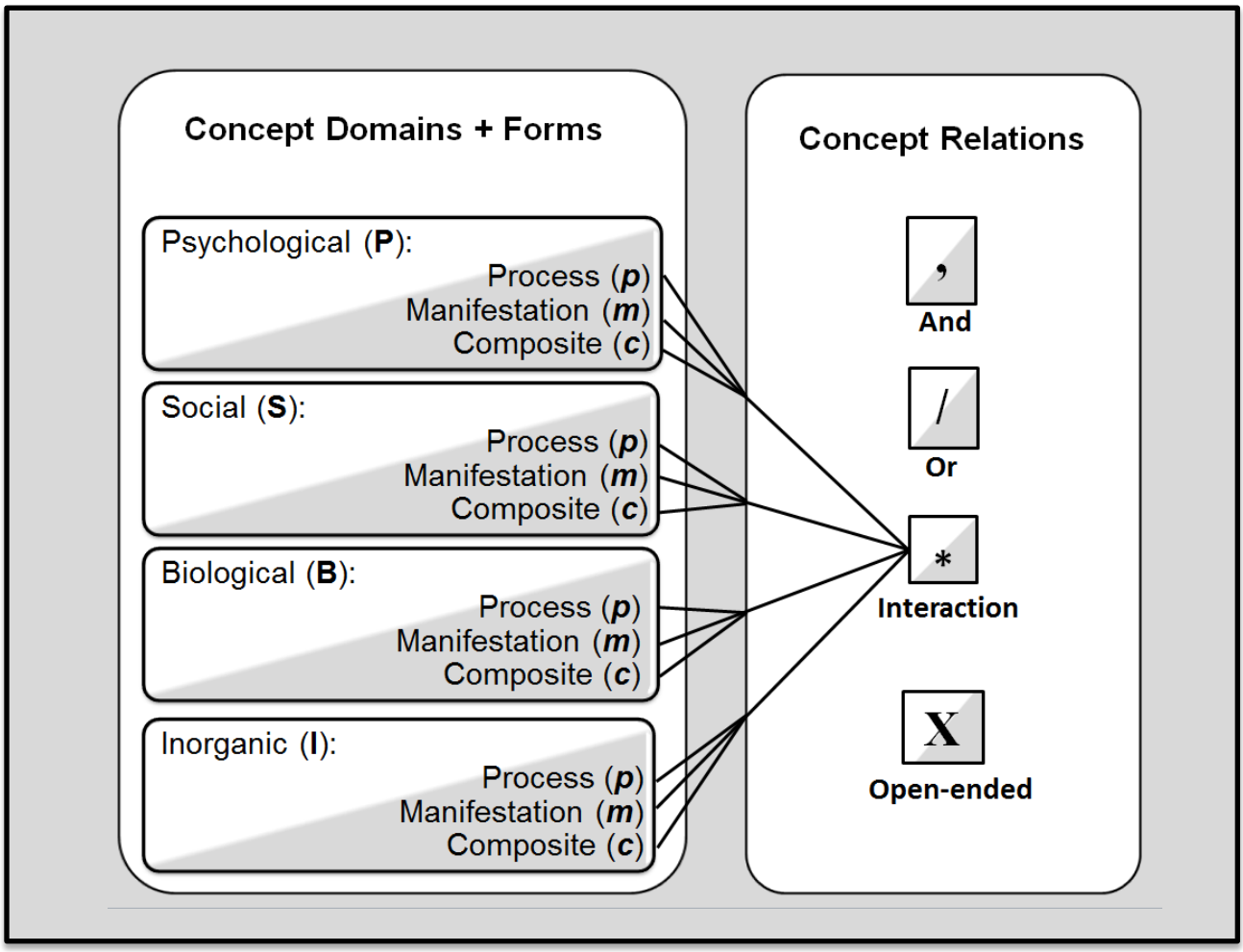
See Appendix A-D for examples of concepts classified under each *form

Within each of the appendices, concepts thought to be processes (p**) were assigned to the upper lightly shaded portion of the text box, manifestations (**m**) were assigned to the middle `medium` shaded portion, and composites (**c**) to the lower darkest shaded portion*.

