

17. Systematic interviews and analysis

Using the repertory grid technique

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When assessing game-oriented work, researchers and designers alike are faced with a difficult choice. On the one hand, an interview session with players could focus on specific game mechanics and design ideals behind them, which the researcher has defined to be of particular relevance. On the other hand, it may also be in the interest of researchers to minimize the direct impact they have during the interview phase itself in order to allow the players to drive, emphasize, and reflect on what they perceive as particularly relevant. This chapter focuses on presenting the flexibility of the repertory grid technique (Kelly, 1955) when used as an interview technique in game-oriented research. Furthermore, the chapter covers some of the systematic tools for analysis—statistical, numerical, and interpretative—that the technique has been extended with over the years.

Personal construct theory

The repertory grid technique is a methodological extension of the personal *construct theory* (Kelly, 1955). Personal construct theory argues that individuals make sense of their world through the construction of dualities that allow the individual to place a particular experience (from an object, an action, or another person) on the scale that the duality creates. For instance, when asked to describe someone, the response could be in terms of how tall or short, relaxed or anxious, and smart or annoying, that this person is perceived to be by the respondent. Noteworthy is that the terms themselves have a particular and highly subjective meaning to each respondent. Furthermore, the duality is formed between the two concepts that make sense to nuance between. Personal construct theory stipulates that constant testing of conscious experiences, individuals build an ever-evolving network of dualities that they apply to make sense and create meaning.

The foundation Kelly (1955) uses for this, is his argument for “man-the-scientist” (today perhaps more appropriately expressed human-the-scientist), that is that this construing of the world is no different than what any scientist might use.

Man looks at his world through transparent templates which he creates and then attempts to fit over the realities of which the world is composed. The fit is not always very good. Yet without such patterns the world appears to be such an undifferentiated homogeneity that man is unable to make any sense out of it. Even a

poor fit is more helpful to him than nothing at all [...] Let us give the name constructs to these patterns that are tentatively tried on for size. They are ways of construing the world.” (Kelly, 1955, p.8–9.)

Constructs are used for predictions of things to come, and the world keeps on rolling on and revealing these predictions to be either correct or misleading. This fact provides the basis for the revision of constructs and, eventually, of whole construct systems. (Kelly, 1955, p.14.)

These constructs are, given the subjective nature of them, what Kelly refers to as the personal constructs. Implicitly, the pairing of two phenomena into a scale also indicates their relation to a third phenomenon, which does not fit into this scale (Bannister and Fransella, 1985). This third phenomenon could however be related to a fourth phenomenon as part of another construct, which in turn is different from a fifth phenomenon, and so on—subsequently yielding an intricate network of personal constructs which dictates the sensemaking process of environments, social interaction and artifacts.

Implied by the focus personal construct theory has on individuals and individual perceptions is a phenomenological stance towards meaning creation (cf. Husserl, 1900). Phenomenology is the study of how conscious experiences give rise to meaning. By arguing that personal construct theory is inherently phenomenological, we interpret for instance the ‘man-the-scientist’ example above as an expression of conscious sensemaking. This implies that subjectiveness is recognized and embraced by the repertory grid technique, and that generalization must be done carefully as an expression of the context rather than as evidence of an objective truth (i.e. what a more Kant, 1781, inspired theoretical view of perception and meaning creation would argue). In simpler terms, the repertory grid technique is a tool that strives to open the doors to an individual’s meaning creation process related to a specific experience.

As Bannister and Fransella (1985) argue, the two phenomena in a personal construct may—and typically are—related to other phenomena. This implies that a larger network of related personal constructs make up what Heidegger (1927) would refer to as an ontology of objects in the world, that is the set of elements through which meaning is created in any given situation. As with personal constructs, ontologies are re-negotiated over time as new experiences and objects test their applicability and relevance.

This change process is similar to the role of coupling within phenomenology. Coupling is an expression of the effectiveness to convey intentionality, that is, the meaningfulness of a particular action. Originally, Brentano (1874) described intentionality as a human actor’s ability to express meaning through action, while derived intentionality (Dourish, 2001) has since been described as the interpretation of meaning that an observer makes (based on her own experiences) as another actor performs (or records, as in the case of a game mechanics that a game developer implements, for instance) an action. As the coupling between an action and the meaningfulness of this action becomes questioned, existing ontologies are challenged and re-assembled in new ways to compensate for the change in (experienced or derived) intentionality. Similarly, as personal constructs are situated dualities related to a particular context, changes in the context implies that the personal constructs may also change in order to compensate for new experiences of action and new meaning of this action.

While the focus on personal construct theory is individual, this does not mean that comparisons between different sets of personal constructs cannot be made. On the contrary, just as intersubjectivity (Schutz, 1932)—the creation of shared meaning between two or more actors—is of significant relevance

to phenomenology, shared sets of personal constructs between several actors speak to the strength of the coupling between an experience of action and the intentionality of this action. While even cases of strong coupling (as all experiences) are subject to change over time, such cases may still be considered particularly suitable to for instance further analysis, development of design principles to support them, or as guide for product development prioritization. In this regard, comparisons between the personal constructs of several individuals could even be argued as one of the core opportunities afforded by personal construct theory.

The repertory grid technique

Through the methodological technique referred to as the repertory grid technique, personal construct theory identifies and systematically analyzes the captured personal constructs—individually for in-depth understanding of a single meaning creation process, or in comparison with other individuals to recognize cases of particularly strong coupling.

