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EXTRACTING INFORMATION FROM REPERTORY GRID DATA: NEW PERSPECTIVES ON CLINICAL AND ASSESSMENT PRACTICE

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The repertory grid technique devised by Kelly (1955/1991) can be useful in clinical practice and research, because it provides significant information in terms of the respondents' mental structure. However, it is a complex technique calling for a substantial investment of time and effort by both clinician and respondent if the information obtained is to be relevant and useful. Its main advantage is that it allows the patient's personally relevant data to be subjected to the rigor of the mathematical-statistical elaboration of underlying structures in the data provided by computer analysis. The present article shows how this can be undertaken using a grid completed by a woman with an eating disorder. Additionally, the paper provides a historical context for grid analyses carried out with a freeware computer program available in English and Italian that incorporates recently developed methods of grid analysis.

Key words: Repertory grid test; Personal Construct Psychology (PCP); iGridstat statistical software; History of grid analysis; Clinical use.

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INTRODUCTION

The Repertory Grid Test was devised within the context of Personal Construct Psychology (PCP) by Kelly (1955/1991), the first purely constructivist approach in clinical and personality psychology. Nowadays, this theory is an important reference point for the many researchers and therapists working within this epistemological and theoretical framework. The repertory (often shortened to "rep") grid technique (Kelly originally referred to it as a "test" presumably to emphasize its role in assessment, although it has little in common with traditional psychometric tests) has been widely used internationally (see Luque, Rodríguez, & Camacho, 1999; Neimeyer, Baker, & Neimeyer, 1990; Ortega, 2007): in North America, United Kingdom, Germany, Spain, Australia, Serbia, as well as Italy, and is often used without reference to Kelly's theory. The technique allows the researcher or clinician to link the personally relevant grid data to the rigor of statistical analysis. Although the repertory grid has been strongly supported in clinical contexts

(Winter, 1992, 2003), little information is available in journals to guide the researcher or clinician. Leach, Freshwater, Aldridge, and Sunderland (2001) provided a guide to the representation of grid data in a standard statistical package, but no articles have addressed analysis of grid data in other ways. Such analyses are confined to specific computer programs, several of which have been developed in Europe, and provide support in German or Spanish. However, although the technique is widely used in Italy, until recently no program has had an Italian translation. This is, instead, important because it can assist in communicating the results from the clinician to the "non-expert" (the patient), because in a constructivist perspective, the patient's construal of the results of the analyses can be just as significant as that of the clinician. In this paper we particularly focused on clinical use, but, thanks to its flexibility and adaptability, the rep test has been broadly used in developmental and educational psychology, organizational psychology, marketing, and many other research fields (Cherubini & Zambelli, 1987; Epting, 1984; Neimeyer & Mahoney, 1995).

THEORETICAL LINKS BETWEEN PERSONAL CONSTRUCT PSYCHOLOGY AND GRID TECHNIQUES

The rep test is a sophisticated technique for identifying the ways through which a person construes his/her experience. It provides information from which inferences on the ways people think about events can be made, but it is not a personality test in the conventional sense.

It derives from Kelly's (1955/1991) personal construct psychology theory, which was proposed in the same book as the repertory grid. The repertory grid is often seen as separate from the theory; however, theory and techniques are closely related. The theory focuses on ways in which people make anticipations, which Kelly called constructs. A person's repertoire of constructs is the basis from which the person construes or understands the world, making predictions about the future. What is to be construed or understood are the events; with this term Kelly meant situations and all psychological objects as well (such as "ideal self" or "mother"), which are generally called elements. Bell (1988) showed that a repertory grid is simply a representation of the relationships between elements and constructs, and data analyses may be carried out in ways that are consistent with the theory. It is important to underline that both elements and constructs are provided by the subjects and are not pre-ordinate by the clinician. In this sense it is not a "test" in the conventional nomothetic way.

Construing the Repertory Grid

The repertory grid proceeds by first deciding on the area in which the therapist (or the researcher) wants to focus. While Kelly was at pains to say that a person's construct system was finite, for practical purposes it is almost infinite. A person's world contains so many elements and constructs that it would be impossible to make an exhaustive representation of them.

In a clinical setting the focus will be on those aspects of the person's world that are relevant to the problem being addressed. The focus of the repertory grid will be defined by the elements specified. The clinician usually decides on the kind and number of elements to be included in the grid. Most grids usually have roughly the same number of elements and constructs. Because the constructs are elicited by a process of consideration of pairs or triples of elements, the number of elements usually defines the size of the grid. Most grids in clinical work have between 10 and 15 elements. The use of fewer elements creates problems in obtaining a usefully representative set of constructs; more elements than 15 presents patients with a substantial mental workload that they may not be able to manage. In choosing the kinds of elements to be included, researchers hypothesize that these are potentially important elements in the person's mental life.

The next decision to be made in setting up a grid is the way in which elements are defined.

In Kelly's original technique, elements were usually chosen by the patient to fit "role titles" provided by the clinician. Some role titles allowed no choice — "me as I am now" —; some allowed a possible choice — "your mother (or the person who filled that role in your life)," — and some allowed a wide choice — "a teacher you admired." Some studies performed by Bell and colleagues (Bell, Vince, & Costigan, 2002; Haritos, Gindidis, Doan, & Bell, 2004) suggested that value-laden role titles, such as the teacher role above or "a girl you did not like" tend to polarize the grid by making constructs subsequently elicited more similar to one another compared to role titles that are neutral, such as "a significant person in your life."

In the clinical grids, self figures generally tend to be the most important, and some wording of self now, such as "me as I am now," is usually the most important among self figures. The next most important self figure is usually the ideal self or "me as I would like to be." Interestingly, the ideal self figure was not considered as an element by Kelly. The next most important group of elements that should be included in a grid is that referring to people who have played a central role in the person's life. Normally, these are family members, particularly mother and father, and, if relevant, the partner or perhaps the son or daughter. Siblings are usually less important but can be important in individual cases (depending on the situation and on the clinician's theoretical orientation). There may also be individuals outside the family who are important in the same way, for instance, "the perpetrator of childhood sexual abuse." Choice of figures from within this group should be guided by other information such as interviews or drawings.