Integration of concept *forms* in the IPC classification process

Concepts are always assigned to a domain before appending an IPC code with the most applicable concept *form*. The subsequent assignment of *concept relationships* (Figure 14) does not differ where concept forms are appended.

Figure 14. Classification of concept relationships that consider concept *forms*



Examples of IPC coding that considers concept *forms*

Sample Item #1: "*Over the past 2 weeks, to what extent has your physical health impacted your psychological health*? (*1=Not much to 7=Very much*)"

This item is coded '**R_B*c*∗P*c***' to represent a rational appraisal (**R**) of a dynamic relationship (∗) between biological & psychological composites:

Appraisal: '**R**_' (To what extent in the past two weeks from *not much* to *very much*)
Concept domains & forms: '**B*c**P*c***' (physical health * psychological health)

Appending concept forms adds descriptive detail that is especially warranted in situations where no existing ICF classification can be assigned (as with the concepts presented above). That is, the addition of concept *forms* gives an investigator a clue about the characteristics about a concept in the absence of any appropriate ICF descriptors. In the case of *composites* (***c***), an investigator may assume that:

i) The concept required a respondent to consider both processes & manifestations
ii) The concept may lack a clear definition, or may be interpreted differently among respondents*
iii) The concept can probably be considered to be 'higher order', yet lacking criteria that would classify it as an open-ended concept (i.e. consideration of 2 or more domains).

This may be especially applicable in situations where concepts are not defined (nd**) by the ICF when formulating full item codes.*

*Commonly sampled concepts classified as composites (**c**) may include:*

Inorganic	Biological	Social	Psychological
- Environment - Living conditions	- Physical Health - Health condition	- Social life - Social well-being	- Emotional Health - Psychological problems

Sample Item #2: "*Physical pain (**Bp**) prevents me from being able to lift my arm above my head (**Bp**) (1=Not at all to 4=All the time)*".

Items sometimes investigate a relationship between two distinct concepts that possess identical concept forms. The sample item above presents a rational appraisal of an interactive relationship between two biological concepts each identified as *processes*, thus is classified accordingly as: '**R_B*p**B*p***'.

Sample Item #3: *"In the last 2 weeks, how much difficulty did you have in your ability to stand unassisted for 30 minutes of time* (*1=None to 4=A lot*)".

This item presents a rational appraisal of an interactive relationship between thirty minutes of 'time' (an inorganic process) and the ability to stand unassisted (a biological process) thus is classified as '**R_I*p*∗B*p***':

Appraisal: '**R_**' (Amount of difficulty in the last two weeks from *none* to *a lot*)
Concept domains: '**I*p******B*p***' (Relationship between 30 minutes of time and standing unassisted)

Sample Item #4: "*How do you feel about your overall quality of life? (1=Extremely sad to 6=Very happy)*"

This item is classified as an emotional appraisal of an open-ended concept (**E_X**), thus no concept *form* is appended.

Appending ICF codes to IPC classifications that include concept *forms*

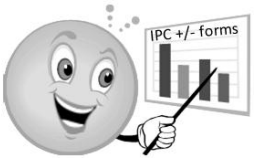
The process of assigning ICF codes to IPC classifications does not differ depending on the presence or absence of appended concept *forms*. IPC classifications (including concept forms) are determined prior to linking concepts with appropriate ICF categories.

Table 7. Sample items and composite item codes that consider concept form

Item #	Fictitious Questionnaires			
	A	**B**	**C**	**D**
1	Rate your current level of happiness with your physical health: Not Happy ——— Very Happy --- **E_** **B*c*** → nd-ph	How much does your physical health affect your relationships with family? (0=Not at all to 7=A lot) --- **R_** **B*c**** → nd-ph **S*p*** → d760	How much time do you spend with your family? (1=None to 4=A lot) --- **R_** **S*p*** → d760	How do you feel about your family relations? (☺ ☺ 😐 ☹ ☹) 1 5 --- **E_** **S*p*** → d760

d760: family relationships, nd-ph: not defined- physical health

Composite item codes (IPC+ICF) that consider concept forms are data-rich and capable of contrasting the content of items based on differences in highly specific attributes. This may be especially important in the absence of applicable concept descriptions using ICF classification codes.

