MEANS-END RELATIONS: HIERARCHIES OR NETWORKS?

AN INQUIRY INTO THE (A)SYMMETRY OF MEANS-END RELATIONS

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Abstract	Means-end relations are generally assumed to be hierarchical, and, by implication, asymmetrical. That is, if A is a means to achieve B, B is not at the same time also a means to achieve A. Literature casting doubt on this directedness of means-end relations is reviewed, and the hypothesis of means-end relations having direction is tested in two empirical studies. In these studies the means-end relations turn out to be symmetrical rather than asymmetrical. Means-end structures may therefore better be conceptualized as semantic networks rather than as straight hierarchies. Consequently, for the presentation and interpretation of the results from means-end studies, the emphasis should be on elements that derive from the network nature of the cognitive structure and not from the (possibly misleading) notions of hierarchy.	
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Means-end relations: hierarchies or networks?

An inquiry into the (a)symmetry of means-end relations

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Key words:

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Abstract

Means-end relations are generally assumed to be hierarchical, and, by implication, asymmetrical. That is, if A is a means to achieve B, B is not at the same time also a means to achieve A. Literature casting doubt on this directedness of means-end relations is reviewed, and the hypothesis of means-end relations having direction is tested in two empirical studies. In these studies the means-end relations turn out to be symmetrical rather than asymmetrical. Means-end structures may therefore better be conceptualized as semantic networks rather than as straight hierarchies. Consequently, for the presentation and interpretation of the results from means-end studies, the emphasis should be on elements that derive from the network nature of the cognitive structure and not from the (possibly misleading) notions of hierarchy.

Introduction

Since its introduction into the marketing literature by Reynolds and Gutman (1984a; 1984b, 1988), means-end analysis has become a frequently-used tool in consumer behavior research. The underlying notion of means-end analysis is, that decision makers choose that course of action (e.g. the purchase of a specific brand) that is most likely to achieve desired outcomes. Here the courses of actions are the means and the outcomes are the ends. Ends are assumed to be connected to means through links and structures of links. It is the purpose of means-ends analysis to unravel and show these means-end structures, which provides important information about why certain consumers do or do not like (and buy) certain products or brands. Means-end analysis can help to better satisfy customer needs, for example by adding attributes to products that act as means to satisfy particular consumer ends. The results from means-end analysis can also help to devise communication strategies that make clear to the consumer how the existing product attributes are linked to his/her consumption goals (ends). Means-ends analysis is also used as a valuable tool for benefit-based market segmentation (Botschen, Thelen and Pieters, 1999; Ter Hofstede, Steenkamp and Wedel, 1999).

Together with the data-collection technique called laddering, means-ends analysis has been applied to a broad range of products and services, varying from airlines (Reynolds and Gutman, 1984b), ski resorts (Klenosky, Gengler and Mulvey, 1993), luxury hotels (Mattila, 1999), Federal Express Services (Reynolds and Craddock 1988), to wine coolers (Reynolds and Gutman 1988), fish (Valette-Florence, Sirieix, Grunert and Nielsen, 1999) and beef (Audenaert and Steenkamp 1997; Ter Hofstede, Audenaert, Steenkamp and Wedel 1998)**.** Whereas the first applications of means-end analyses were concerned with products and services per se, in recent years means-ends analysis has moved to a broader domain. For example, Pieters, Baumgartner and Allen (1995) used means-end analysis to study the goals that are underlying consumers' weight loss behavior. Bagozzi, Henderson, Dabholkar and Iacobucci (1996) analyzed means-end chains of consumers regarding their attitudes towards recycling, and Bagozzi and Dabholkar (2000) used means-ends analysis to examine the public's perception of President Clinton. In 1995 the International Journal of Research in Marketing published a Special Issue on Means-Ends Analysis. Recently a book was published with contributions on the application of means-end analysis in marketing and advertising (Reynolds and Olson 2001).

Laddering

The technique most applied to reveal consumers' means-end structures is, by far, the so-called laddering technique (Reynolds and Gutman 1988). Often laddering is even equated with means-ends theory, although the theory should be separated from the methodology (Ter Hofstede et. al., 1998). The laddering technique consists of three phases:

(1) elicitation of salient attributes, e.g. using the Kelly Repertory Grid method (Fransella and Bannister, 1977), the rank ordering technique (Reynolds and Gutman, 1988; Lines, Breivik and Supphellen, 1995), hierarchical dichotomization or free elicitation (Steenkamp and Van Trijp, 1997).

(2) depth-interviews. This is a one-on-one interviewing technique, using primarily a series of directed probes (Reynolds and Gutman, 1988). The typical laddering question, which is repeated time and again, is: "Why is that important to you?" As

point of departure serves a concrete distinction consumers make when choosing a product (here the attributes from phase 1 are used). For example, in the case of airlines, a respondent might start with the attribute *aircraft type*, and via a series of "Why is this important to you" questions, produce the following ladder: *aircraft type->more space->physical comfort->get more done->accomplishment->self esteem* (Reynolds and Gutman 1984b).

(3) analysis of results. In this phase content analysis is used to categorize the idiosyncratic responses into a smaller number of categories. Examples of these categories are concepts such as self-esteem and accomplishment, as just given in the airline example. Subsequently, a so-called implication matrix is developed, which shows the links between the concepts in terms of means and ends. From the implication matrix, the so-called *hierarchical value map* is constructed, depicting the content and structure of consumer knowledge in a graphical way (Ter Hofstede et. al. 1998). This hierarchical value map is supposed to provide important information about why consumers appreciate or do not appreciate certain products, and therefore can be very relevant for marketing purposes, e.g. for formulating advertising strategy.

Critical issues

So far, most studies in means-ends analysis have followed the more or less standard laddering methodology, as just described. However, laddering as a qualitative interviewing technique is not without limitations. Grunert and Grunert (1995) and Ter Hofstede et al (1998) are among the first researchers to ask critical questions about the laddering technique. One problem is that due to its qualitative nature, means-ends analysis has to be limited to samples of modest size. Furthermore, the interviews are costly and require highly trained interviewers.

However, other issues can be raised with respect to laddering. A very important question is about the underlying model of (consumer) cognition that is supposed to generate the responses during the laddering interviews. One model is that consumers have structures of goals, which are ordered from high to low, where lower-ordered goals serve as means and higher-ordered goals as end. This model is evidently *hierarchical*, and the idea is that through the laddering interviews this hierarchical system is captured from the mind of the consumers. However, whether such a hierarchical structure exists in any form in the consumer's mind is not investigated; it is assumed (Cohen and Warlop, 2001: 403). There is an alternative model, in which consumers just have patterns of concepts in their minds, systems of interlinked concepts, where one concept gets its meaning from its links with other concepts. Such patterns, which cognitive psychologists use as a model for knowledge representation in the human mind, are called association patterns or *semantic networks* (Johnson-Laird 1988: 327-329; Chang, 1986; Grunert, Beckmann and Sørensen, 2001: 67). A goal structure is a particular type of a semantic network. Anderson (1983: 161) conceives of a goal structure as a data structure in working memory, no different from other memory structures. Means-end relations are semantic relations between verbal statements (Spradley, 1979: 112). Whether these relations are hierarchical, remains to be seen.

So, networks in which the relations describe a hierarchy of concepts represent a special class of semantic networks. Means-end structures are traditionally assumed to belong to this special hierarchical class. Hence, Reynolds and Gutman (1984b) refer to the graphic representation of consumers' means-end structure, derived from laddering, as a "Hierarchical Value Map". A basic difference between a (non-hierarchical) semantic network and a hierarchical network is, that in a non-hierarchical network the relations between items are *symmetric*, and in a hierarchical network they are *asymmetric*. In a non-hierarchical semantic network, a link between A and B can just as well be called a link between B and A. However if A is a means to achieve B as the end, we cannot just turn this around and say that B is also a means to achieve A. The difference between both types of networks can also be expressed by saying that hierarchical networks are *directional*, whereas non-hierarchical networks are not.

It is interesting to note that authors in different means-end studies use different terminology. In some articles it is explicitly mentioned that the purpose of a means-end study is to discover the *goal structures* of the respondents with respect the topic under study. For example, Pieters et. al (1995) want to find the goal structure underlying the objective of losing weight", and Bagozzi et. al. want to do the same with respect to waste recycling. However, in other studies instead of goal the more neutral term *concept* is used (e.g. Ter Hofstede et. al. 1998), or *cognition* (Bagozzi and Dabholkar 2000). Of course, "concept" and "cognition" have much less of a hierarchical connotation than "goal". Nevertheless, also these latter studies do not question the hierarchy assumption, and analyze the data as if hierarchy is a fact.