Many other possibilities exist, such as dyadic elements, first proposed by Ryle and Lunghi (1970), and recently used by Winter et al. (2007) in a study of patients with self-harm injuries. The latter employed cross-partner perception figures: "how [name of partner] would like me to be" and "how I would like [name of partner] to be." Other authors specifically used relationships, such as "your relationship with your mother" and "your mother's relationship with you." Rowe and Slater (1976) followed this approach in a study in which grids were completed by both patient and therapist before and after treatment. Also authors approaching family therapy from a constructivist perspective (see, for instance, Feixas, 2007; Feixas, Procter, & Neimeyer, 1993; Procter, 1985, 2007; Ugazio, Negri, Fellin, & Di Pasquale, 2009) used relational elements, such as "the relationship between mom and dad as I see it," based on the systemic principle of "circularity" (Palazzoli, Selvini, Boscolo, Cecchin, & Prata, 1980).

When elements have been identified, the person is asked to compare and contrast two or three of them in order to elicit a set of constructs. The way in which the two elements are similar becomes one pole, and the difference from the third element becomes the other pole. Kelly's key notion about constructs was that they are bipolar. In some circumstances, the task of differentiating among three elements is too difficult for the patient, and a simpler distinction is asked for between only two elements. Sometimes the poles have been described as "emergent" or "implicit", but this has usually been in settings where only one pole is named by the patient and the second is assumed. Consequently, in eliciting constructs from elements, what is actually elicited are the two poles and the construct is what links the poles. The construct is usually referred to by the pole pair, for instance, "warm/cold" or "hard/soft."

Finally, the person is asked to rate elements. Each element is positioned between the two extremes of the construct using a 5- or 7-point rating scale; this is done repeatedly for all the constructs that apply, thus the meaning of the element to the patient is captured, and statistical analyses varying from simple counting the number of times an element is located on a particular scale position (e.g., midpoint or an extreme) to more complex multivariate analyses are made possible.

ANALYSIS OF GRID DATA[1]

Unlike other tests and questionnaires, repertory grid is more complex in the structuring of data collected, where elements (such as persons, objects, or concepts) are jointly assessed with respect to a set of bipolar constructs. This complexity has, from the very start, required equally complex methods of analysis.

In his book, Kelly also presented a method of analysis of grid data. He referred to it as a form of "factor analysis," and called it a "nonparametric solution to the problem," which "gives essentially the same answers that conventional factorial methods give and, in such a small fraction of the time, that the method is quite feasible for clinical use" (p. 280). However, it was not that practical for clinicians. Kelly's example required the scanning and counting of the 418 elements by construct cells in his grid several times. Although simpler than conventional factor analysis, it needed some form of computational assistance. It was programmed for a computer as early as 1962, but a published version was available only over 20 years later (Potter & Coshall, 1986).

BRIEF HISTORY OF COMPUTER PROGRAMS FOR THE ANALYSIS OF REPERTORY GRID DATA

The eventual popularity of the repertory grid, particularly in clinical domains, can be traced to the adoption of the grid by Bannister (1960) to identify thought disorder in schizophrenia. While this particular usage of the grid has declined, it was probably responsible for the first widely available computer program for analysis of repertory grid data. In 1964, Slater published *The principal components of a repertory grid*, a mainframe computer program, through a British Medical Research Council grant, which also provided a service whereby people could send their grid data in and receive a printout of the analysis. In 1967, the program became known as INGRID, the acronym which still defines a particular kind of analysis. By 1973 this service had analyzed 10,000 grids (Slater, 1976, p. 2), but in that year it was disbanded, and the program distributed to a number of university computer centres. University computer centres were not, however, all that accessible to clinicians, and it is unlikely that the grid would have flourished without further technical developments. In the 1970's, remote access to mainframe computers became possible through the use of distributed teletypes which allowed for interactive computer usage. Shaw and Thomas (1978) promoted the use of cluster analysis in interactive computing contexts for analyzing grid data. This technology was transferred to the early personal computers in the 1980's as were variants of Slater's principal component analysis. The 1980's also saw the origins of the freeware versus commercial software approaches (which persists to this day), with RepGrid (Gaines & Shaw, 1990) and FlexiGrid (Tschudi, 1993) providing more sophisticated commercial support, while GAB (Higginbotham & Bannister, 1983), Circumgrids (Chamber & Grice, 1986), and G-PACK (Bell, 1987) being freely available, though somewhat cruder in their interfaces.

Flexigrid, although an English language program, was the first developed in Europe (Norway). In the 1990's more repertory grid programs were developed in Europe, for example that by Feixas and Cornejo (2002) in Spain. While these programs had versions in English, they were also available in the language of origin. Currently available programs include Grid-cor/Record (Feixas & Cornejo, 2002) in English and Spanish versions,[2] Gridsuite (Fromm, 2007) in English and German, and Idiogrid (Grice, 2002) and Gridstat (Bell, 1998/2009) in English only. All but Gridstat (a DOS program) are Windows-based. Some can also be used to collect repertory grid data (an issue not considered here) and all can provide both summary indices and representations of grid data.

Many summary indices for grid data have been devised (see Fransella, Bell, & Bannister, 2004) and continue to be devised (e.g., Bell, 2004a; Feixas & Saul, 2004). A few summary indices employ conventional statistical measures; for instance, the average correlation among constructs is often used to represent Bieri's (1955) notion of cognitive complexity-simplicity. Others have no statistical counterparts (for instance Lanfield's "functionally independent construct" index; FIC). Some of these indices such as the "implicative dilemma" index by Feixas and Saul (2004) call for a critical level of a measure to be defined in order to indicate whether the phenomenon (e.g., an implicative dilemma) is present or not. All Windows-based programs require this to be pre-set, while the DOS-based Gridstat is more interactive in that it provides on-screen distributions of the measure to assist in setting the critical level.