The repertory grid technique has been used in a wide array of fields, including information systems research (cf. Hunter, 1997; Moynihan, 1996; Tan and Hunter, 2002; Olsson and Russo, 2004), clinical psychology (Shaw, 1980; Shaw and Gaines, 1983; 1987), organizational dynamics and organizational design (Dunn and Ginsberg, 1986; Wacker, 1981), and human computer interaction (Easterby-Smith, 1980; Fallman, 2003; Fallman and Waterworth, 2010). Given the suitability and use of the repertory grid technique in other research fields, the technique has significant support for its applicability as a general research tool and subsequently may safely be embraced in game-oriented research as well.

Through a number of illustrations related to game-oriented research, this chapter will exemplify how to use repertory grids as methodological tool of inquiry. Before we can move to these illustrations, however, we must first establish what the main components are in the technique and how they are used to empirically elicit and evaluate peoples' subjective perceptions. The three main components involved in developing repertory grids are elements, constructs, and links (Tan and Hunter, 2002).

ELEMENTS

The elements represent that which is being examined, and could for example be different architectures, or different social groups. Elements may be *supplied* by the researcher (Reger, 1990) — which is common when using theory to guide element selection (e.g. using Lund, 2003, to explore the material aspects of a particular environment) — or *elicited* from the participants (Easterby-Smith, 1980) — using scenarios, pools of potential elements, or discussion with the respondent. Several rules apply for what makes valid elements, e.g. that they should be discrete (Stewart and Stewart, 1981), homogenous (Easterby-Smith, 1980), non-evaluative (Stewart and Stewart, 1981) and representative (Beail, 1985; Easterby-Smith, 1980).

CONSTRUCTS

The constructs are used as the assessment basis for the elements under examination, and could in a comparison of social groups include for example «small–large», «passive–active», «hierarchical–empowered», and «local–distributed». A technique known as laddering is commonly employed during elicitation, where neutral and probing questions such as “why [...]”, “in what way [...]”, and “can you

elaborate on [...]” are asked to insure that the researcher understands well the context of the labels used by the respondent (Reynolds and Gutman, 1988).

There are four ways to approach respondents with constructs.

1. Constructs may be supplied by the researcher in order to control the exploration, and allow for statistical analysis of similarities and differences among the respondents (Latta and Swigger, 1992).
2. Constructs may be elicited based on triadic comparison of elements. This approach randomly presents three elements at a time to the respondent, who points out which of the three is different than the other two, and what this difference is. Labeling differences and similarities is entirely done by the respondent, without researcher intervention. This process is repeated over all possible combinations of elements or using a pre-determined set of combinations between elements. A combination of supplied and elicited constructs may be used if a certain degree of freedom as well as control is important (Easterby-Smith, 1980).
3. Group elicitation of constructs is essentially a workshop format of normal elicitation (Stewart and Stewart, 1981). Subjective meaning of each individual respondent is somewhat lost as the group discusses and agrees on what best represents them as a whole. However, comparing individually elicited constructs with group elicited constructs can in itself capture which parts overlap between the individual and the group.
4. Full context form may also be used to elicit constructs. This implies leaving it to the respondent to sort through all elements and place them in any number of piles, where each pile has a specific meaning to them, and where all elements in each pile have the same aspects associated with them. Once the sorting is done, the respondent is asked to give two or three words that capture the unique meaning of each pile. This has been used in cognitive psychology (Reger, 1990) and to find shared meaning in organizational contexts (Simpson and Wilson, 1999). This fourth alternative uses its own way of linking elements with constructs through statistical analysis of the groupings and relationships between them (rather than the more common approach detailed below).

LINKS

The links between elements and constructs are provided by finally asking the respondent to *rate* each element on a scale using the constructs. Odd number scales such as one to five, one to seven, one to nine, and one to eleven have been successfully used (Tan and Hunter, 2002). It has been suggested that retest reliability is likely to be lower when using a scale of more than one to five (Bell, 1990). Those in favor of larger scales argue that this offers greater freedom in rating to the respondents, and recommend a rating scale larger than the number of elements that are being compared (Hunter, 1997). Alternatively, respondents may *rank* all elements between the labels of each construct. Using ranking, respondents may however feel forced to find differences between elements that they do not subscribe to. As a result, rating is the most common technique used (Tan and Hunter, 2002).

Using repertory grids in game-oriented research

For game-oriented research, the potential use of the repertory grid technique of course depends on

the research interest first and foremost. The technique is inherently comparative, regardless if treating them as idiographic or nomothetic entities. The notions of idiographic and nomothetic grids are explained further in the latter part of this text, but in brief—an idiographic grid focuses on the subjective experiences of the individual, while a nomothetic grid focuses on the comparison of individual or group grids. The comparative nature stems from the set of elements that are being compared and drive the rating (and possibly entire elicitation process) of constructs. In the case of idiographic grids, both elements and constructs may be elicited, while nomothetic grids require that either elements or constructs (or both) are supplied by the researcher.