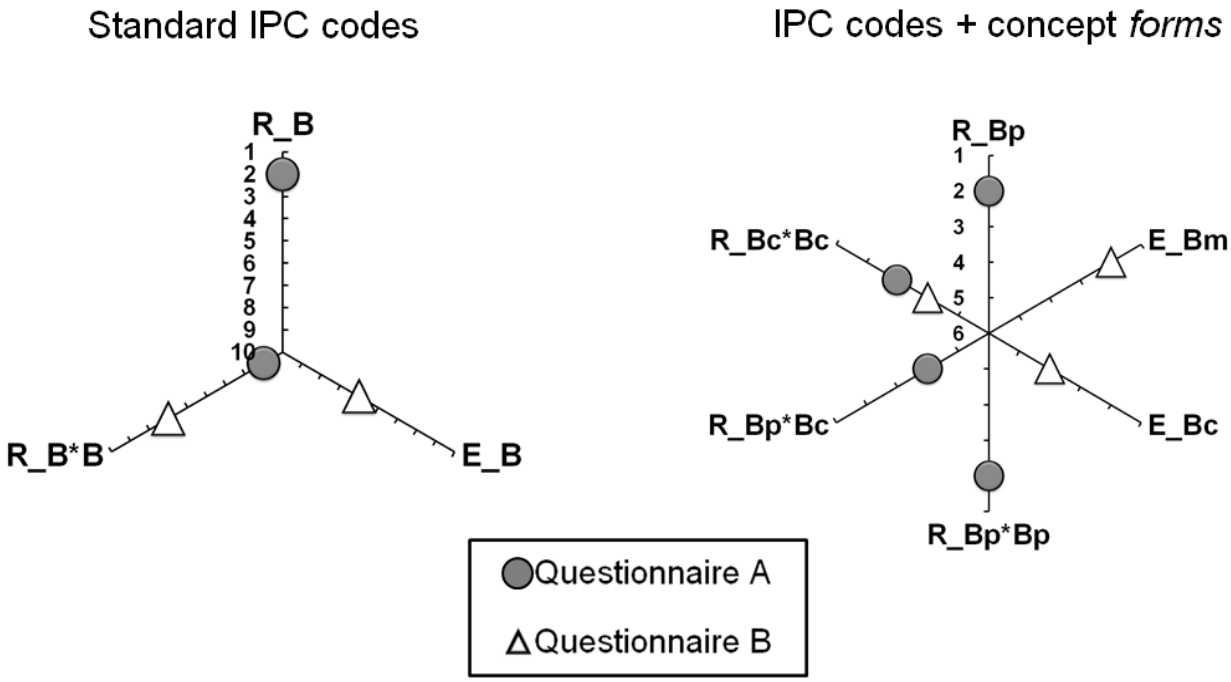


Presenting IPC Data that includes concept *forms*

Frequency tables & radar plots (see **Table 4** and **Figure 10**) can be used to present IPC codes that include both concept domains & forms, either in the presence or absence of appended ICF codes.

A side by side comparison of radar plots (Figure 15) demonstrates how item content can be differentiated when concept forms are considered. When only "standard" IPC codes are considered (without appended concept forms), differences in item attributes may be difficult to discern. Appended concept forms may be useful for detecting differences in item content based on a few specified attributes of concepts classified by using the IPC.