This lack of flexibility is also evident in the representations of grid data. Hierarchical cluster representations can vary according to the choice of the measure of association and method of clustering. Principal component solutions can depend on the method of rotation used, and singular-value-decomposition can depend on the kind of prescaling adopted (see Bell, 2004b). Many grid programs contain few or no options of these procedures. Representations that are consistent across different methods are likely to reflect structures in the data, rather than structures imposed by the method. This is particularly true of cluster analysis where Gore (2000) recommended looking for consensus between computer solutions with different measures of association and different methods of clustering. Gridstat is the only grid program to allow that.

The Program Used to Analyze the Grid (Gridstat/iGridstat)

The current version of Gridstat is now available in English and Italian (as iGridstat). It is the first grid analysis package to have a working version in Italian. The current version of the program also contains an important addition. Although it has been known for many years (e.g., Mackay, 1992), the orientation of the bipolar construct poles is arbitrary. This does not affect the construct structure as a rule but does affect the statistics and structure for elements. Bell (2010) proposed a solution to this problem and Gridstat/iGridstat now checks the entered grid to see if constructs are aligned in a consistent fashion, and, if not, re-aligns the constructs so as to be consistent. It also contains several very flexible approaches to identifying conflict in grids (such as the approach by Feixas & Saul, 2004), and a new method for identifying hierarchical relationships among constructs or elements.

Other changes implemented in this version include some diagnostic suggestions for problems encountered in reading the data file. While these are not perfect, they do help in identifying problems such as missing or extra labels and insufficient data. In addition, iGridstat is able to read the files from the Idiogrid and Gridcor programs as both use similar text files though structured differently. The program can also write files in Gridcor, Idiogrid, or SPSS syntax format, while some diagnostic information in output has now been made optional. Furthermore, some procedures have been added to map hierarchical relationships among elements or constructs (see Bell, Winter, & Bhandari, 2010, for an example).

CLINICAL USE

The rep test in clinical setting allows the clinician to collect subjective meanings and structure them empirically rather than to interpret the patient's narratives through a pre-defined theory. The ways in which this structure can be identified are as follows.

There are three ways to look at the numerical information in a grid: 1) looking at individual element and construct representations; 2) looking at relationships between elements and between constructs; 3) looking at the overall grid.

Here we will illustrate these methods using a grid provided by Elisabetta, a 17-year-old girl suffering from an eating disorder. She's attending high school and living with her parents, a brother, and a sister. She says she started starving herself and lost eight kilos during the previous six months. On her admission to the eating disorder center, she was experiencing intense fear of gaining weight or becoming fat, even though she was seriously underweight (BMI = 14.7).[3] She was checking the number of calories consumed by restricting or exercising with the sole purpose of losing weight, but at the expense of friendships, homework, and other responsibilities. She never referred to binge eating and to having forced vomiting. She had met with a psychiatrist some time earlier but felt that this had not helped her. She asked to be admitted to the eating disorder center under pressure by her mother who was worried about her progressive weight loss; her sister too had had eating problems in the past.

Her grid is shown in Figure 1. It should be noted that Elisabetta used "obstinate" and "weak" in different ways in her constructs. The alert clinician would note this and perhaps make some inquiries about it later to use in making judgements about Elisabetta's ways of thinking about people.

Although compact in appearance, the grid contains a large amount of data. The 13 elements are comprised of self figures, family, and friends. Elisabetta distinguished among these figures with 18 bipolar constructs. Because each of the 13 figures were located or rated on 18 constructs, 234 ratings were obtained which linked elements to constructs and provided data through which the underlying relationships among (and between) elements and constructs could be identified.

	Elisabetta	Brother	Sister	Parents	Veronica (disliked)	Carlotta (admired)	Federica	Simone	Vanessa	Francesca	As I would like to be	As others see me	As others would like me to be	
spontaneous	3	–3	–1	–2	–2	–2	–3	–3	–1	0	–3	–3	–3	false
fragile	–2	1	–1	–2	–3	–2	1	0	2	–2	–1	–1	0	indifferent
happy	–2	–3	–2	0	3	–2	–3	–3	–2	–2	–3	–2	–3	problematic
reliable	–3	–3	–3	0	2	–3	–2	–3	1	–3	–3	–3	–3	thinks about own interests
closed	2	3	2	2	1	–2	3	1	3	–1	3	3	3	extroverted
obstinate	–3	–3	–3	–3	–3	0	–3	1	–2	–1	–3	–3	0	weak
strong	–2	–2	–3	1	–2	–2	–3	0	–1	1	–3	–1	–3	weak
obstinate	–2	–3	–2	1	–3	2	0	1	–2	2	–2	–2	–1	hidden
insensitive	2	3	2	–1	0	3	3	3	1	1	3	2	3	kind-hearted
undecided	2	3	3	–2	–1	–1	2	0	2	–2	3	2	3	decided or definite
altruist	–2	–2	–2	0	2	–3	–2	–3	1	–1	–3	–2	–3	selfish
simple	–1	–3	1	0	0	–3	–3	–3	–1	–2	–2	–1	–2	less hasty
impulsive	–3	–3	–1	1	–2	2	–2	2	–3	2	–3	–3	–1	prudent
accommodating	3	3	3	–2	2	–3	3	–2	2	–2	3	3	3	ambitious
anxious	–2	2	–2	–3	–2	0	2	2	–1	–1	2	1	2	controls situations
proud	–2	–2	–3	1	–3	2	–2	2	–2	–1	–2	–2	0	passes over things
perfectionist	–2	–2	–3	1	–1	–1	–3	–1	1	1	–2	–2	–1	hasty
irritable person	–3	1	–3	–2	–1	3	–1	3	0	1	0	–3	1	calm

Note. The positive and the negative sign represent the left and right pole of the construct, respectively. The absolute value (0 to 3) indicates the proximity of the element to the extreme pole (3) for the considered construct.

FIGURE 1
Elisabetta's repertory grid.