Purpose of the paper

The main purpose of the present article is to question this hierarchy assumption. We have serious doubts about the directionality of means-end relations. We will first discuss our main reasons for these doubts. Subsequently, we will describe a data collection method which enables us to test the hierarchy hypothesis. We will then examine two different means-end data sets, and study the extent to which, in this data, means end relations are symmetrical or asymmetrical. We will show the results from statistical tests which clearly indicate that means-end relations tend to be symmetrical rather than asymmetrical. Consequently, there is tendency that the networks are non-hierarchical, rather than hierarchical. We will then discuss the implications of these results. Should we abandon means-ends analysis altogether? If not, what do our findings imply for the way the data for means end analysis should be collected, analyzed and interpreted, and what is the best way to present the outcomes from means-end studies?

Recently, two interesting extensions to laddering have been proposed. Ter Hofstede et. al. (1998), developed the so-called association pattern technique (APT) which makes it possible to collect means-ends data from a large sample of respondents. Bagozzi et al. (1996) introduced network analysis techniques (from social sciences) to means-end data, which they used to examine the link structures among a large set if goals. In our approach we will build on these recent advances in means-end analysis, and extend them for the purpose of our research here.

Doubts about the directionality of means-end relations

The first doubt about the directionality of means-end relations stems from the fact that the directionality "observed" in empirical studies can, to a large extent, be explained as an artifact of the data collection technique. Means-end research has been criticized because of its tendency to produce directed means-end relations as a consequence of its own assumption of hierarchy (Bagozzi and Dholakia 1999). In laddering sessions each "ladder" is established by a sequence of variations of the typical laddering question: "Why is that important to you?" . Therefore, an individual ladder can be thought of as a linear sequence of answers to this question. In this sequence the concepts are one-to-one connected. The ordering of the concepts is supposed to correspond with increasing levels of abstraction (Reynolds and Gutman 1988; 12). Each ladder starts with a relatively concrete concept and the subsequent concepts (answers to questions) are of an increasing level of abstractness. For example, the ladder in the airline example given earlier (Reynolds and Gutman 1984b) starts with the concrete concept of aircraft type and ends with the much more abstract concepts of accomplishment and self esteem. The set-up of the interview is such that the respondent is more or less “forced” into this direction. Respondents are literally "pushed up" a hierarchy in an effort to discover which concepts seem to be linked hierarchically (Cohen and Warlop, 2001: 403). This is especially the case when the “hard laddering approach” is used, which forces the respondent to follow one ladder at a time, and in which each subsequent answer is on a higher level of abstraction (Grunert and Grunert 1995). In this setting it cannot occur that a respondent declares a relationship symmetric, i.e. make the statement that A leads to B, and also says that B leads to A. Such cases, called “mutuals”(see later), cannot possibly emerge in the data collection process. Thus, the laddering technique may be too directive and too narrow, in that it imposes on respondents a specific structure and a sequence of responses to elicit from this structure (Bagozzi and Dholakia, 1999: 23). It infers a linear hierarchical structure from a potentially much larger cognitive network (Grunert and Grunert, 1995: 214). This larger network is not necessarily (completely) hierarchical.

The second source of doubts about the directionality of means-end relations is the empirical findings in the literature. It turns out that sometimes respondents go from abstract values to concrete product attributes, which implies a reversal from the hierarchical ordering (Johnson, 1989: 600). For instance, the prestige of a brand of furniture may matter to a consumer because the brand prestige ensures that a nice color of wood is used for the furniture. Furthermore, means-end relations among concepts at a same level of abstraction occur, e.g. between the color of wood and the kind of tree the wood stems from (Johnson, 1989: 600; Ter Hofstede, Audenaert, Steenkamp and Wedel: 1998: 49). In the standard laddering technique such "same level orderings" are difficult to deal with.

In their study on the goal structure behind the consumer value of using weight, Pieters et. al (1995) constructed an implication matrix on the basis of the laddering data, after ordering the items according to level of abstractness. They conclude that "the strongly hierarchical nature of the goal structure becomes immediately apparent since there are more cell entries above the diagonal then below the diagonal of the implication matrix" (p 237). This is indeed what we would expect in a hierarchical network. In an implication matrix the row-items are means and the column items are ends. If a concept is an end for a (lower and left positioned) other concept, this will produce an entry in the above-diagonal half of the implication matrix. Generally, it will not, at the same time produce an entry in the under-diagonal half of the implication matrix, which would imply that is also a means to the other concept. In this case we would have a mutual. However, that researchers tend to find these above-diagonal implication matrices (Pieters et. al 1995; Bagozzi et. al. 1996; Audenaert and Steenkamp 1997) is not so much evidence of the hierarchical ordering of the concepts in the respondent's mind, but rather a result from the way of interviewing. As we just saw, it is very unlikely that a respondent will declare a relationship symmetrical, because he/she is pushed into one direction. Therefore, the interesting feature of these empirically found implication matrices is not so much that *there are more cell entries above the diagonal than below the diagonal of the implication matrix* but that that there *are any cell entries in the below-diagonal half at all.* And there are quite a few of these mutuals. For example in the study on losing weight, Pieters et. al. (1995) found for the concepts *physical appearance* and *self-esteem* almost as many entries implying that physical appearance (means) leads to self esteem (end), as entries implying that self-esteem (means) leads to physical appearance (end). In a similar way, in their study on recycling, Bagozzi et. al. (1996), found for the goals *save environment* and *avoid landfills* that save environment (means) leads to avoid landfills (end) and at the same time avoid landfills (means) leads to save environment (end). Since the laddering method is strongly biased against such mutuals, the occurrence of these mutuals are clear indications of symmetries in the underlying cognitive network.

Another piece of evidence against the hierarchy is the emergence of loops in the structure. These loops appear too often to be considered as mere incidents. Pieters, Baumgartner and Allen (1995: 238) found, for instance, a loop of means-end relations between the goals of "self-esteem", "confidence" and "achievement" and Botschen, Thelen and Pieters (1999: 46) a loop between "right clothing", "feeling good" and "reduce uncertainty". The loops illustrate Grunert and Grunert's (1995: 217) observation, that respondents may jump back and forth between different levels of abstraction. Such loops undermine the hierarchical nature of the means-end structure as a whole. Austin and Vancouver (1996: 353) observe, how the multidirectional nature of goal hierarchies has led some researchers to refer to them as "weak hierarchies" (Frese and Zapf, 1994) or "heterarchies" (Hyland, 1988: 645). Thus, it seems highly questionable whether concepts can be ordered unambiguously in a hierarchy from concrete to abstract.

The third source of doubts about the directionality of means-end relations stems from psycholinguistic research on the symmetry of semantic relationships in general. Both philosophers and psychologists used to view "similarity" as a prime example of a symmetric relationship. However, tests of symmetry produced unexpected results. Tversky (1977) found that respondents agreed much more strongly with the phrase: "North Korea is similar to Red China" than with the phrase: "Red China is similar to North Korea". Of his 69 respondents, 66 thought the first phrase was more appropriate than the second. Also in colloquial language, we say, "the portrait resembles the person" rather than "the person resembles the portrait" (p. 328). Gleitman, Gleitman, Ostrin and Miller (1996) were able to replicate Tversky's results for several semantic relations, e.g. "is similar to", "is equal to", "is identical to", "matches", "is different from" and "is far from". So, semantic relations supposed to be symmetric turned out to be fairly asymmetric, and we conclude that semantic relations can behave to some degree symmetrically and asymmetrically at the same time. If these findings generalize to all semantic relations, this would also apply to means-end relations. After all, means-end relations are semantic relations (Spradley, 1979). If semantic relations supposed to be symmetric have turned out to be fairly asymmetric, why would means-end relations, which are supposed to be asymmetric, not at the same time show a tendency toward symmetry? If the analogy holds, the amount of symmetry in means-end relations in means-end networks may be considerable. To our knowledge, the tendency of means-end relations toward symmetry has never been investigated. We will take up this challenge in the remainder of the paper.

Method

The approach that we take for investigating the hierarchical nature of means-end relations is straightforward. The main steps are given in Table 1.

<Table 1 about here>

We start with a conventional laddering procedure, in which we determine the concepts in the respondents' minds that are relevant to the issue under study. As usual, this is done in the form of qualitative, face-to-face interviews. Subsequently, we carry out a follow-up study, where the respondents are effectively "filling in" their own implication matrix. For each pair of concepts A and B, at one point in the interview it is asked whether A leads to B, and, at another point in the interview, whether B leads to A. In a sense, this approach is an extension of the association pattern technique (APT), applied by Ter Hofstede et. al. (1998). They also had respondents fill out their personal implication matrix in a large-scale survey study. However, Ter Hofstede et. al had different concepts in the rows and columns of the matrix. For example, in one case, the columns are "attributes" and the rows are "consequences". Therefore, in this APT method it is impossible for a respondent to produce mutuals. In our method the concepts in the rows and the concept in the columns of the implication matrix are the same, and it is perfectly possible for a respondent to say that A leads to B, as well as that B leads to A. Also, different from

Ter Hofstede et. al., we did not make a a-priori classification of the concepts into attributes, consequences and values.

When analyzing the data, we first analyze at the level of the sample, i.e. we examine the *aggregate* implication matrix for the incidence of mutuals. Subsequently we look at the implication matrices of the *individual* respondents. For the individual analysis, following Bagozzi et. al (1996), we use techniques from (social) network analysis to study the (a)symmetry of means-end relations (Wasserman and Faust 1994).