The highly structured interview technique lends a strong support to researchers. This process may (if so desired) be almost entirely free from researcher bias, but is still flexible enough to allow respondents to define the language (through construct elicitation) that they themselves feel is most appropriate given their subjective experiences and meaning creation process while playing. For instance, if the interest lies in understanding player styles over different map designs in *StarCraft 2* (Blizzard Entertainment, 2010), each map is an element candidate. The researcher may then chose the sample type and sample size they expose these elements to, for example, players of all races, only Zerg players, only Terran players, only Protoss players, players recognized as rush/timing attack players, players recognized for their late-game prowess, etc. Similarly, if the researcher interest is to compare different implementations of for instance player-vs-player combat in MMOs, the different MMOs become the elements used to elicit constructs. The selected MMOs must of course all have some form of player-vs-player element in order to be representative (cf. Beail, 1985; Easterby-Smith, 1980)—as listed earlier in the rules for element selection.

If, on the other hand, the research focus lies in testing the applicability of research hypotheses, it may be relevant to supply constructs rather than elicit them to increase researcher control over the direction of the results. Research hypotheses can be developed in many ways, but are commonly defined through a literature review, based on a pre-defined theoretical research framework, or through best-practice review of de facto patterns used in industry or by end-users. An example of this could be hypotheses related to the common argument for continuous playtesting as important during all stages of game design and development (cf. Fullerton, 2008). Through literature review of effective playtesting techniques, a set of related hypotheses could be generated for what ‘should’ be useful at different stages of design and development. By conducting repertory grid sessions with designers and developers in game developing organizations—using the identified playtesting techniques as elements—researchers may test extant research understanding versus actual use and impact in industry.

Constructs are not the only ones that may be elicited however. Using formal analysis (see chapter 3), gameplay design patterns (cf. Björk and Holopainen, 2004; Holopainen, 2011), or game design mechanics (cf. Järvinen, 2008; Sicart, 2008), recognized patterns and mechanics may be used as sources for supplied constructs, that respondents are asked to elicit game support for. As argued earlier, elicitation may also be in part supplied and in part elicited. If we for instance start from a pre-defined set of constructs related to gameplay design patterns to elicit game support for these, it is feasible to include a second repertory grid phase where additional gameplay design patterns within the elicited set of games are elicited. This would make the study in part nomothetic as it starts from a pre-defined set of constructs, and in part idiographic as it allows each respondent a chance to add constructs based on the individually elicited elements. If the researcher, prior to the second elicitation phase, would combine

all elements elicited from the respondents during the first phase and expose all respondents to the full set of elements, the study would be nomothetic and allow for comparison between participants.

As an effect of the comparative nature of repertory grids, results typically lead to a set of characterizing constructs that may be discussed in relation to the particular research focus. As illustrated by Olsson (2011), the grid results themselves do not have to be the end result of a study. Instead, the results may for instance be used as foundation for theory development by applying a theoretical framework to the grid results to further contextualize the results and identify gaps between theory and grid results. Such gaps imply research opportunities that in themselves are contributions and potentially end result of the study, or may be viewed as opportunities for design and development activities. Such activities may then be assessed either using repertory grids again later, or through other assessment techniques based on researcher needs and relevance for the study.

Analyzing repertory grids

As earlier discussed, repertory grids are founded on the personal construct theory and subsequently hold particular interest in the individual perspective. A result of this is that repertory grids are commonly analyzed individually, and we will therefore begin this section by outlining common approaches for such analysis. Following this, we present analysis techniques focusing on commonalities in order to capture coupled experiences that are shared between sets of individuals. This section presents a subset of the analysis techniques described in Tan and Hunter (2002) with related links to the free-to-use WebGrid tool (WebGrid, 2014) where applicable. The reliance on WebGrid illustrations of this chapter is motivated by the tool being free-to-use and its steady development over the last decade (maintained by the University of Calgary and University of Victoria). A considerable body of research has furthermore been developed in relation to it, which is also shared on its website (RepGrid, 2014) together with links to both the free web based WebGrid tool (WebGrid, 2014) and RepGrid stand-alone applications available in limited personal free-to use and full research/enterprise licenses (Center for Personal Computer Studies, 2014). Analysis techniques not covered by WebGrid that are presented below are still equally relevant to consider, but starting by familiarizing oneself with the free analysis tools is a good way to get into repertory grids.

INDIVIDUAL GRID ANALYSIS

Content analysis implies identifying the most common tendencies through simple frequency count. This means that the researcher counts how many times particular elements or constructs are discussed by the respondents (Hunter, 1997; Moynihan, 1996). Alternatively, categories of similar constructs or elements may be identified and counted (Stewart and Stewart, 1981). This may be particularly useful if the object being counted (constructs or elements) were elicited from the respondents, as this reduces the likelihood that the same constructs are mentioned more than once.

Rearranging repertory grids (Bell, 1990; Easterby-Smith, 1980) is done by reordering elements and constructs so that constructs that are similarly rated are placed close to each other. As much as possible, this is then repeated for the elements in order to position similarly interpreted elements as close to each other as possible. When rearranging repertory grids, visual focusing (Hunter, 1997) can be performed. This means that construct poles may be reversed if this aids identification of similar constructs or ele-

ments. The reason for this is that patterns in the ranking of elements are in this case the focus and not the order in which respondents identified the poles (Hunter, 1997). An illustration of this process may be found in Stewart and Stewart (1981). WebGrid (2014) supports automatically rearranging and visual focusing as part of the FOCUS cluster (Shaw and Thomas, 1978) transformation analysis.