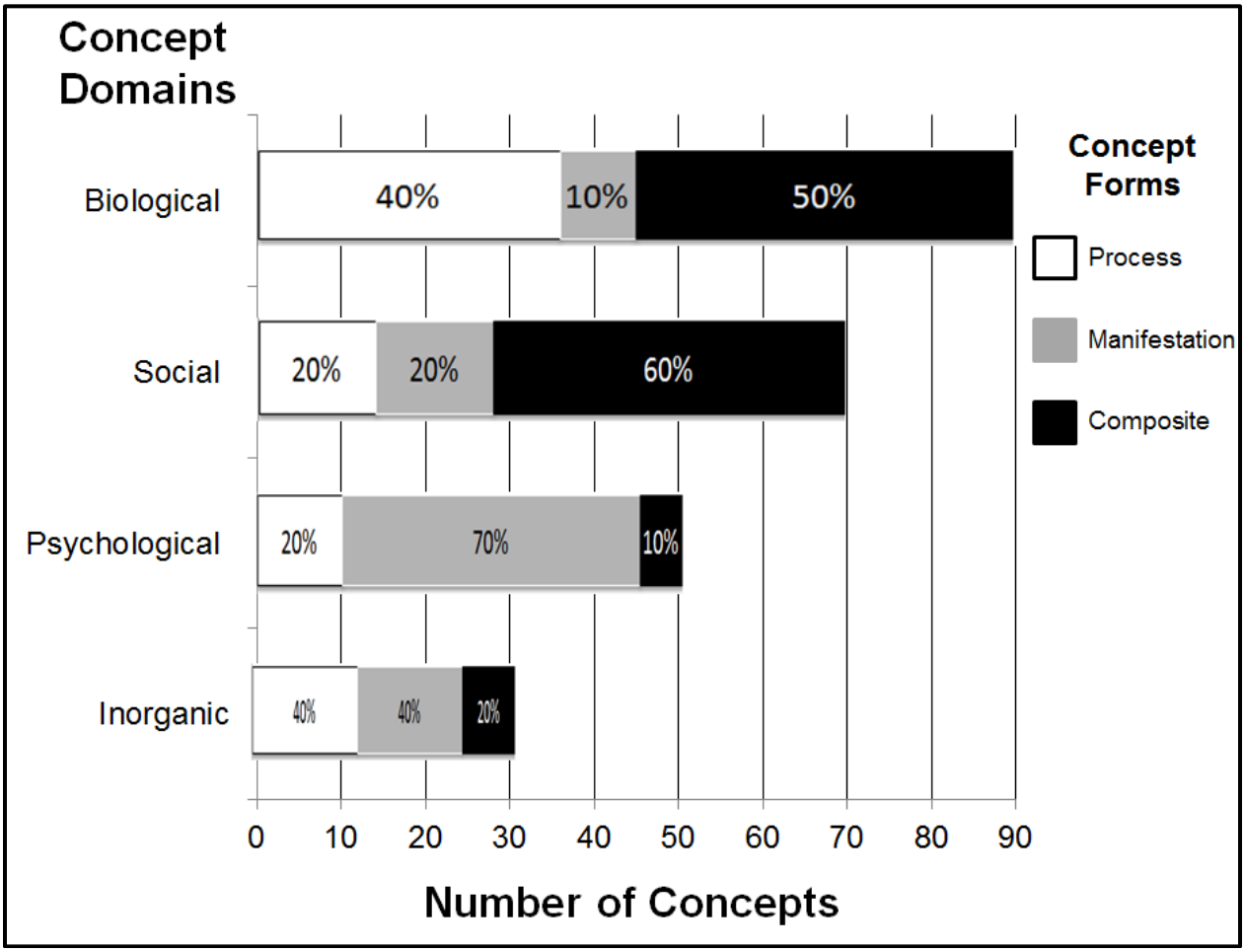
Figure 15. Comparison of plotted IPC data +/- concept forms



Using the exact same questionnaire items, the above figure demonstrates how content profiles may differ based on the presence or absence of appended concepts forms.

Where information pertaining to concept *form* is of particular interest, a clustered bar chart can be a useful format to present data generated from the classification process (Figure 16). Doing so allows for a comparison of content profiles based on specified attributes of concepts presented.

Figure 16. Presenting concept domains + forms using clustered bars*



*Sample data represent a fictitious pool of 200 items. Bar lengths represent the number of concepts that are appended to each of the items classified under the each concept domain. Segment widths represent the percentage of concepts (under the heading of each concept domain) that are appended to each concept form. For example, among 200 items, 90 contained concepts classified as being biological. 50% of these biological concepts were characterized as being 'composite' forms **(c)**. Only 30/200 items contained concepts classified as being inorganic, and only 20% of those inorganic concepts were characterized as being composites.*

**The data presented do not account for appraisal types, concept relationships or open-ended concepts.*

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