This method for investigating the hierarchy of means-end relations was carried out for two sets of data. The first study is among students of business administration and informatics, about the goals underlying their preferences for future employers after graduation (Van Brero, 1998). The second study is among employees of a software house about what they do in their job and what motivates them.

Study 1: Choice of an employer

Step 1

Twenty students from six Dutch universities were asked to mention ten organizations they considered as potential employers. Respondents ranked the potential employers in order of preference, and the starting attributes for the laddering interviews were assessed from these rank orders (Reynolds and Gutman, 1988: 14). For this purpose, respondents were asked to give the criterion because of which they preferred number one to number two, number two to number three, and so on. Each of those criteria successively served as the starting point for the laddering question: “why is this important to you?" The interviewer repeated this question until the respondent was unable to give further answers, and then proceeded to the next criterion of distinction between future employers, etcetera. Figure 1 shows the aggregate hierarchical value map for all twenty respondents. In order to prevent the map from becoming too cluttered and uninterpretable (Pieters, Baumgartner and Allan, 1995: 238), only means-end relations that have been mentioned by at least four out of twenty respondents have been adopted in the Hierarchical Value Map.

<Figure 1 about here>

Step 2

For the survey, we needed a number of concepts that would be large enough to represent the most important goals of the respondents, while at the same time the number of goals should be so concise to keep the questionnaire feasible. Van Rekom, Wierenga and Van Riel (1998) found the total number of times a concept was mentioned as an end (this is called the number of "in-degrees") to be a good predictor of how important a concept was to respondents. In order to achieve a feasible number of concepts for the questionnaire, a scree plot was made with the number of indegrees on the y-axis and the concepts sorted in descending order of indegrees along the x-axis. At the number of 11 concepts, the steep downward slope of the curve flattened out. The eleven concepts that were most often mentioned as ends served as input for the survey part of the study (Table 2). The concepts from Figure 1 that were adopted into the quantitative research are those with the hatched boxes is Figure 1.

Table 2 about here

Between all eleven concepts, means-end relations were assessed in both directions. The questionnaire presented all fifty-five possible dyads, i.e. pairs of concepts, in both directions. At each proposed means-end relation, respondents marked whether they agreed with the particular means-end relation or not. The questionnaire showed the complete matrix with the same concepts as potential means in the rows and as potential ends in the columns. Respondents were instructed to work though the matrix column by column. This way, means-end relations in the two opposite directions for the same pair of concepts were asked separately from each other. Pretesting showed, that respondents had no problems with the questionnaire. The questionnaire was mailed to a sample of thousand students' home addresses at seven Dutch universities. The total response was 146 (14,6 % response), of which 136 had filled out the questions regarding means-end relations completely. These 136 questionnaires served as input to step 3 of our approach: the analysis.

Step 3

The output from step 2 is, for each respondent, a matrix filled with ones and zeros. It is a square matrix with the same concepts both in the rows and in the columns. As an example, the implication matrix found for one particular respondent, say respondent R, is given in Table 3.

<Table 3 about here>

The row concepts *i* are the means and the column concepts *j* are the ends. If a link X_{ij} in the matrix is 1, this means that the respondent agrees with the existence of a means-end relation from concept *i* as a means to concept *j* as an end. If X_{ij} is 0, this means that according to the respondent, there is no means-end relation from *i* to *j*. Table 3 shows which ends *j* are implied by which means *i*, and therefore, Reynolds and Gutman (1988) called such matrices "implication matrices". It is immediately clear, that Table 3 contains quite a few "mutuals". For example, this respondent has stated that "feel fine"(1) is a means to "personal development"(2), but at the same time that "personal development" is a means to "feel fine".

Aggregate analysis

First we look at the aggregate implication matrix. The aggregate implication matrix is obtained by simply taking the average ratings of the implication matrices of the individual respondents, such as the one shown in Table 3. The aggregate implication matrix is presented in Table 4.

Table 4 about here

In a truly hierarchical network, for each pair of concept *i* and *j*, one would expect a concentration of observations either in cell (*i,j*) or in cell (*j,i*), but not in both. Concept *i* is either a means towards concept *j*, or the other way around, but not both. It is directly clear from Table 4 that this kind of asymmetry does not hold at all. Rather the opposite is true. If cell(*i,j*) has a relatively large number of observations, there is a significant tendency that this is also true for cell(*j,i*). We computed the correlation coefficient between the numbers of entries in "symmetrical" cells, i.e. we correlated the numbers in cell (*i,j*) with cell (*j,i*), etc. over all 55 combinations. This correlation coefficient is 0.28 ($p < 0.001$). This correlation points to significant symmetry among means-end relations. If respondents say that A is a means towards B as an end, they are also more likely to say that B is a means towards A as an end.

Individual analysis

Strictly speaking, a non-asymmetrical aggregate implication matrix could still be in agreement with hierarchical networks at the individual level, due to the aggregation over a heterogeneous population. One respondent could have a hierarchical network where *i* is the means towards *j* as an end, whereas for another respondent, also with a hierarchical network, *j* is the means towards *i* as the end. Aggregation could then produce entries in the implication matrix, both in cell (*i,j*) and cell (*j,i*). To refrain from the effects of mixing different respondents, an analysis at the level of the individual implication matrices, such as the one of Table 3 is needed.

Let *g* be the number of concepts making up the network. In this case, $g = 11$. The diagonal of the matrix is empty: no means can imply itself as an end. Thus, the matrix for each respondent has $g*(g-1) = 11* 10 = 110$ valid cells. The total of goals served by a single means *i* is the row total of that concept in the matrix, X_{i+}. This number is referred to as the concept's "outdegrees". The total of means that serve a concept *j* is the sum of entries in the column belonging to that concept, X_{+j}. This number is referred to as the "indegrees" of that concept. Indegrees and outdegrees are the marginal totals of a respondent's implication matrix, also referred to as "marginals". For example, for respondent R, the concept "feel fine" has 4 outdegrees and 9 indegrees (Table 3). This implies that it serves four times as a means and nine times as an end. For each dyad of concept *i* and concept *j* in the matrix, four different forms are possible (see Figure 2).

<Figure 2 about here>

The first possibility is a *null dyad.* ($X_{ij}= X_{ji} =0$). For instance, Table 3 shows a null dyad for ""prove yourself" and "satisfaction". The next possibility is an *asymmetric dyad from i to j,* i.e. if X_{ij} is 1 and X_{ji} is 0. An example in Table 3 is the relation between "personal development" and "perform properly". It can also be an *asymmetric dyad from j to i*, i.e. if X_{ij} is 0 and X_{ji} is 1 (e.g. between "feel fine" and "get far in your career"). Finally, between two concepts there can be a *mutual dyad*, where both X_{ij} and X_{ji} are 1. For example, in Table 3 we have a mutual between "feel fine" and "personal development". Let *M* be the total number of mutual dyads. *M* is the critical number for testing hypotheses regarding the symmetry of means-end relations. For the respondent presented in Table 3 (respondent R) *M* is 10. If means-end relations are neutral toward symmetry, the expected value of *M* is equal to the number of mutual relations under mere chance (given the values of the marginals). As we will see later, the expected number by mere chance in the case of respondent R of Table 3, is 8.84. So, respondent R has *more* mutuals than expected by chance. Therefore, respondent R demonstrates a tendency towards symmetrical means-end relations. However, if means-end structures have a clear hierarchy and means-end relations have a clear direction, the number of mutuals should be significantly *smaller* than expected by chance.

We study the (a)symmetry of the observed individual implication matrices (Wasserman and Faust 1994) in two steps. First, we measure the amount of (a)symmetry in the individual implication matrices. Subsequently, we carry out statistical tests on this (a)symmetry. For the measurement we use the so-called p1 model (Holland and Leinhardt, 1981), which is in principle a dyadic interaction model. It posits a model for the natural logarithm of the probability that a concept *i* as a means serves a concept *j* as an end, while concept *j* as a means serves concept *i* as an end (Iacobucci, 1994: 614). For the purpose of this study, the parameter ρ is the crucial one. It is the log of the increase of the odds, that $X_{ij} = 1$ due to $X_{ji} = 1$.

In formula (Holland and Leinhardt, 1981:36): $$\exp(\rho) = \frac{\left(\dfrac{P(X_{ij}=1 \mid X_{ji}=1)}{P(X_{ij}=0 \mid X_{ji}=1)}\right)}{\left(\dfrac{P(X_{ij}=1 \mid X_{ji}=0)}{P(X_{ij}=0 \mid X_{ji}=0)}\right)}$$

If, for a particular respondent, this parameter ρ is larger than zero, this means that for that respondent means-end relations tend toward symmetry. In case of complete symmetry, ρ would approach infinity. If ρ is smaller than zero, the means-end relations are asymmetric.