Transformation is a common approach for analyzing repertory grids. This includes FOCUS cluster analysis (Shaw and Thomas, 1978), where clusters of similarly rated elements and constructs are placed in linked groups. These links show the level of numerical similarity between the elements and constructs. Highly similar ratings for two constructs may signify that they are in fact the same aspect but with minor nuance differences. As elaborated in for example Fallman (2003) and Olsson (2011), it is recommended to semantically review clustered elements and constructs in order to verify that the similarities are likely because of a shared fundamental aspect rather than coincidental similarity. Olsson (2011) and Olsson and Russo (2004) complement this semantic review with qualitative interpretations of the laddering process (Reynolds and Gutman, 1988) used during the interview session to increase the validity of the semantic review. FOCUS cluster analysis is the main form of analysis supported by WebGrid (2014), although additional analysis tools have been added in the later versions of WebGrid as a complement to FOCUS cluster analysis.

Decomposing repertory grids implies breaking the grids down to the fundamental structure. PrinGrid analysis is an example of decomposing which WebGrid (2014) supports. It uses the decomposition technique of *principal component analysis* together with the popular factor analysis (Bell, 1990; Easterby-Smith, 1980; Leach, 1980). This implies that each construct is treated as a vector to permit vector analysis to be used in order to rotate constructs as much as needed in n-space to present the constructs (vectors) as separated as possible from each other in a two-dimensional figure. Elements are then mapped onto this two-dimensional image to show which construct poles (vector nodes) are closest to them, or in simpler terms which construct poles are central to each element, and the relative distance between each element.

Cognitive content analysis may be measured in three ways: element distance, construct centrality, and element preference. Such measurements are possible to compare across individuals and are part of the original propositions by Kelly (1955). They have been widely reviewed in extant literature on personal construct theory (Dunn, et al., 1986; Fransella and Bannister, 1977; Fransella, et al., 2003; Slater, 1977).

1. *Element distance* measures the distance between elements and represents the respondent's perceived similarity between them. Elements that have construct ratings that are similar on all constructs are considered closely related while those rated differently on all dimensions are considered different. This simple definition implies that elements with high similarity are interpreted as sharing the same underlying meaning for the respondent. The FOCUS cluster analysis (Shaw and Thomas, 1978), which WebGrid (2014) supports, performs element distance measurements as part of its analysis. It is based on Reger's cluster analysis technique (Reger, 1990).
2. *Construct centrality* describes what Kelly (1955) theorized as constructs that are central to an individual in relation to all other related constructs (hold a high correlation to all other constructs). Identifying the correlation strength may be done with a simple correlation matrix or as part of factor analysis (Reger, 1990). The PrinGrid analysis of WebGrid (2014) is an example of construct centrality analysis.

3. *Element preference* refers to the desirability of each element in relation to the other elements being compared, as perceived by the respondent. This is calculated by the average score of each column of a repertory grid, where the highest average signifies the most preferred element. Care must be taken if element preference will be used as analysis technique, as the context of the grid session must clearly be stated as the preference of one element over the other(s) (depending on if using a dyadic or triadic elicitation process). If the context is to identify nuanced descriptions of differences between elements that all have merit, element preference analysis is not suitable. In addition, construct pole reversal via visual focusing (Hunter, 1997)—which is part of the WebGrid (2014) FOCUS cluster analysis—cannot be used as this would affect the calculation of column average for an element. Fortunately, element preference is simple to calculate manually (or by using a spreadsheet) based on the original repertory grid, before any other analysis is used to for instance rearrange, transform or decompose it.

Cognitive structure analysis may be measured in three ways: cognitive differentiation, cognitive complexity, and cognitive integration. The use of univariate analysis for all three measures has been reviewed widely (Dunn, et al., 1986; Fransella and Bannister, 1977; Fransella, et al., 2003; Slater, 1977). The multivariate analysis that for instance factor analysis (Reger, 1990) performs shows complexity and integration.

1. *Cognitive differentiation* describes the number of constructs used for the element analysis. Many constructs imply that the cognitive differentiation is high, while low differentiation means that only a few constructs were used. This is measured by simply counting the number of constructs elicited (or supplied).
2. *Cognitive complexity* refers to the correlation level of the different constructs. The greater the correlation level is, the greater the similarity between constructs are, which implies that the constructs are similar in meaning. Starting from a high number of constructs (large cognitive differentiation), and inspired by Fallman (2003), Olsson (2011) uses multiple stages of analysis where highly correlated constructs in each stage are grouped into single constructs in order to identify a set of constructs that best describe the full (read: high) cognitive complexity of his study.
3. *Cognitive integration* describes the degree of linkage between constructs. It is therefore the opposite of cognitive complexity and thus measured in the same way. As illustrated in the multiple stages of Olsson (2011), the cognitive integration itself provides an insight into the richness of meaning creation of respondents and the many facets that go into this process. High correlation between constructs implies a highly integrated system of interpretation (and subsequently lends support for clustering constructs together).

COMMONALITY ANALYSIS

Analyzing repertory grids from multiple respondents allows researchers the chance to identify commonalities. This may be achieved in at least two ways, and the purpose of the study directs which approach should be pursued.

Element commonality analysis focuses on identifying commonalities between the elements in question, such as for Fallman (2003) and Olsson (2011), the constructs from each respondent may simply be added

to one large summative repertory grid. For traceability, it may be relevant to index constructs from each respondent as they are placed in the summative repertory grid (which in practice is a group repertory grid), in order to preserve the ability to return to for instance laddering questions as semantic review is done during FOCUS cluster analysis. This is important as constructs may semantically appear to be the same for two or more respondents, but still be paired with different construct nodes and subsequently may imply different meaning. Correlation analysis coupled with laddering should be used in such cases to increase the reliability of the semantic review. This form of commonality analysis is in principle the same as an individual repertory grid analysis, save the added care which must be taken during possible clustering of constructs.