Before analyzing the grid data, we need to be aware that the orientation of the numerical data in the grid will be a function of the way in which the bipolar constructs were elicited. If the two elements that are alike are both positive figures [e.g., "Carlotta (admired)" and "as I would like to be"], then the pole corresponding to their similarity will reflect this positive attribute (e.g., reliable). Because the left-hand pole (rating = –3) corresponds to the descriptor of the pair of similar elements, then if the two figures are negative [such as "Veronica (disliked)" and "parents"] the pole corresponding to their similarity will reflect a negative attribute (e.g., obstinate). If all constructs have the same orientation, with the positive pole on the left and corresponding to –3, the grid data will be easier to interpret.

Thus a preliminary step in analyzing a grid should often be to align all the constructs. This can be done by asking the respondent to indicate his/her "preferred" pole. (This is also done in a related personal construct technique, called laddering.) Another way of doing this is when, if the grid contains the element "ideal self," whichever pole of each construct is aligned with the ideal self is the preferred one. Of course, this may not be of any use when the ideal self is located at or near the midpoint (as is the case for the last of Elisabetta's constructs, namely "irritable person/calm").[4]

There is also an automatic way of doing this. We can analyze the correlations between constructs and identify those constructs which generally correlate negatively with others, and reverse them. The computer program used here[5] will automatically check for this before carrying out any analysis. Here (Figure 2) seven of the 18 constructs were reversed. The ideal self figure is now more consistently (though not always) scored –3.

	Elisabetta	Brother	Sister	Parents	Veronica (disliked)	Carlotta (admired)	Federica	Simone	Vanessa	Francesca	As I would like to be	As others see me	As others would like me to be	
spontaneous	3	–3	–1	–2	–2	–2	–3	–3	–1	0	–3	–3	–3	false
indifferent	2	–1	1	2	3	2	–1	0	–2	2	1	1	0	fragile
happy	–2	–3	–2	0	3	–2	–3	–3	–2	–2	–3	–2	–3	problematic
reliable	–3	–3	–3	0	2	–3	–2	–3	1	–3	–3	–3	–3	thinks about own interests
extroverted	–2	–3	–2	–2	–1	2	–3	–1	–3	1	–3	–3	–3	closed
obstinate	–3	–3	–3	–3	–3	0	–3	1	–2	–1	–3	–3	0	weak
strong	–2	–2	–3	1	–2	–2	–3	0	–1	1	–3	–1	–3	weak
obstinate	–2	–3	–2	1	–3	2	0	1	–2	2	–2	–2	–1	hidden
kind-hearted	–2	–3	–2	1	0	–3	–3	–3	–1	–1	–3	–2	–3	insensitive
decided or definite	–2	–3	–3	2	1	1	–2	0	–2	2	–3	–2	–3	undecided
altruist	–2	–2	–2	0	2	–3	–2	–3	1	–1	–3	–2	–3	selfish
less hasty	1	3	–1	0	0	3	3	3	1	2	2	1	2	simple
impulsive	–3	–3	–1	1	–2	2	–2	2	–3	2	–3	–3	–1	prudent
ambitious	–3	–3	–3	2	–2	3	–3	2	–2	2	–3	–3	–3	accommodating
controls situations	2	–2	2	3	2	0	–2	–2	1	1	–2	–1	–2	anxious
proud	–2	–2	–3	1	–3	2	–2	2	–2	–1	–2	–2	0	passes over things
perfectionist	–2	–2	–3	1	–1	–1	–3	–1	1	1	–2	–2	–1	hasty
irritable person	–3	1	–3	–2	–1	3	–1	3	0	1	0	–3	1	calm

Note. These are Elisabetta's constructs, while others may not see impulsive as a positive characteristic, it is correctly aligned for Elisabetta — as it is now consistent with spontaneous.

FIGURE 2
Elisabetta's repertory grid with constructs consistently aligned.

Looking at Individual Element and Construct Representations

As indicated earlier, extreme and midpoint ratings say something about the way the respondent construes his/her world. Elisabetta places elements mainly at the positive pole of her constructs (the pole associated with the rating –3). Table 1 provides this information.

TABLE 1
Details of extreme and midpoint ratings

	Value	Frequency	Percentage
Maximum	3	11	6.00
Minimum	–3	46	27.00
All extreme (3, –3)			33.00
Midpoint	0	14	8.00
Expected number per rating (uniform distribution): 24(14.3%)			

Thus the distribution of elements between construct poles is not uniform. More elements are allocated to the extremes and fewer elements are located in the middle of the constructs. Aligning the constructs consistently allows us to make sense of summary statistics associated with each construct and element. If we look at these statistics for the constructs, we see that this positive view is not uniform across all constructs, as shown in Table 2.

TABLE 2
Construct information

Mean	*SD*	%Extreme	%Midpoint		
–1.77	1.67	54	8	1	spontaneous/false
0.77	1.42	8	15	2	indifferent/fragile
–1.85	1.61	46	8	3	happy/problematic
–2.00	1.71	69	8	4	reliable/thinks about own interests
–1.77	1.58	49	0	5	extroverted/closed
–2.00	1.41	62	15	6	obstinate/weak
–1.54	1.39	31	8	7	strong/weak
–0.85	1.75	15	8	8	obstinate/hidden
–1.92	1.27	46	8	9	kind-hearted/not very sensitive
–1.08	1.90	31	8	10	decided or definite/undecided
–1.54	1.55	31	8	11	altruist/selfish
1.54	1.28	31	15	12	less hasty/simple
–1.08	2.02	38	0	13	impulsive/prudent
–1.23	2.36	62	0	14	ambitious/accomodating
0.00	1.84	8	8	15	controls situations/anxious
–1.08	1.69	15	8	16	proud/passes over things
–1.15	1.35	15	0	17	perfectionist/hasty
–0.31	2.01	38	15	18	irritable person/calm
–1.05	1.66	35.90	7.69	Average of means	
0.96	0.28	18.31	5.13	Standard deviation of means	

We can also look at the elements in the same way, as shown in Table 3.

Here we see that As I would like to be and Brother are the most positively seen (negative scores) and no-one is really seen in a negative way. Parents, Carlotta, and Francesca are close to the midpoint and Carlotta (the admired figure) has the highest variation in her location on the constructs (as shown by the largest standard deviation).