For an explanation of the full model, which contains additional parameters, for the overall density of the implication matrix, a concept's propensity to serve as a means (to any other end), a concept's propensity to be a goal (to any other means) and a normalizing parameter to ensure that the probabilities sum up to one, respectively, the reader is referred to Holland and Leinhardt (1981). The essence of the parameter ρ is that, taking into account all these propensities just mentioned, it measures the tendency of the respondent to be asymmetrical (ρ <0), symmetrical (ρ>0) or just neutral (ρ=0). Under the assumption, that the dyads are statistically independent from each other (Holland and Leinhardt, 1981: 36) the model can be estimated. Ter Hofstede, Audenaert, Steenkamp and Wedel (1998: 46) found this assumption to be unproblematic in their analysis of means-end matrices.

The parameters ρ were estimated for all 136 respondents using the UCINET V program (Borgatti, Everett and Freeman, 1999). For respondent R, with the implication matrix of Table 3, the estimated ρ is 1.15, which confirms its tendency towards symmetry (ρ>0). The estimation results over all respondents with respect to ρ are shown in Figure 3.

Figure 3 about here

For 10 respondents ρ could not be computed because their matrices lacked variation. The mean estimated ρ for the remaining sample of 126 respondents was 1.20, indicating, on average, a more than threefold ($e^{1.20}$ = 3.32) increase in the odds that X_{ij} = 1 when X_{ji} =1 over the value obtained when X_{ji} = 0. This means that if a particular concept i serves as a means towards another concept j, the probability that concept j serves also as a means towards concept i is 3.3 times bigger than if i would not lead to j. This implies that, on average, there is a considerable tendency toward symmetry. But not all respondents have the same tendency towards symmetry. Of the 126 respondents, 70 (56 %) have an estimated value of ρ that is larger then zero, implying a tendency towards symmetry. There are 45 respondents with a ρ-value smaller than zero. This means that 36 % show a tendency towards asymmetrical means-ends relations. 11 respondents (8 %) had a ρ of exactly zero. The standard deviation of the estimated ρ is 3.5. On the whole, thus, there seems to be a tendency toward symmetry rather than toward asymmetry, although the variation among respondents is considerable.

Testing the significance of (a)symmetry

In principle it would be possible to test for each respondent whether or not the parameter ρ is equal to, or different from zero. This could be done by running the estimation of ρ twice, first with letting its value free and then with its value constrained to zero. The significance of the difference could then be established by calculating the log-likelihood statistic. However, Holland and Leinhardt (1981: 41) found a consistent evidence for a bias, if this approach is followed. Therefore, for matrices with $g < 20$, such as those collected in this study, Snijders (1991: 402) has proposed an exact test. We use this test method here, which takes, instead of ρ, the number of mutuals M in the matrix, as the variable of interest. Snijders (1991) developed a method for enumerating all matrices that have given numbers of indegrees and outdegrees. Once all the matrices have been enumerated, this method can be used to establish the expected number of mutual relations M and the probability that this number can arise while the null hypothesis of no tendency toward mutuality holds. For matrices larger than $g = 8$ this enumeration algorithm becomes infeasible and Snijders (1991: 407) replaces it by a Monte Carlo simulation algorithm. This algorithm calculates, for a given implication matrix, for each number of mutuals the probability of observing that number by chance, (i.e. if there is no tendency towards either symmetry or asymmetry). This is done by running a Monte Carlo simulation that randomly generates implication matrices with the same number of indegrees and the same number of outdegrees as the given matrix. For each of the respondents, we simulated 10.000 matrices that have the same number of indegrees and outdegrees as had been observed with these respondents.

For example, let us look at the results for respondent R, of which the implication matrix is given in Table 3. For this respondent, the observed number of mutual relations, $M_{observed}$, is 10. We carried out the simulation for this respondent. The resulting distribution under the null-hypothesis of neutrality (no tendency towards symmetry or asymmetry) is given in Figure 4 . The actual number of mutuals of respondent R, 10, is on the right-hand side of this distribution, implying that, under the null-hypothesis it is rather unlikely to observe a number of mutuals as high as 10. It turns out that for respondent R, $M_{expected}$, the average of the simulated numbers of mutuals, is 8.84.

<Figure 4 about here>

To judge the significance of the outcome 10, we can compute the probability to find, under the null-hypothesis, a value of 10 or larger, which is 0.27. Since we include the full probability of finding the observed value of M into the critical region, this is a conservative test. If we had computed the probability of finding, by chance, a value for M *larger* than the observed value, the probability would only have been 0.06.

The procedure, illustrated for respondent R, has been applied to the implication matrices of all respondents in the sample. For fifteen respondents the test could not be carried out, because they had “saturated” implication matrices. This means that these matrices were so constrained by their marginals that the simulation could not produce matrices different from the observed matrices. These saturated respondents were left out from the further (a)symmetry analysis. However, it is interesting to not that these respondents on average had 47 mutuals (on the total of 55 dyads), which makes clear that for these respondents the relations between the concepts are overwhelmingly symmetric.

Given the limited information per respondent, it is often not possible to reach significance for an individual respondent. For 10 out of the 121 respondents for which the probability distribution of M could be obtained, the probability of observing, under the null-hypothesis of neutrality, a value of M larger than the one actually found is smaller than 0.05. For these respondents, the hypothesis of neutrality can be rejected in favor of the hypothesis of symmetry, at the individual level (α=0.05). In order to draw conclusions at the sample level, the results of the different respondents have to be combined.

Combination of scores from different respondents

For this purpose, we add the Z-scores of individual respondents and divide the sum by the square root of the number of measurements (Rosenthal, 1991; Stouffer, 1949). Of course, the respondents with the saturated matrices are left out here again. Table 5 shows, by way of example, the results of the simulation of respondent R (of Table 3 and Figure 4), and those of another respondent, R+. From the probabilities assessed with Snijder's (1991) simulation method, the Z-score belonging to de standard-normal distribution has been computed. The combined Z of the two respondents is $(0.6291+1.3328)/\sqrt{2} = 1.38$. The corresponding one-sided p is 0.0838.

<Table 5 about here>

In this example, both respondents had their $M_{observed}$ larger than their $M_{expected.}$ If, however, the second respondent would have a difference in the opposite direction, the Z of the probability that the second respondent would have an *M* at least as small as $M_{observed}$ should be used, in combination with a negative sign in order to account for the difference in direction (Rosenthal, 1991: 89). The Z-values were summed up and divided by the square root of 121, leading to an overall Z value of 3.22, corresponding to a one-sided p of 0.001. So the compound hypothesis of neutrality is rejected in favor of the alternative hypothesis that, overall, there is a tendency towards symmetry. If a respondent says that concept *i* is a means towards concept *j*, more often than by chance, the respondent will also say that concept *j* is a means towards concept *i*. The summary statistics for Study 1 are given in the first numerical column of Table 6.

<Table 6 about here>

All three statistics: the correlation of the numbers in symmetric cells of the aggregate implication matrix (1), the mean value of the coefficient ρ measuring the tendency towards symmetry of individual implication matrices (2), and the outcome of the pooled z-statistic for determining the probability of finding the observed number of mutuals under the null hypothesis of no tendency towards mutuality (3), convey the same message. There is a clear tendency towards symmetry in the means-end relations of this study. We will no turn to a second study, to see whether we observe the same phenomenon.

Study 2 On-the-job Motivation in a Software House

Step 1

This second study was held among the employees of a software house, and was carried out in the same three steps as described earlier. Twenty-five employees from a larger Dutch software house were interviewed about what they did in their job and what motivated them. Respondents were asked to mention concrete instances of what they did, and then the interviewer started the typical laddering question "why is that important to you?". The interviewer repeated this question until the respondent was unable to give further answers and then proceeded to the next example of a concrete activity of the respondent on his job. Then the laddering sequence started again with that new activity. The resulting hierarchical value map was discussed with management of the organization The twenty-four concepts that appeared the higher half in the resulting hierarchical value map were included in the questionnaire of Step 2.

Step 2

We thought that presenting all 24*23=552 possible relations between these 24 concepts to each individual respondent would be too tedious and time-consuming. Therefore, we distributed the questions regarding means-end relations across three different versions of the questionnaire in which each respondent was confronted with eight concepts. Table 7 shows the concepts in each of the three substudies.

<Table 7 about here>

As in study 1, the respondents indicated whether they agreed or disagreed with the existence of means-end relations between each of these eight concepts as a means and the other concepts as an end. We sent a questionnaire to every fourth employee to be found on an alphabetical list of employees. Of the 248 questionnaires mailed to the employees' homes, 146 were returned (59 % response; response was endorsed by management). As for the demographic variables of job category and location, chi-square tests showed no significant differences between the respondents of the three versions of the questionnaire. Because each version contains different concepts, we report of them as three different substudies within the study.