Respondent commonality analysis focuses on identifying commonalities between respondents rather than between elements, there are three main approaches that may be used (Ginsberg, 1989): linguistic analysis, mapping techniques, and multivariate techniques.

1. *Linguistic analysis* is a formal process used by Walton (1986) which classifies respondent expressions as part of well-established and stable construct categories within a discipline. The focus lies on minimizing researcher bias during interpretation and is a somewhat cumbersome process (Tan and Hunter, 2002).
2. *Mapping techniques* include Q-type factor analysis and multidimensional scaling (MDS). These may be used to map collective meanings from individual respondents or groups of respondents. Q-type analysis results in clusters of individuals that are closest to each other, as per their ratings of the elements. Meanwhile, MDS analysis results in elements that are most frequently rated becoming placed closer together. This yields a normative map that shows which of the elements provide best-fit for the respondents.
3. *Multivariate techniques* include for instance variance analysis, regression analysis and discriminate analysis. Such techniques are applied to each individual repertory grid and the resulting structure is compared. The goal here is to identify groups of respondents that show a similar structure in their individual repertory grids, as such similarity hints towards a similar cognitive understanding of the elements. Due to the focus on structure for groups of respondents, multivariate techniques allow for testing of hypotheses and are useful to understand group behavior, such as organizational work patterns or end-user patterns.

Further commonality analysis techniques are available in Tan and Hunter (2002), but the above are among the more common. Element commonality analysis was added to this chapter, despite not being listed by Tan and Hunter, as it is an example of recent adaptations of repertory grid commonality analysis. An attractive aspect of both individual repertory grid analysis and commonality analysis is the potential for multi-stage analysis, using complementing forms of analysis to enrich the cognitive understanding.

Repertory grid research design

SAMPLE SIZE

Repertory grid sessions and analysis is a highly intensive exercise, where researchers must have prepared well and ideally test (cf. Olsson and Russo, 2004; Olsson, 2011) the intended process against a

few respondents to validate and adapt the process before executing it on the full set of respondents. The focus on detail is high and data is treated carefully which leads to a relatively small sample size needed. Based on the findings of Dunn, et al. (1986) and Ginsberg (1989), Tan and Hunter (2002) argues that 15 to 25 respondents within a comparable population is likely to be sufficient in order to generate constructs that approximate a *universe of meaning* for the specific repertory grid foci. At this point, further constructs from additional respondents may use different words semantically but tend to represent the same cognitive meaning. From a game-oriented perspective, comparable population means that researchers must carefully consider if the respondents may be placed in one group without risk for the results to become conflicting. For instance, can novice players be mixed with hardcore players given the research objective? If the research concern is something that is not likely to be affected by the level of experience, the two can be combined. On the other hand, if the level of experience may affect the results it is instead better to use two sample populations if both groups of players are of interest. This would mean having one group of experienced players and one group of novices, ideally 15 to 25 in each if the goal is to define a generalizable set of constructs for the elements in question.

In the case of Dunn, et al. (1986), 17 respondents were used to generate a total of 23 unique constructs. Interestingly, these constructs were identified already after the tenth interview. Of course, in cases where the focus is not on identifying a universe of meaning, such as when conducting assessments of group behavior patterns in an organization, the relevant sample size may be smaller. An example of this is the shared understanding between the respondents lies in focus, perhaps as part of a change or innovation process. Using a smaller set of respondents to generate input to a more broadly distributed questionnaire is furthermore possible.

PREVIOUS EXAMPLES OF USE

Before deciding on the design of a new repertory grid study—and particularly if this is the first time conducting one—reviewing some existing studies is a good idea. While this is of course always a good idea when using a tool or technique, it is of particular value for the repertory grid technique due to the sheer number of options that the flexibility of the method provides. Some hands-on examples of use may therefore provide useful guidance and furthermore illustrate contrasting options that allow informed methodological reflections to be developed.

As repertory grids presently lacks diffusion in game-oriented research, five examples from the information systems (IS) domain will be used instead. The first four examples of table 1 are adapted from Tan and Hunter (2002) while the fifth example is from chapter five of Olsson (2011) in order to show a more recent example of extended use. Incidentally, Olsson (2011) contrasts a context-aware game for passengers in cars with other context-aware applications used in cars. As Olsson's work is positioned towards IS rather than game-oriented research, the game itself is not in focus. Rather, his focus was on the interaction patterns that the game created which were contrasted with other in-car applications to better understand the mediation process between human and non-human agents in dynamically changing contexts. The work illustrates, however, that games are also relevant as study objects in other research streams than the strictly game-oriented outlets, and that using games is also accepted in those research streams.