TABLE 3
Element information

Mean	*SD*	%Extreme	%Midpoint		
–1.39	1.89	33	0	1	Elisabetta
–2.06	1.58	61	0	2	Brother
–1.89	1.41	44	0	3	Sister
0.33	1.60	11	22	4	Parents
–0.39	2.03	28	11	5	Veronica (disliked)
0.22	2.20	33	11	6	Carlotta (admired)
–1.94	1.47	50	6	7	Federica
–0.28	2.13	39	17	8	Simone
–1.00	1.41	11	6	9	Vanessa
0.44	1.54	6	6	10	Francesca
–2.11	1.49	61	6	11	As I would like to be
–1.94	1.22	39	0	12	As others see me
–1.61	1.60	50	179	13	As others would like me to be
–1.05	1.66	35.90	7.69	Average of statistic	
0.95	0.29	17.52	7.07	Standard deviation of statistic	

Looking at Relationships between Elements and between Constructs

One of the oldest indices associated with the repertory grid is a measure of cognitive complexity. This is usually based on the average correlation between constructs. If it is large, then all the constructs are highly correlated and related to the elements in much the same way. The person might, thus, be said to construe his/her world in a simple way. If the average correlation is low, the constructs are differentiated and the person might be said to construe the environment in a complex way. We can also compute such means for each construct to determine which constructs are like the others and which are different. This information is shown in Table 4.

The average correlations are similarly reasonably high for all constructs (except the first two) indicating these constructs are being used in the same way. The first two constructs are more weakly related to the others, though we might speculate that this was due to Elisabetta's unfamiliarity with the procedure.

We can, of course, look at the correlations in a more complex fashion by carrying out a principal components analysis. Figure 3 shows that only two components are needed to explain the correlations. The two components are unusually similar in the amount of variance they explain and together account for 71% of the variation. There is a statistical guide for the correct number of components to extract, devised by Velicer (1976), using the Minimum-Average-Partial-Correlation (called MAPr here) for which the lowest value (here, .130) indicates the number of components (here, 2).

TABLE 4
Average correlation for each construct

Mean	*SD*		
.25	0.31	1	spontaneous/false
.35	0.36	2	indifferent/fragile
.46	0.48	3	happy/problematic
.42	0.49	4	reliable/thinks about own interests
.46	0.46	5	extroverted/closed
.46	0.45	6	obstinate/weak
.43	0.44	7	strong/weak
.50	0.51	8	obstinate/hidden
.52	0.50	9	kind-hearted/not very sensitive
.54	0.47	10	decided or definite/undecided
.47	0.51	11	altruist/selfish
.44	0.44	12	less hasty/simple
.53	0.54	13	impulsive/prudent
.55	0.55	14	ambitious/accomodating
.48	0.45	15	controls situations/anxious
.49	0.48	16	proud/passes over things
.44	0.40	17	perfectionist/hasty
.45	0.43	18	irritable person/calm
.46	0.46	Average of correlations	
.07	0.06	Standard deviation of correlations	

Root	Minimum Average Partial Correlation (MAPr)	Eigenvalue	Eigenvalue as percentage of total	Cumulative percentage	Graphic representation of relative size of eigenvalues
0	.228				
1	.246	6.749	37.5	37.5	***
2	.130	6.034	33.5	71.0	***
3	.140	1.854	10.3	81.3	*************
4	.148	1.120	6.2	87.5	********
5	.142	0.772	4.3	91.8	******
6	.177	0.516	2.9	94.7	****
7	.219	0.334	1.9	96.6	***
8	.264	0.251	1.4	98.0	**
9	.379	0.153	0.9	98.8	**
10	.429	0.140	0.8	99.6	*
11	.782	0.051	0.3	99.9	*
12	.000	0.024	0.1	100.0	*

FIGURE 3
Information about the complexity of construct correlations.

In order to make sense of factor loadings, we rotated them. First, we chose a correlated factor solution (which tends to give a clearer picture), then, if the correlations between the factors were low, we might opt for a simpler uncorrelated factor solution. Here, we used a Promax rotation (not shown), where the factor correlation was .03, so we opted for an orthogonal solution (the equamax method because it equally simplifies both rows and columns) shown below (Table 5).

TABLE 5
Rotated principal component loadings for constructs

	IFS	1	2
spontaneous/false	1.00	.01	.42
indifferent/fragile	.47	.31	.52
happy/problematic	.99	.05	.86
reliable/thinks about own interests	.99	.06	.75
extroverted/closed	.95	.81	.13
obstinate/weak	.45	.73	.45
strong/weak	.46	.66	.40
obstinate/hidden	.95	.90	.14
kind-hearted/not very sensitive	.95	.16	.95
decided or definite/undecided	.43	.81	.52
altruist/selfish	.98	.08	.87
less hasty/simple	.70	.33	–.78
impulsive/prudent	1.00	.94	.02
ambitious/accomodating	.97	.97	.12
controls situations/anxious	.97	.11	.90
proud/passes over things	.79	.85	.29
perfectionist/hasty	.28	.61	.46
irritable person/calm	.21	.65	.52
Overall Index of Factorial Simplicity	.82		
Variance of factors		6.69	6.10
Percentage of variance		37.15	33.86

Note. IFS = Index of Factorial Simplicity.

A measure of the extent to which each construct is related to a single factor only is the Index of Factorial Simplicity (IFS)[6] devised by Kaiser (1974). In Table 5, the IFS value tells us how nearly unifactorial the constructs are. Ten of our constructs have IFS values greater than .90, suggesting they are not complex in themselves. The first factor is defined by ambitious, impulsive, obstinate, proud, and extroverted, while the second is defined by kind-hearted, controls situations, altruist, happy, simple, and reliable. Notably here we only used one pole. On the second factor, less hasty/simple has a negative sign, while the other high values are positive, hence we listed the reverse pole for this construct.