Step 3

Again, the output of step 2 is for each respondent a matrix filled with zeros and ones. For each substudy we can compute the aggregate implication matrix, as we did in study 1. For the aggregate implication matrices the correlation coefficients between the numbers of observations in cell (i,j) and cell (j,i) are, for the three substudies: 0.26, 0.37, and 0.43, respectively (Table 6). All these correlations point into the same direction. Also in this study, the means-end relations show time and a tendency toward reciprocity. The same way as in Study 1, the p1 model has been estimated and Snijders' (1991) matrix simulations were run. The three columns on the right in Table 6 show the results for all three substudies

The three substudies show an average value of ρ ranging from 1.56 to 2.30, implying a clear tendency toward symmetry. Also in these three substudies there is considerable variation in ρ, as expressed by its large standard deviation. For the individual respondents in each of the three substudies the Snijders' (1991) procedure was carried out at the individual level, and subsequently the results were pooled using the method of Rosenthal (1991) and Stouffer (1949). The numbers of respondents for which the Snijders' simulation test could be carried out in the three versions were 44, 47 and 43 respectively As can be seen in Table 6, again the overall tendency is significantly toward symmetry.

Looking at the summary results of Table 6, our conclusion from two different studies, with one of these studies actually consisting of three independent substudies, is that means-end relations show a significant tendency towards symmetry. This puts the hierarchical nature of means-end relations into serious doubt and should have consequences for the way we deal with laddering and the results of laddering. We will elaborate on this in the remainder of this paper.

Implications

Our research has led to the conclusion that there is more reason to interpret the means and ends which emerge from laddering studies as connected nodes in a semantic network, than as means and ends (in the literal sense) in a hierarchical goal structure. This is a significant departure from the "conventional wisdom", and reflection is needed on the consequences of this finding. Here we will deal with three questions: (a) Can we understand our results in the light of the current psychological literature on this subject? ; (b) Should researchers still apply laddering?; and (c) If the answer to the last question is "yes", what are the changes that we should make in the presentation and interpretation of the results from laddering studies?

Understanding the results from the perspective of psychological literature

In the first part of this paper, we put forward the idea that means-end relations, like other semantic relations, might behave to some degree symmetrically and asymmetrically at the same time. A priori, one thinks of means-end relations as asymmetrical relations. However, we found for means-end relations, that symmetry is even a stronger tendency than asymmetry. This finding is the complement of the results of Gleitman et. al. (1996) who found that a priori symmetrical semantic relations show a significant amount of asymmetry (an example is the semantic relation: “is equal to”).

The shift from a hierarchical interpretation of means-end structures toward a network-interpretation that seems to be needed, parallels the shift from a hierarchical interpretation toward a network interpretation in earlier semantic literature. Collins and Loftus (1975: 411) introduced their more network-like theory of spreading activation as an elaboration of the earlier hierarchical model of Collins and Quillian (1969) in order to correct what they called "a rich variety of misinterpretations" of the earlier model (cf. Chang, 1986: 216). The spreading-activation theory is able to better explain a lot of empirical evidence (Chang, 1986: 210).

Another interesting input from psychology is the suggestion of Gleitman et al. (1996) to explain the asymmetry of semantic relations that otherwise seemed symmetric in terms of the "figure-ground" distinction. They refer to Talmy's (1978) distinction between a "figure" and a "ground". A "figure" is a "moving or conceptually moveable object". A "ground" is "a reference object, itself having a stationary setting within a reference frame, with respect to which the figure's site, path or situation is characterized". For instance, the relation "is next to" is perceived to be symmetric. However, when the position of a bicycle and a house are compared, the bicycle is in general perceived to be the moveable object, and not the house. Therefore, we say: "The bicycle is next to the house", and not: "The house is next to the bicycle". Something similar might be the case with means-end networks. Some concepts may be perceived to be less moveable than others. The research question, what determines whether a concept is a "ground" rather than a figure is an intriguing one, and may provide us valuable insight into what means-end structures essentially represent. This would imply, for instance, that a concept like "get far in your career" gets its meaning through its connection to the much more central concept of "being motivated" in Figure 5. "Being motivated" is much more anchored in the whole structure, and therefore serves as the more stable ground. Because it is so well connected (having the highest centrality) a change in any single connection will not have a great impact on its weight or total meaning, whereas more peripheral concepts like "get far in your career" or "grow into a higher position" are more susceptible to change in their means-end relations. "Being motivated", than, is the ground, in comparison to which the other concepts are being judged.

Should we still apply laddering?

At this stage, we would not discourage researchers from using the laddering technique. On the contrary, the laddering technique has its merits whenever motives for behavior have to be investigated, for instance when consumer motives for the choice of certain brands have to be established. The power of the laddering technique is its potential to have respondents put the self-evident into words. The technique provides sufficient provocation for respondents to become conscious of motives which drove them in their choices but of which they were not aware. Unconscious motives play a role in how people behave. The explanatory power of unconscious goals may be as large as that of conscious goals in explaining respondents' behavior, even when people may be completely unable to reveal these motives on their own (Bargh, Gollwitzer, Lee-Chai, Barndollar and Trötschel, 2001). In this aspect, laddering has undeniably its superiority over other available techniques for qualitative research, provided we keep its limitations into account when interpreting the results. Laddering is a very effective technique for finding links between concepts, but it should be clear that often these links do not have a distinct direction. The network itself is more important than the possible hierarchies within the network

Furthermore, as we have seen in this paper, the value of laddering can be significantly enhanced by using the results from a qualitative laddering study as inputs for a large scale quantitative follow-up study in which the means-end structures are more fully determined, including the symmetries that they contain.

Implications for the interpretation of the results from laddering studies

In the hierarchical view of means-end structures there is a natural focus on the concepts at the *top* of the hierarchy. There is a flow toward desired ends at successively higher levels, from concrete product attributes to important aspects of the consumers' self-concepts (Gutman, 1997: 546). In that view, top-level values are more important than intermediate consequences. However, if means-end relations are less directional than assumed, the conceptualization of goal structures as semantic networks is more appropriate (Novick and Hurley, 2001). In that case the focus should be on the most *central* concepts in a network, rather than on the concepts at the highest hierarchical levels. This means that it is preferable to characterize a concept by its position in the network, defined by its relations with other concepts, than by its level in the hierarchical value map (HVM).

We will illustrate this for the study about employer choice (Study 1), that we have used earlier in this paper. We have drawn, in Figure 5, the network derived from the aggregate implication matrix. For Figure 5, we took the network notion of centrality of a concept as point of departure. Centrality of a concept in a network is defined as the sum of the relations a concept has (Freeman, 1979:200), i.e. of the number of indegrees plus the number of outdegrees. Therefore, for each of the concepts, we have calculated centrality as the sum of the indegrees and outdegrees of Table 4. The most central concept, "be motivated" is in the centre, and the distance at which the other concepts have been plotted in the figure represents the difference in centrality of the respective concepts from "be motivated". The concepts can be viewed as lying on different concentric circles around the most central concept, with the radius of each circle given by the difference in centrality between the most central concept, "be motivated" and the respective concepts. The figure has been visually optimized using the Krackplot program (Krackhart, Blythe, and Herbert, 1995). All relations on which more than 90 % of the respondents agreed have been adopted into the figure. Note that many arrows are now bi-directional.

<Figure 5 about here>

We can compare Figure 5 with the HVM derived for the same study, shown in Figure 1. First of all, the concepts in Figure 5 appear much more mutually coherent than the same concepts in figure 1. The visualization of the structure in terms of central versus peripheral concepts seems much more coherent than the more rigid hierarchical representation of Figure 1. But the greatest advantage of drawing a means-end structure as a network is its robustness when relations turn out to be symmetrical or when they form loops. The network conceptualization flexibly accommodates for such phenomena.

But it is not just the fact that the graph derived from the network is more attractive than the hierarchical value map. Statistics following from the network notion (centrality, indegrees) give a more valid picture of the cognitive structure of concepts and their relations than statistics from the hierarchy notion (e.g. level in the HVM hierarchy). To illustrate this point, for the concepts in Study 1 we have computed for each concept two network statistics (centrality, indegrees) and one hierarchy concept (level in the HVM of Figure 1). Centrality and indegrees were computed from the quantitative study, and indegrees was also computed from the qualitative study. Level in the HVM was computed from the qualitative study. In Study 1 we have also measured the importance of the different concepts, as perceived by the respondents. For this purpose, respondents were asked to rate the importance of the concepts on a seven-point scale, ranging from "1" = very unimportant to "7" = very important. Table 8 gives the results for the eleven concepts.

<Table 8 about here>

Table 9 gives the correlation coefficients among the five measures from Table 8. If we take the importance that respondents attach to the different concepts as our leading perspective, it is clear from Table 8 that the network statistic centrality reflects much better what the respondents think about the different concepts than the levels of the concepts in the HVM. The correlation of importance with centrality is 0.74 (p=

0.014), whereas there is no correlation between the level of a concept in the HVM and its importance (r = -0.09; p=.90) (Table 9).