	Hunter (1997)	Moynihan (1996)	Phythian and King (1992)	Latta and Swigger (1992)	Olsson (2011)
Research objective	Explore the qualities of 'excellent' systems analysts	Identify situational factors from the planning and running of new IS development projects	Develop rules for an expert system to support customer tender evaluations	Validate the grid in modeling communal knowledge regarding design of system interfaces	Initial data analysis prior to applying a theoretical mediation framework for context-aware applications
Research perspective	Qualitative	Qualitative	Quantitative	Quantitative	Mixed
Nature of repertory grid	Idiographic	Idiographic	Nomothetic	Nomothetic	Nomothetic
Key findings	Several themes considered as qualities of excellent systems analysts	Identified themes over and above literatureDifferences in project managers' construction of project contexts	Identified key factors and rules influencing tender decisionsExpert system improved consistency	Commonality of constructions support the use of the grid to model group knowledge	15 characterizing aspects of context-aware systems in cars8 mediation types after individual element analysis
Element selection	Systems analysts with whom participant has interacted	Systems development projects on which participant has worked	Previous customer tender enquiries	Components of online bibliographic retrieval systems	Ten context-aware systems related to travel by car
Construct elicitation	ElicitedQualities of 'excellent' systems analysts	ElicitedSituational factors influencing risks in new systems projects	SuppliedKey factors and rules influencing tender decisions	SuppliedAttributes of system interface design	SuppliedBased on the Olsson (2011) mediation framework
Linking	Minimum context form (triadic sort) and ladder-ing	Minimum context form (triadic sort)	Minimum context form (triadic sort) and laddering	Minimum context form (triadic sort) and supplied con-structs	Constructs not perceived as relevant may be declined Laddering
Grid analysis	Rating Content analysis Visual focusing	None Content analysis	Rating (grid) Ranking (elements) Cluster analysis (FOCUS) Correlation	Rating Cluster analysis Correlation	Rating Multi-staged FOCUS Cluster analysis
	COPE and VISA		Mathematical model-ing		Semantic review and lad-dering

Sample and size	53 users and IT professionals from two insurance companies	14 systems development project managers	Two manager experts involved in assessing tender enquiries	Instructor and students who completed an information search and retrieval course	11 interviewees with experience from embedded systems development

Table 1. Five examples of how repertory grids have been used within information systems research (adapted from Tan and Hunter, 2002, and Olsson, 2011).

RESEARCH APPROACH: QUALITATIVE, QUANTITATIVE, OR MIXED METHODS?

Repertory grids lend themselves well for qualitative as well as quantitative analysis, or a mix of the two to increase the richness of possible interpretation. Two of the five examples in table 1 rely on qualitative analysis. In the case of Hunter (1997), content analysis was used to interpret aspects of ‘excellent’ systems analysts. The content analysis included visual focusing and computer software (COPE) to assist the identification of emerging themes. Meanwhile, Moynihan (1996) used repertory grids to guide the decision-making process for projects working with external clients. In this case, individual repertory grids were created for each respondent and content analysis used to identify themes based on the elicited constructs.

The quantitative approaches used by two of the five examples in table 1 rely on mathematical or statistical analysis of their repertory grids. Phythian and King (1992) used FOCUS cluster and correlation analysis on individual respondent’s repertory grids, and on combined grids for all respondents. This was used to identify key factors needed for a systematic decision-making process support tool. Latta and Swigger (1992) used cluster analysis (and Spearman’s rank order correlation—see Latta and Swigger [1992] for further details) to identify similarities in interpretations among students after interface design lectures, and the correlation strengths of these similarities.

A mix of quantitative and qualitative analysis techniques may also be used. In the example of Olsson (2011), a multi-stage process for identifying unique constructs of rich meaning was developed. In each stage, FOCUS cluster analysis was used to identify clusters of constructs with similar cognitive meaning to the respondents. These suggested clusters were then reviewed semantically to ensure that the clustering did not include falsely positive matches or contradictions that laddering responses could not explain. The quantitative FOCUS cluster analysis was subsequently reviewed qualitatively using semantic review and qualitative laddering responses to increase reliability of the identified clusters. The mix of quantitative and qualitative techniques for analysis allowed Olsson (2011) to identify unique constructs with rich meaning that capture the complex and dynamic mediation process that human actors perceive while using context-aware systems and interacting with others during travel by car. Using only quantitative analysis, Olsson would likely have had to reject and dismiss many suggested construct similarities as it would otherwise have been impossible to separate falsely similar constructs from those that laddering elaboration could support as related. Vice versa, relying only on qualitative analysis, researcher bias and sheer number of constructs would likely have prevented many of the rich constructs to be even considered.

REPERTORY GRID NATURE: IDIOGRAPHIC OR NOMOTHETIC?

Repertory grids are either idiographic or nomothetic in their nature. *Idiographic* implies that the focus is on the individual and her subjective experiences, with results subsequently presented as expressions of the individual cognitive meaning. If the research instead focuses on comparing repertory grids of individuals or groups of individuals, such grids are considered *nomothetic*.

For ideographic grids, and as was the case for Hunter (1997) and Moynihan (1996), the elements being compared are not shared between all respondents. If constructs are elicited rather than supplied, this means that generalization over the entire sample of respondents become impossible to do, which leads researcher focus towards depth of analysis rather than breadth. Themes that are common—despite the different elements (and possibly different constructs as well)—between the respondents *may* emerge, but this cannot be taken for granted or forced out of the data. Any such themes must clearly be rooted in the individual respondent's construct elaborations, which implies that using techniques such as laddering during interview sessions are recommended.

Tan and Hunter (2002, p.52) stress, however, that “researchers interested in the idiographic characteristics of individual unique RepGrids are not restricted to analyzing the elicited RepGrid data purely from a qualitative perspective”. They note that research on strategic management holds examples where quantitative analysis has been performed on idiographic RepGrids. For instance, in a study by Simpson and Wilson (1999) a list of key success factors for effective strategies was used as elements. The studied companies supplied the factors and the resulting data was analyzed using multidimensional scaling, correlation, and cluster analysis.