Principal components is one way, through which we can see patterns of association among constructs or elements. Another way of representing these patterns is cluster analysis. This produces a dendrogram which shows how groupings of elements (or constructs) can be built up from a situation where all elements are in separate groups to the other extreme where they are all in one group. Figure 4 shows a clustering of elements using Ward’s method (minimum error sums of squares) based on Euclidean distances calculated across all 18 constructs.

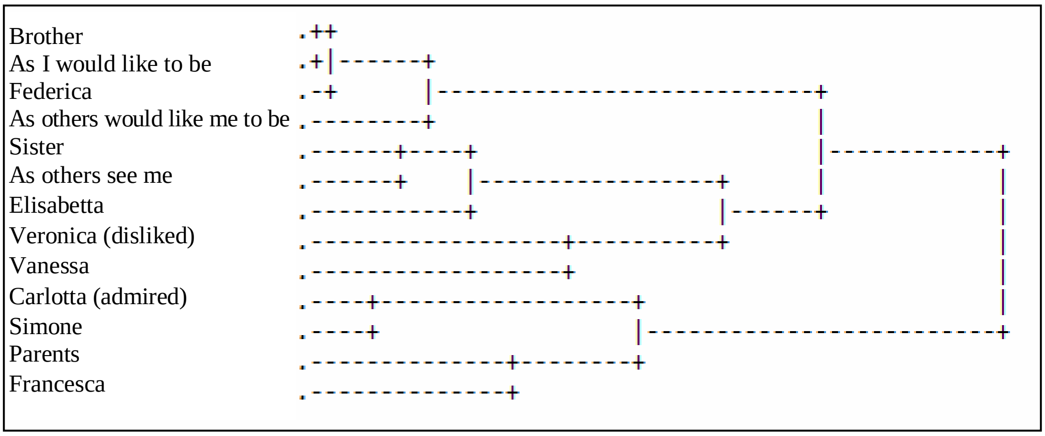

FIGURE 4
Clustering of elements.

Figure 4 displays a tight cluster of elements: Brother, As I would like to be, Federica, and perhaps As others would like me to be. These elements have similar profiles across constructs and hence have short Euclidean distances between them. Elisabetta sees herself linked to As others see me and Sister. Veronica and Vanessa are a little alike but less so than any of the others as the distances between them are greater, while Carlotta, Simone, Francesca, and relatives form another group.

Both principal components and cluster analysis look only at either constructs or elements. We cannot obtain a representation of all the grid, that is both elements and constructs, by these analyses. Ironically, the more complex analysis looking at elements and constructs simultaneously is in fact an older way of looking at repertory grid data.

Looking at the Overall Grid

In the 1960s, Slater (1964) introduced a technique we now know as singular-value-decomposition that enables both elements and constructs to be represented together. One limitation of this technique is that it was, until very recently, restricted to two-dimensional maps showing the relative locations of elements and constructs. But a complex grid may need more than two dimensions to represent complex relationships among constructs and elements.

There have been a number of different ways of representing the constructs and elements in these maps. Elements always appear as points on the map. Constructs, however, are shown in different ways. The construct data is like the principal component solution shown earlier. It consists of two columns of coordinates which, for each construct, define a point in space. However, representations differ. For a two dimensional solution, a line is often drawn from the point back through the origin for the same length. The two ends of this line represent the two construct poles. Other representations (such as that originally used by Slater) show the construct poles as points on a circle encompassing the elements. For three dimensions, these problems magnify. Such plots are not easy to interpret with all construct poles and all elements represented. A simple solution however, is to use the cluster analysis referred to above to group the elements and constructs in this space. Here we used the coordinates of both elements and constructs (like the construct principal components; but not shown here to save space) to calculate distances among and between both constructs and elements. A cluster analysis of these distances grants the following dendrogram (Figure 5).