<Table 9 about here>

So, the levels of the concepts in Figure 1 do not tell much about how important people believe a concept to be. The network statistic “indegrees”, i.e. the number of times a concept has been mentioned as a goal can be considered as a proxy for the centrality of a concept. As Table 9 shows, indegrees from the quantitative study does have a positive correlation (0.33) with importance (although this correlation does not reach significance here). Indegrees can also be computed for the data from the qualitative interviews. Interestingly, this statistic, a network statistic, but derived from the qualitative laddering stage of the study, and computed on the basis of only 20 interviews, has a relatively high correlation with importance (r = 0.60, p = 0.07). So, even if only the results of a qualitative laddering study are available, it is better to pay attention to network statistics such as indegrees of the concepts, than to the levels of the concepts in the HVM.

It is also interesting to look at the scores of individual concepts on the different statistics in Table 9. For one particular concept “feel fine” there is a lot of agreement. It receives the top ranking for level in the HVM, importance, and indegrees and it receives the largest but one ranking for centrality. However, for another concept “get far in your career”, the HVM-statistic "level" suggests that this is a relatively high-level concept, whereas the network statistic centrality suggests the opposite, which is in agreement with its lower importance score. For such a concept a researcher would be wrong-footed if the level in the HVM is taken as the indication of importance. To give another example, the concept “be motivated”, would not have emerged as a very central concept in the choice of an employer, had only the HVM been used.

In conclusion, means-end analysis can still provide interesting insights, but for the presentation and interpretation of the results, the emphasis should be on elements that derive from the network nature of the cognitive structure and not from the, possibly misleading, notions of hierarchy.

Further research questions

The results of this study leave us with several questions for further research

The two studies reported in this paper confirm, that if respondents are given the freedom to respond to each pair of concepts in the way they want, a significant tendency of means-end relations toward symmetry shows up. Interestingly, the tendency towards symmetry is not universal. A subset of respondents (a minority in both studies) do demonstrate the tendency towards asymmetry, as would be expected under the hypothesis of hierarchy. Future research may address the question, what factors influence an individual’s tendency to perceive relations as more or as less symmetric.

If we can represent respondents' means-end structures more completely, it would be intriguing to see, what path laddering interviews would follow through such a network. By mere chance, more central concepts in the network might attract the direction of laddering interviews, just because they have more means-end connections. But then, once the most central concept is reached, a further insistence on the question "why is this important to you" would produce means-end relations which lead away from the centre of the respondent's means-end structure. The higher one gets in a means-end structure established with the traditional laddering technique, therefore, the more the structure may be an artefact of the interview situation This is also an interesting subject for further research.

Finally, it should be emphasized that this is the first article in which the asymmetry of means-end relations is seriously put into question. Much more work is needed. First, researchers should delve deeper in cognitive psychology and linguistics, to get more insight in what happens if a respondent is probed about his/her cognitive structures about products and brands by means of laddering. A few interesting notions have been dealt with in this paper, but probably there is more to say. Second, more empirical research is needed. It would be interesting to examine if the amount of symmetry in means-end relations is higher for specific types of products or brands, for specific types of respondents, or for respondents with different levels of knowledge about the domain under study. This may provide interesting information on the sense those respondents make of the information they have regarding the products or brands under study. Maybe, once researchers are willing to relax unwarranted assumptions regarding means-end analysis and laddering, they will be able to enjoy and use the full richness of opportunities provided by this research approach.

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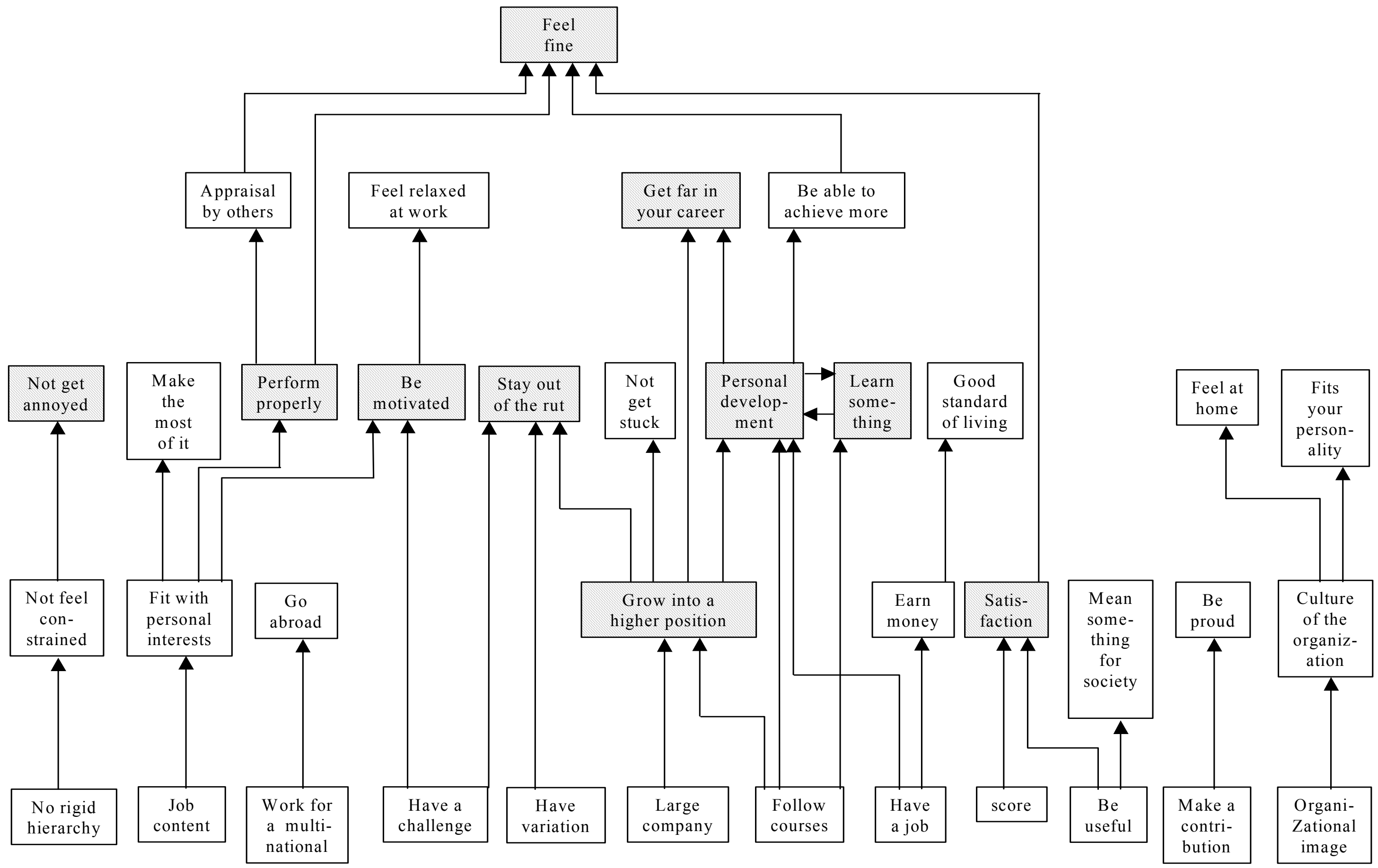


Figure 1 Hierarchical Value Map of Study 1: Choice of an employer

Shaded boxes refer to the concepts used in step 2 of the analysis. Of these, the concept "prove yourself" is missing in Figure 1 because it did not pass the criterion of being mentioned by at least four respondents, needed to be included in Figure 1. This concept did have a large number of indegrees, though.