Research that focuses on comparing repertory grids of individuals or groups of individuals are instead considered *nomothetic* in their nature. In order to allow comparisons, elements or constructs must be shared between the respondents (Easterby-Smith, 1980). As noted by Tan and Hunter (2002), this form of research tends to be quantitative, but the mixed approach by Olsson (2011) illustrates how quantitative and qualitative analysis may be used in combination during nomothetic repertory grid studies. While all three nomothetic examples in table 1 use supplied elements as well as constructs, it is sufficient if either of these is supplied (cf. Fallman, 2003; Olsson and Russo, 2004) and the other is elicited.

Concluding reflections

The above examples illustrate potential use of the repertory grid technique and should be interpreted as such. They were selected as they show different research agendas, as well as different approaches to the use of the repertory grid technique. For more in-depth examples of specific studies, simply following up by reading the referenced studies listed above is recommended. As the focus of such reading is on how the repertory grid technique was used, it does not matter that the studies come from non-game research. In fact, the support from multiple research domains that they illustrate strengthens the argument that the technique is likely to be useful within game-oriented research as well.

An advantage of the repertory grid technique as data collection tool is the relative ease with which the research process can be tested before exposing it to the full set of respondents. Using colleagues and associates with at least a rudimentary understanding of the problem domain in question, allows researchers the opportunity to both practice with the technique itself and informally validate the

design of the grid process. The extensive flexibility of the repertory grid technique—ranging from element selection or elicitation, via construct selection or elicitation, as well as how to approach the actual interview session and in particular the laddering process, to the number of options for analysis—means that dry-run tweaking is advisable.

Finally, Tan and Hunter (2002) make two important points about the use of repertory grid that bears repeating. First, the repertory grid technique can be used together with other research methods, for instance to validate other techniques, or as a pre-study phase that directs further investigation. Second, the repertory grid technique is part of the personal construct theory, which itself is one of several theories in cognitive science (Berkowitz, 1978). Specifically, this chapter has emphasized the inherent phenomenological assumptions that the personal construct theory relies upon, beyond what Tan and Hunter (2002) elaborate on.

The impact of the philosophical foundation that the personal construct theory—and subsequently the repertory grid technique—relies upon is important. Mixing the use of repertory grids with methodological techniques that are neither neutral in stance (such as mathematical and statistical analysis—neither of which were part of Kelly’s original analysis techniques, but were included above), nor share the phenomenological foundation, is problematic as the findings and chain of arguments of such a mix would not be internally consistent. This is of course always the case of any mixed method approach, and as such is not to be considered a flaw in the research method, but rather a precaution for the use—rather than abuse—of the method.

Recommended reading

- Bradshaw, J.M., Ford, K.M., Adams-Webber, J.R. and Boose, J.H., 1993. Beyond the repertory grid: New approaches to constructivist knowledge acquisition tool development. *International Journal of Intelligent Systems*, 8(2), pp.287–333.
- Coshall, J.T. 2000. Measurement of tourists’ images: The repertory grid approach. *Journal of Travel Research*, 39(1), pp.85–89.
- Enquire Within 2014. Helpful hints for using the repertory grid interview. Available at: <<http://www.enquirewithin.co.nz/hintsfor.htm>>.
- Jankowicz, D., 2003. *The easy guide to repertory grids*. Chichester: Wiley.

References

- Bannister, D. and Fransella, F., 1985. *Inquiring man*. 3rd ed. London: Routledge.
- Beail, N., 1985. An introduction to repertory grid technique. In: N. Beail, ed., *Repertory Grid Technique and Personal Constructs*, Cambridge: Brookline Books, pp.1–26.
- Bell, R.C., 1990. Analytic issues in the use of repertory grid technique. *Advances in Personal Construct Psychology*. 1, pp.25–48.
- Berkowitz, L., 1978. *Cognitive theories in social psychology*, New York: Academic Press.
- Björk, S. and Holopainen, J., 2004. *Patterns in game design*, Boston: Charles River Media.