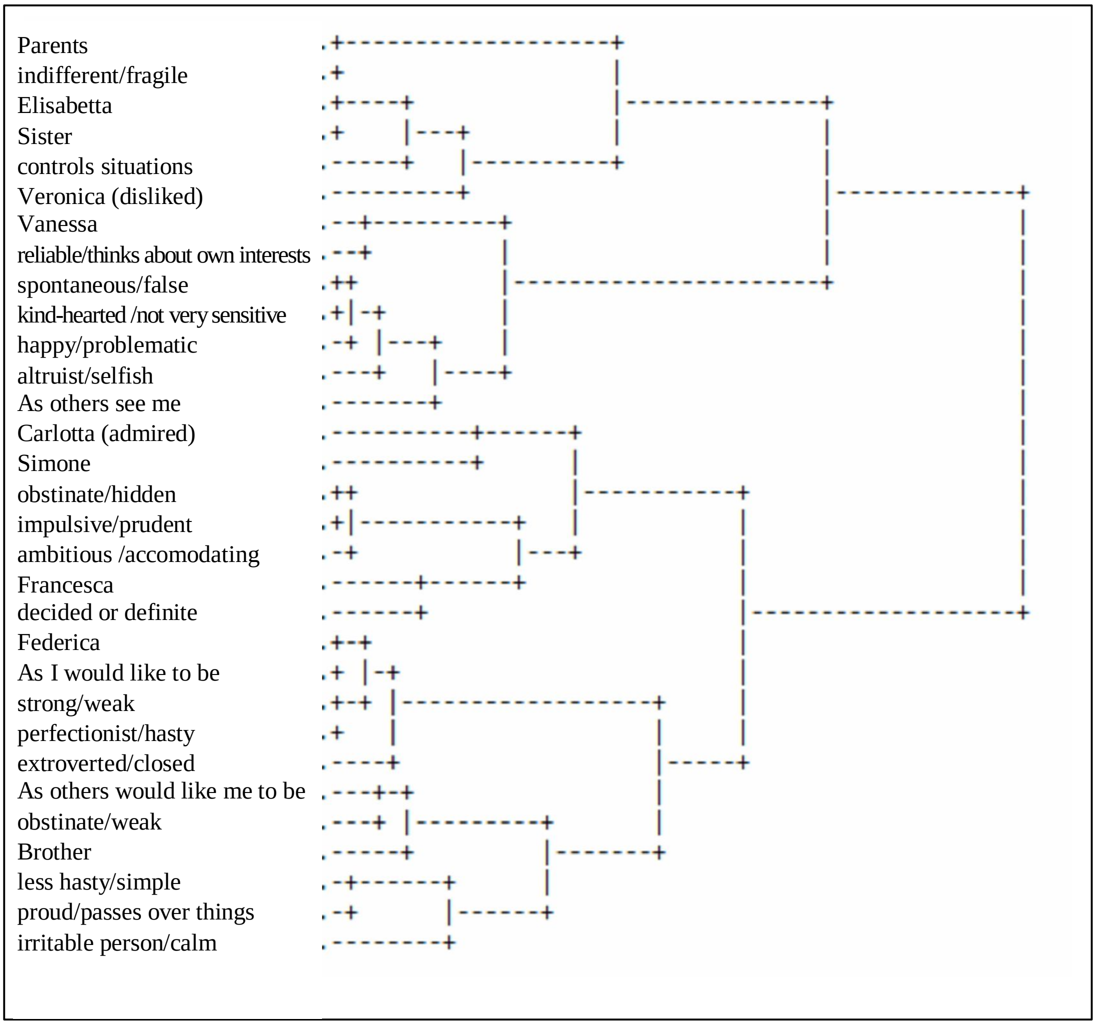

FIGURE 5
Gridstat output of Cluster dendrogram of the locations in a common space
for both elements and constructs (Ward method).

This contains a lot of information and we need to break it down somewhat to see the details. The overall dendrogram can be broken down into four main clusters. A good place to start in any interpretation is to look for the self-figure (Figure 6). It is part of the first big cluster, linked firstly to her sister and to the spontaneous/false construct.

```
Parents                        .+--------------------+
indifferent/fragile            .+                    |
Elisabetta                     .+----+               |----
Sister                         .+    |---+           |
controls situations            .-----+   |-----------+
Veronica (disliked)            .---------+
```

FIGURE 6
Part of Figure 5 showing the closest links for Elisabetta in Gridstat output.

None of these links is strong. This grouping is very weakly associated with the other part of this cluster containing relatives and some constructs. We could conclude that Elisabetta does not see herself as having strong links with others, or strong links between herself and the ways in which she sees others (i.e., her constructs).

The other most important figure is the ideal self, As I would like to be (Figure 7). This is part of a small sub-subgroup of the first of the four main clusters.

```
Federica                       .+-+
As I would like to be          .+ |-+
strong/weak                    .+-+ |-------------------+
perfectionist/hasty            .+   |                   |
extroverted/closed             .----+                   |--
As others would like me to be  .---+-+                  |
obstinate/weak                 .---+ |---------+        |
Brother                        .-----+         |--------+
less hasty/simple              .-+-------+     |
proud/passes over things       .-+       |------+
irritable person/calm          .---------+
```

FIGURE 7
Part of Figure 5 showing the closest links for the ideal self (As I would like to be) in Gridstat output.

The ideal self is associated firstly with Federica (interestingly, not Carlotta whom she admires) and the perfectionist/hasty and strong/weak constructs. In the original grid in Figure 1, the ideal self is located at the strong and perfectionist poles. This is a very significant finding from a clinical perspective, because it allows us to make hypotheses concerning the link between the ideal self representation and eating disorders. Elisabetta would like to be stronger and more precise (constructs evaluated as –2 with reference to Elisabetta, and –3 with reference to the ideal self). These constructs were attributed at a maximum level to Federica (–3), while the ideal self shares other characteristics with Carlotta, whom she admires: reliability, a kind heart, and altruism, evaluated as –3. Unfortunately, although evaluated as important, these constructs do not seem very relevant to the ideal representation of the self. We may, therefore, hypothesize that character-strength and perfectionism are linked to control (including control in eating). As stressed in the literature (Castiglioni, Faccio, Veronese, & Bell, in press; Faccio, 2012; Faccio, Centomo, & Mininni, 2011; Faccio, Cipolletta, Romaioli, & Ruiba, 2011; Romaioli, Faccio, &

Salvini, 2008), this finding seems to describe the patient's expectations regarding self-representation "in the eating problem," becoming less important in self-representations of patients "outside the eating problem." In other words, this finding could be interpreted as a clinical signal, typical in persons at the beginning of treatment, who are totally involved in the eating dynamics or control problems regarding food. The disliked person, Veronica, can be seen to be quite distant from both other persons (Vanessa is the closest) and all constructs. In a way, Elisabetta treats herself as being fragmented or split off from her world. And yet she does not construe the person she admires, namely Carlotta, in a better way.

Carlotta is seen as somewhat similar to Simone, both being weakly associated with the constructs: obstinate/hidden, impulsive/prudent, and ambitious/accommodating, although these constructs are more closely associated with Francesca (Figure 8).

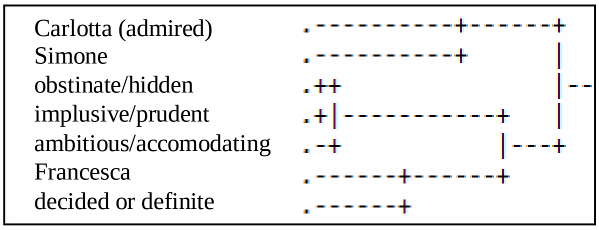

FIGURE 8
Part of Figure 5 showing the closest links for Carlotta in Gridstat output.

Special Issues in Using Repertory Grids in Clinical Research

In Kelly's famous metaphor of "man-the-scientist," he sees ordinary people acting like scientists in their day-to-day lives. The scientist metaphor is also true of the work that many of us do without thinking of it as "science." This is particularly so for therapists and others engaged in the process of therapy which is itself a research activity. In cognitive-behavioral therapy a problem is identified, an intervention is applied to the problem, and an assessment is made of the outcome. In those theoretical approaches (like systemic constructionism and/or narrative perspective), in which the problem is not conceived as "out there," but as co-constructed, de-constructed, and reframed within the therapeutic conversation, the rep grid can provide the clinician with a useful map of the client's subjective universe of meanings. This can be of great value in understanding the patient's perspective and to co-construct, during the therapeutic process, new semantic dimensions plausible to the patient but alternative to the ones linked to his/her problems, in order to facilitate him/her in working out feasible solutions.