Figure 2 The four kinds of means-end dyads

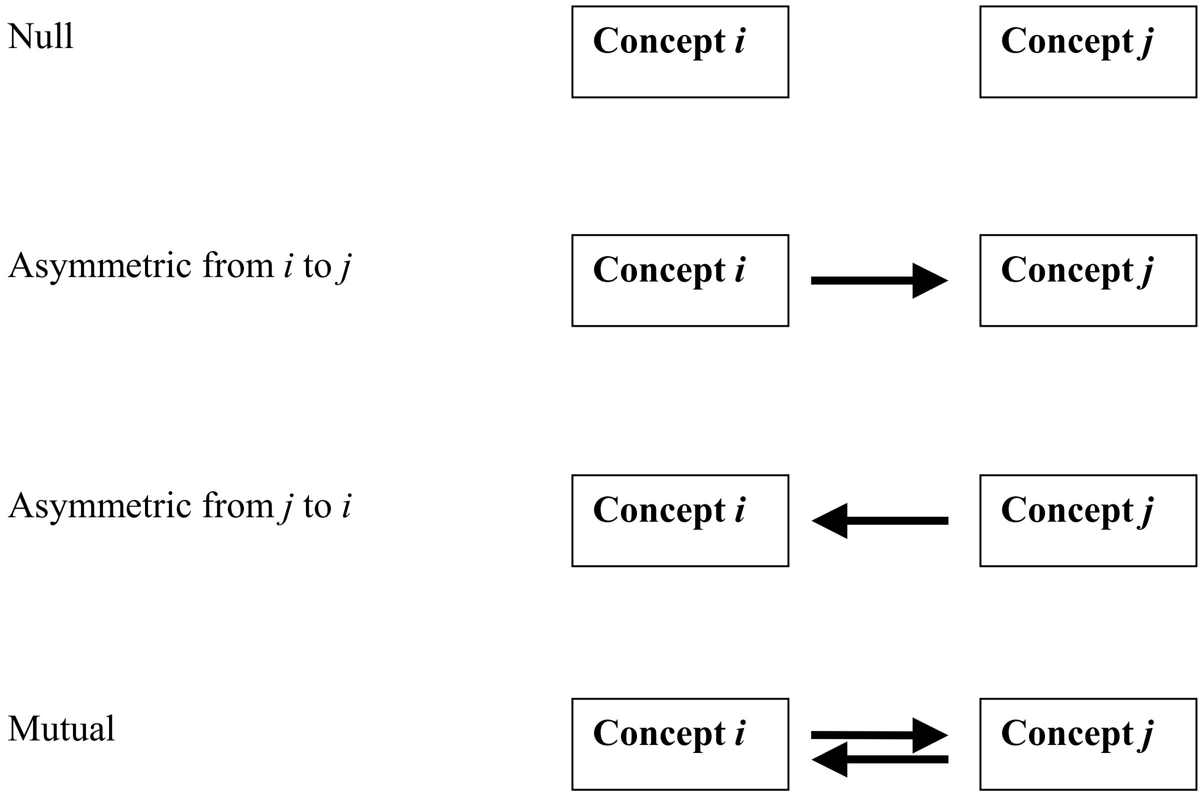


Figure 3: Distribution of ρ from Study 1

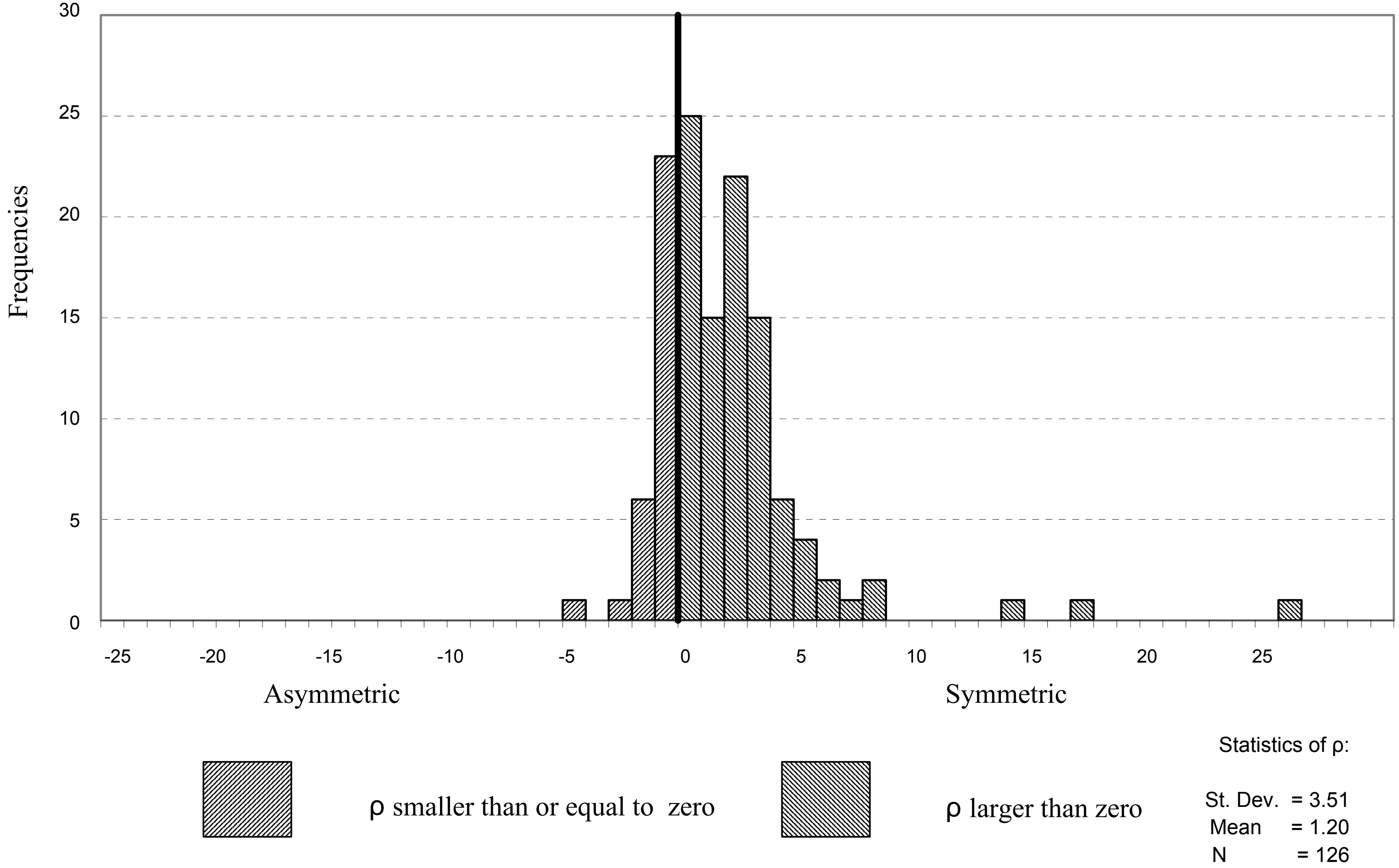
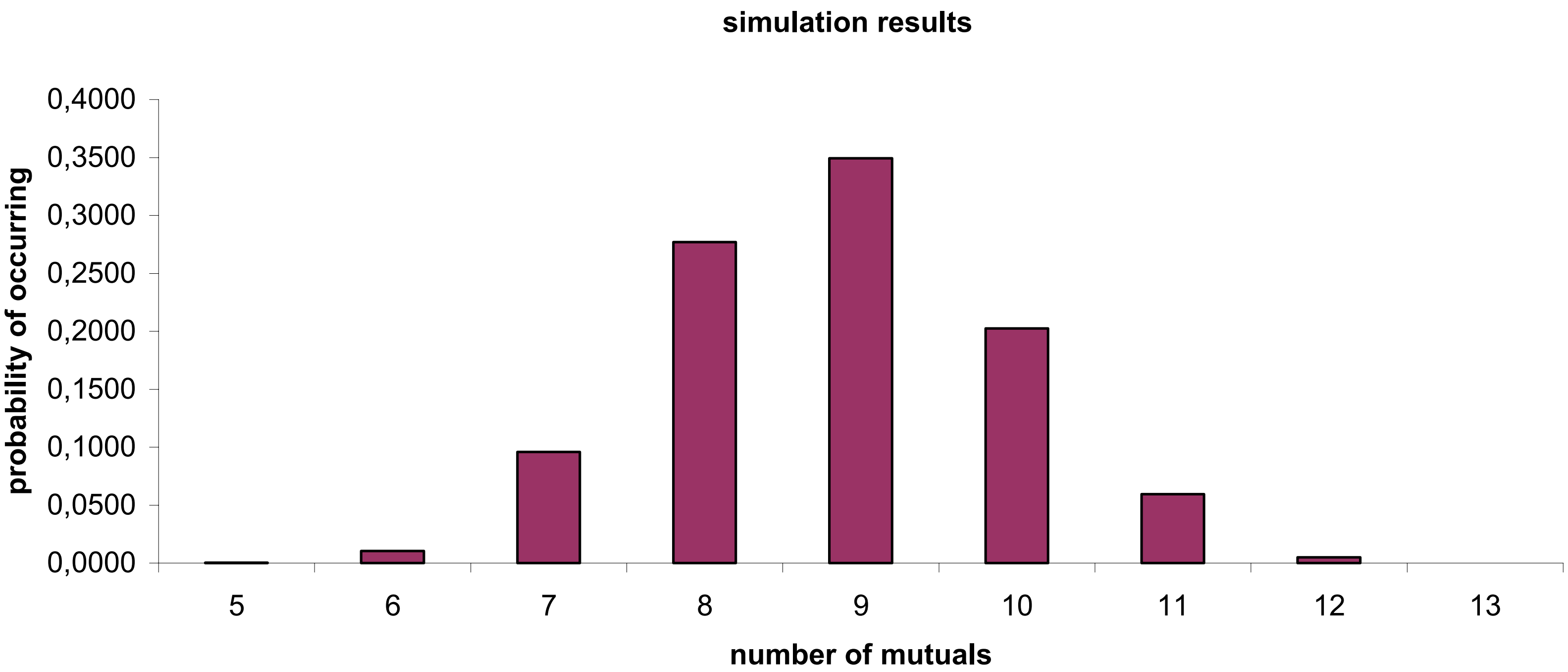