- Blizzard Entertainment 2010. *Starcraft 2: Wings of liberty* [game]. Blizzard Entertainment. Available at: <<http://us.blizzard.com/en-us/games/sc2/>>.
- Brentano, F., 1874. *Psychology from an empirical standpoint*. English translation 1995, New York: Routledge.
- Center for Personal Computer Studies 2014. *Rep 5* [computer program]. University of Calgary. Available at: <<http://repgrid.com/>>.
- Dennett, D., 1987. *The intentional stance*. Cambridge: MIT Press.
- Dourish, P., 2001. *Where the action is: The foundations of embodied interaction*. Cambridge: MIT Press.
- Dunn, W. N., Cahill, A. G., Dukes, M. J. and Ginsberg, A., 1986. The policy grid: A cognitive methodology for assessing policy dynamics. In: W.N. Dunn, ed., *Policy analysis: Perspectives, concepts, and methods*. Greenwich: JAI Press, pp.355–375.
- Dunn, W.N. and Ginsberg, A., 1986. A sociocognitive network approach to organizational analysis. *Human Relations*, 40(11), pp.955–976.
- Easterby-Smith, M., 1980. The design, analysis and interpretation of repertory grids. *International Journal of Man-Machine Studies*, 13, pp.3–24.
- Fallman, D., 2003. In romance with the materials of mobile interaction: A phenomenological approach to the design of mobile interaction technology. PhD. Umeå University.
- Fallman, D. and Waterworth, J.A., 2010. Capturing user experiences of mobile information technology with the repertory grid technique. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments*, 6(2), pp.250–268.
- Fransella, F., and Bannister, D., 1977. *A manual for repertory grid technique*, New York: Academic Press.
- Fransella, F., Bannister, D. and Bell, R., 2003. *A manual for repertory grid technique*, 2nd ed., Chichester: Wiley-Blackwell.
- Fullerton, T., 2008. *Game design workshop: A playcentric approach to creating innovative games*. 2nd ed. London: Elsevier.
- Gaines, B.R. and Shaw, M.L.G., 1993. Eliciting knowledge and transferring it effectively to a knowledge-based system. *IEEE Transactions on Knowledge and Data Engineering*. 5(1), pp.4–14.
- Ginsberg, A. 1989. Construing the business portfolio: A cognitive model of diversification. *Journal of Management Studies*, 26(4), pp.417–438.
- Heidegger, M., 1927. *Being and time*. Translated 1962. New York: Harper & Row.
- Holopainen, J., 2011. Foundations of gameplay. PhD. Blekinge Institute of Technology.
- Hunter, M.G. 1997. The use of RepGrids to gather interview data about information systems analysts. *Information Systems Journal*. 7, pp.67–81.

- Husserl, E., 1900. *Logical investigations*. Translated 1970. London: Routledge.
- Järvinen, A. 2008. Games without frontiers: Theories and methods for game studies and design. PhD. University of Tampere.
- Kelly, G., 1955. *The psychology of personal constructs*. Vol 1 & 2, London: Routledge.
- Latta, G.F. and Swigger, K., 1992. Validation of the repertory grid for use in modeling knowledge. *Journal of the American Society for Information Science*. 43(2), pp.115–129.
- Leach, C., 1980. Direct analysis of a repertory grid, *International Journal of Man-Machine Studies*, 13, pp.151–166.
- Lund, A. 2003. Massification of the intangible: An investigation into embodied meaning and information visualization. PhD. Umeå University.
- Moynihan, T., 1996. An inventory of personal constructs for information systems project risk researchers. *Journal of Information Technology*. 11, pp.359–371.
- Olsson, C.M., 2011. Developing a mediation framework for context-aware applications: An exploratory action research approach. PhD. University of Limerick.
- Olsson, C.M. and Russo, N.L., 2004. Evaluating innovative prototypes: Assessing the role of lead users, adaptive structuration theory and repertory grids. In: *Proceedings of IFIP WG 8.6*. Dublin. pp.1–25.
- Phythian, G.J. and King, M. 1992. Developing an expert system for tender enquiry evaluation: A case study. *European Journal of Operational Research*, 56(1), pp.15–29.
- Tan, F. B. and Hunter, M. G. 2002. The repertory grid technique: A method for the study of cognition in information systems. *MIS Quarterly*. 26(1), pp.39–57.
- Reger, R. K., 1990. The repertory grid technique for eliciting the content and structure of cognitive constructive systems. In: A.S. Huff, ed., *Mapping Strategic Thought*. Chicester: John Wiley & Sons, pp.301–309.
- RepGrid, 2014. Rep 5. Available at: < <http://repgrid.com/>>.
- Reynolds, T. J. and Gutman, J., 1988. Laddering theory, method, analysis, and interpretation. *Journal of Advertising Research*. 28(1), pp.11–31.
- Shaw, M.L.G., 1980. *On becoming a personal scientist: Interactive computer elicitation of personal models of the world*. New York: Academic Press.
- Shaw, M.L.G. and Gaines, B.R., 1983. A computer aid to knowledge engineering. In *Proceedings of the British Computer Society Conference on Expert Systems*, pp.263–271.
- Shaw, M.L.G. and Gaines, B.R., 1987. KITTEN: Knowledge initiation & transfer tools for experts & novices. *International Journal of Man-Machine Studies*. 27(3), pp.251–280.

- Shaw, M.L.G. and Thomas, L.F., 1978. FOCUS on education: An interactive computer system for the development and analysis of repertory grids. *International Journal of Man-Machine Studies*. 10, pp.139–173.
- Schutz, A., 1932. *The phenomenology of the social world*. Evanston: Northwestern University Press.
- Sicart, M., 2008. Defining game mechanics. *Game Studies*, 8(2). Available at <<http://gamestudies.org/0802/articles/sicart>>.
- Simpson, B. and Wilson, M., 1999. Shared cognition: Mapping commonality and individuality. *Advances in Qualitative Organizational Research*. 2, pp.73–96.
- Slater, P., ed., 1977. *Dimensions of intrapersonal space: Volume 1*. London: John Wiley & Sons.
- Stewart, V. and Stewart, A., 1981. *Business applications of repertory grid*. London, UK: McGraw-Hill.
- Wacker, G. I., 1981. Toward a cognitive methodology of organizational assessment. *Journal of Applied Behavioral Science*. 17, pp.114–129.
- WebGrid, 2014. *WebGrid 5*. Available at: <<http://webgrid.uvic.ca/>>.
- Walton, E.J., 1986. Managers' prototypes of financial terms, *Journal of Management Studies*, 23, pp.679–98.

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