Repertory grids can assist in all stages of the therapeutic process in a number of ways. In the problem identification phase, we can see how Elisabetta construes others in her life. She tends to make favorable judgements; the ways in which she sees herself and others (her personal constructs) are divided into two separate groups, and the people in her life are grouped in terms of these constructs in ways that may not seem apparent from simply examining the construct labels without reference to the elements (e.g., the admired person is not seen in the same way as Elisabetta's ideal self). One of the important uses of the information, derived from a repertory grid, can be included in the therapy process as a basis for asking questions of the person who completed the grid. Another important use for the grid is in monitoring progress. Will Elisabetta move her actual and ideal selves closer together as therapy progresses?

But can we use grids in this way in conventional research? A defining feature of psychological research is the notion of replication — the need for multiple observations, typically a sample of individuals. The reason we need such a sample is that we can thus examine variability across individuals. Some of this variability will correspond to our research question (do people in the treatment group differ from those in the non-treatment group?) and some will form the basis of a comparison for answering our question (e.g., how much do people vary within these groups?). To assess variability and make comparisons, our observations must be made under the same conditions. Herein lies the problem for repertory grids arises in conventional research.

The "classical" repertory grid is one in which respondents provide elements and constructs that are relevant to their lives. These constructs and elements may (and almost certainly will) differ from person to person, and may also differ across occasions for the same person. How, then, can we make comparisons between people "under the same conditions?" There are two solutions to this dilemma. One is to allow all respondents their idiosyncratic grids, and to base comparisons on summary measures calculated for each different grid. This approach has several drawbacks, one being the limited range of such measures available. The most common are the various measures of "cognitive complexity." Many of these indices, however, are relatively insensitive to true cognitive complexity (see Bell, 2004c). Another kind of measure relates to conflict or inconsistency in grids. Slade and Sheehan (1979) suggested such a measure, although their index had computational problems and conflict was shown to be rare. An older approach (Carroll & Carroll, 1981) also allowed for measurement of inconsistency between elements and constructs. This was recently operationalized by Bell (2010) and is part of Gridstat/iGridstat. A third approach, by Feixas, Saúl, and Sánchez (2000), would require each grid to have two specific elements: actual and ideal self. This requirement relates to the second solution to the problem of the individuality of grids, which calls for the restriction of freedom in choosing elements and constructs. In its weakest (least restrictive) form, it does not hamper the freedom of the respondent much, rather it forces the researcher to make an assumption about the grid. This assumption, usually unstated, relates to the use of role titles in grids. As seen earlier, this is a common feature of repertory grids. If different grids have the same role titles (but with different elements nominated by different respondents under these role titles), then the researcher may assume that these elements are common across respondents (which is not necessarily true). Thus, in Feixas et al.'s (2000) conflict approach above, all respondents would have a "current self" and an "ideal self." Other specific common roles of interest might be a sexual abuser figure or the therapist; however, all elements could be treated as common and analyses may be carried out to represent the common configuration of elements. An example of such an analysis in patients with anorexia nervosa can be seen in the study by Marsh and Stanley (1995).

Less freedom for respondents might involve elements that are completely defined. This can be important when respondents are stressed (e.g., when recovering from a psychotic episode) and the cognitive load in the repertory grid process (which can be substantial) needs to be reduced. Stereotypical figures, such as "an unhappy person" or "a calm person," can be included along with self and ideal self to make up a set of elements that can be easily construed.

Supplying constructs further increases the commonality of the grid across respondents, but further restricts the individuality of the grids. As with supplying elements, it reduces the cognitive load on the respondents and can, thus, be useful in situations where respondents are stressed or impaired. There are two possible drawbacks to this. One is that the constructs must be relevant. This is often dealt with by carrying out a pilot study with a few individuals in which constructs are elicited and then by using the most common constructs from this phase as common constructs provided by the researcher in a larger study. The second issue is whether the different individuals use the constructs in a similar way. Bell (2000) suggested a way in which this can be assessed by looking at the element rating data for each construct separately. This data is the same as ordinary rating scale data where if a one-factor solution in a principal component analysis is found, the scale is assumed to be unidimensional for that sample. In the same way with grid data, if one factor can account for the element correlations with respect to each construct, all individuals can be assumed to be using each construct similarly to differentiate among the elements.

CONCLUSIONS

As shown in clinical application, the possibilities of use and the alternatives for analyzing data are various and entirely adaptable to the particular concerns of the clinician and the patient. The technique can be fitted to the patient's world perception, but also to the clinician's therapeutic aims. However, the use of the repertory grid (and the analysis of its data) is a complex technique, calling for a substantial investment of time and effort by both clinician and respondent if the information obtained is to be relevant and useful. The fact that the technique has survived in a climate of simplistic intervention and treatment is clear evidence of its value.

NOTES

1. We focused here on the main issues in the analysis of a single grid, deferring to a later section the issue of analyzing multiple grids.
2. An Italian version of Gridcor was published in the late 1990's; however, it is no longer available.
3. The Body Mass Index (BMI), or Quetelet index, is a heuristic proxy for human body fat based on an individual's weight and height. It is defined as the individual's body weight divided by the square of his or her height.
4. Her grid is shown in Figure 1. It is in Elisabetta's words. Thus constructs were not always symmetrical grammatically (such as the last construct, "irritable person/calm"). It should also be noted that Elisabetta used "obstinate" and "weak" in different ways in her constructs. The alert clinician would note this and perhaps make some inquiries about it later to use in making judgements about Elisabetta's ways of thinking about people.
5. Gridstat/iGridstat (Bell, 1998/2009, 2010).
6. Kaiser's (1974) Index of Factorial Simplicity (IFS) is an index that lies between 0 and 1, with higher values indicating greater simplicity in the pattern of factor loadings. It is calculated as a function of the difference between the factor loadings raised to the fourth power and the factor loadings squared.

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