Figure 4 Distribution of simulated numbers of mutuals for respondent R



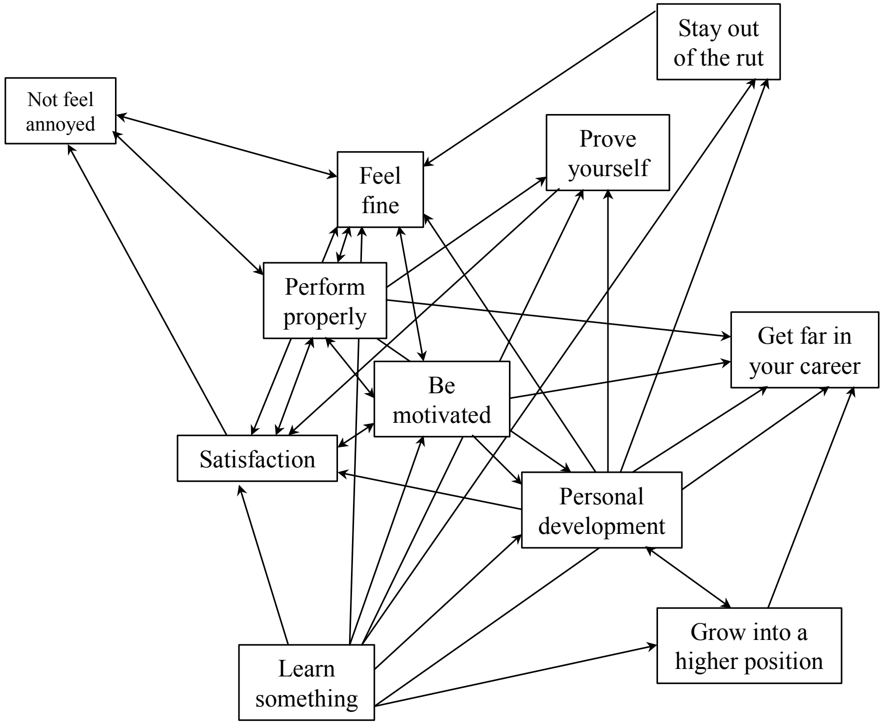


Figure 5 Network representation of the quantitative means-end results (relations recognized by at least 9 out of 10 respondents)

Table1 Steps in the method for investigating the hierarchical nature of means-end relations

Step 1 Carry out a conventional (qualitative) laddering procedure among respondents from the population of interest and find the relevant concepts

Step 2 Include these concepts in a large-scale survey among respondents from the same population, and have respondents for each pair of concepts A and B, answer the question whether (1) A is a means towards B as an end, and (2) whether B is a means towards A as an end.

Step 3 Analyze the data with a particular attention for the mutuals, i.e. those cases where a respondent states that A leads to B and at also that B leads to A. In particular: do these mutuals occur more often (less often) than would be expected under conditions without a tendency towards (a)symmetry?

Table 2 The eleven concepts in Study 1

1	feel fine
2	personal development,
3	satisfaction
4	learn something
5	perform properly
6	get far in your career
7	stay out of the rut
8	be motivated
9	prove yourself
10	grow into a higher position
11	not get annoyed

Table 3 Example of an individual implication matrix (Respondent R)

No	Ends ► Means ▼	1	3	3	4	5	6	7	8	9	10	11	out-degrees
1	feel fine	-	1	1	1	1	0	0	0	0	0	0	4
2	personal development	1	-	0	0	0	1	0	0	0	0	0	2
3	satisfaction	1	0	-	0	1	0	0	1	0	0	0	3
4	learn something	1	1	1	-	1	0	1	1	0	0	1	7
5	perform properly	1	1	0	0	-	0	0	0	1	0	0	3
6	get far in your career	1	1	0	0	0	-	0	1	0	0	0	3
7	stay out of the rut	1	1	0	0	0	0	-	1	0	0	0	3
8	be motivated	1	1	1	1	1	1	0	-	1	1	0	8
9	prove yourself	1	1	0	0	0	1	0	0	-	0	0	3
10	grow into a higher position	1	1	0	0	0	1	0	1	1	-	0	5
11	not get annoyed	0	0	0	1	1	0	0	0	0	0	-	2
	indegrees	9	8	3	3	5	4	1	5	3	1	1	

Table 4 Aggregate implication matrix of Study 1

No	Ends ► / Means ▼	1	2	3	4	5	6	7	8	9	10	11	out-degrees
1	feel fine	-	0,71[1]	0,90	0,42	0,93	0,63	0,63	0,90	0,60	0,40	0,88	6,99
2	personal development	0,94	-	0,92	0,74	0,79	0,91	0,85	0,84	0,90	0,86	0,66	8,42
3	satisfaction	0,97	0,48	-	0,38	0,89	0,65	0,73	0,90	0,58	0,44	0,85	6,88
4	learn something	0,90	1,00	0,93	-	0,75	0,90	0,95	0,89	0,90	0,86	0,60	8,67
5	perform properly	0,96	0,93	0,93	0,62	-	0,88	0,70	0,94	0,91	0,82	0,89	8,56
6	get far in your career	0,68	0,75	0,77	0,54	0,38	-	0,58	0,70	0,80	0,54	0,49	6,24
7	stay out of the rut	0,90	0,66	0,80	0,55	0,76	0,52	-	0,82	0,42	0,39	0,85	6,67
8	be motivated	0,96	0,94	0,88	0,81	0,96	0,91	0,66	-	0,83	0,81	0,72	8,49
9	prove yourself	0,80	0,81	0,85	0,49	0,71	0,83	0,61	0,75	-	0,75	0,54	7,14
10	grow into a higher position	0,76	0,94	0,79	0,76	0,55	0,94	0,84	0,85	0,78	-	0,54	7,76
11	not get annoyed	0,89	0,35	0,71	0,36	0,88	0,51	0,48	0,75	0,46	0,30	-	5,69
	indegrees	8,76	7,57	8,49	5,65	7,60	7,69	7,03	8,35	7,17	6,18	7,02	81,49

[1]The numbers in the cells represent the proportions of respondents who filled in '1' = 'this row concept is a means to achieve the column concept as an end'

Table 5 Simulated and observed numbers of mutuals for two respondents R and R+

Respondent	Numbers of mutual relations with corresponding probabilities derived from simulation Example for two respondents (Snijders 1991)											No of Mutuals expected from simulation	No of mutuals observed	Probability of obtaining observed number or larger	corresponding z-value
R	No of Mutuals	5	6	7	8	9	10	11	12	13		8,84	10	0,2670	0,6291
	probability under H_0	0,0003	0,0104	0,0958	0,2771	0,3494	0,2025	0,0594	0,0050	0,0001					
R+	No of Mutuals	21	22	23	24	25	26	27	28	29	30	25,95	28	0,0913	1,3328
	probability under H_0	0,0003	0,0005	0,0144	0,0845	0,2543	0,3299	0,2249	0,0794	0,0114	0,0005				

Table 6 Summary outcomes of the two studies: analysis whether means-end relations are symmetric versus neutral (H_0)

	Study 1	Study 2		
		Subsample 1	Subsample 2	Subsample 3
r [n(i,j), n(j,i)] (aggregate)	0.28	0.26	0.37	0.43
mean ρ	1.20	1.56	1.88	2.30
standard deviation ρ	3.51	3.79	4.63	4.31
Pooled test statistic z	3.22	2.18	2.70	4.62
Significance of pooled test statistic :P($M>M_{obs}$ under H_0)	0.001	0.015	0.003	0.000

Table 7 The three versions of the questionnaire in Study 2

Concepts	Version 1	Version 2	Version 3
1	Motivate people	Achieve a good result	Enjoy your work
2	Satisfy the client	Solve problems	Reach your goal
3	Internal recruitment	Simplify the information flow	Focus on a specific market
4	Keep each other informed	Foster employee commitment	Stay in touch with clients
5	Make profit	Bring in orders	Be creative
6	Cooperation	Submit offers	Foster togetherness
7	Be professional	Deliver quality	Think in the long term
8	Establish the problem	Deliver value added	Be asked for by the client

Table 8 Network statistics and importance ratings of the concepts of Study 1. Concepts have been ordered in descending order of centrality.

Concept	Centrality in quantitative Study	Indegrees in quantitative Study	Level in Figure 1	Indegrees in qualitative research	Average importance ratings by respondents
be motivated	18.43	9.28	2	23	6.16
feel fine	17.66	10.24	4	73	6.44
perform properly	17.48	8.38	2	25	6.29
satisfaction	16.99	9.77	1	39	6.42
personal development	16.72	7.88	2	45	6.36
learn something	15.29	6.15	2	36	6.20
prove yourself	14.97	7.46	-	22	5.40
get far in your career	14.57	8.13	3	25	5.39
grow into a higher position	14.51	6.49	1	21	6.03
stay out of the rut	14.18	7.32	2	32	5.90
not get annoyed	14.01	8.10	2	19	5.60

Table 9 Correlations for the statistics of Table 8

Measure	Centrality from the survey	Indegrees from the survey	Level from the laddering interviews	Indegrees from the laddering interviews
Indegrees from quantitative survey	0.69*			
Level from the laddering interview	0.19	0.40		
Indegrees from the laddering interviews	0.43	0.48	0.61	
Importance ratings by respondents	0.74*	0.33	-0.09	0.60

* Significant at 5 % level

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