# INTRANSITIVE CONSUMER PREFERENCES

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**Summary:** If people's rating/ranking are not supposed to be a perfect measure of their product preferences and their choices are only partially guided by their preferences then free-choice paradigm will produce spreading of ratings. People not necessarily rational and also bear boundaries in computing capacity; consequently they are not capable of comparing several objects transitively. We aim to describe the phenomenon of intransitivity and to examine the impact of enhancing dimensions on its degree. In our study we are investigating intransitivity in participants' preferences during selection between simple, medium complex, and complex products. Using the Q-method – dedicating importance to subjectivity - if every participant receives the products to compare based on their own importance ratings, subjectivity is preserved, and thus the biasing effect can be decreased. Based on this result, we are going to collect data using a computer based experimental design to investigate the proportion of intransitivity in choices.

**Keywords:** rating; ranking; preferences; complexity; intransitivity

**Összefoglalás:** Ha feltételezzük, hogy az emberek értékítéletei és rangsorolásaik nem tökéletes mérőeszközei termékpreferenciáiknak és választásaikat csak részben irányítják a preferenciáik, akkor a szabad választás paradigmája a rangsorolások eltolódását eredményezi. Az emberek nem szükségszerűen racionálisak, és számítási képességeik behatároltak; következésképpen nem képesek arra, hogy több tárgyat tranzitív módon összehasonlítsanak. Célunk, hogy leírjuk az intranzitivitás jelenségét és megvizsgáljuk a dimenziók növekvő számának az intranzitivitás fokára gyakorolt hatását. Tanulmányunkban az intranzitivitást vizsgáljuk a megkérdezettek egyszerű, közepesen komplex és komplex termékek között történő választásainak preferenciáin keresztül. A Q-módszert használva - fontosságot tulajdonítva a szubjektivitásnak -, ha minden résztvevő saját fontossági rangsorolása alapján kapja meg az összehasonlítandó termékeket, akkor a szubjektivitás megőrizhető; ezzel a hiba csökkenthető. Erre az eredményre alapozva, egy számítógépes kísérleti modell használatával adatgyűjtést végzünk, amelyben megvizsgáljuk a választásokban megnyilvánuló intranzitivitás arányát.

**Kulcsszavak:** értékelés; rangsorolás; preferenciák; komplexitás; intranzitivitás

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## INTRODUCTION

Since Brehm's (1956) initial free-choice experiment the free-choice paradigm (hence: FCP) is widely assumed to occur because decisions create cognitive dissonance. Cognitive dissonance is then reduced through rationalization. Contrary to Brehm, Chen and Risen (2010) have argued that all the cognitive dissonance studies have been subject to a methodological flaw due to the fact that they had implicitly supposed that preferences could be measured thoroughly. If people's rating/ranking (of product preferences) are not supposed to be a perfect measure of their preferences and their choices are only partially guided by their preferences then FCP will produce spreading of ratings, even if people's attitudes remain completely unchanged. According to Chen and Risen a reassessment is needed for FCP and for the conclusions drawn from it. All the results and discussions are based on a preconception: people are capable of evaluating things (product, choices, etc.) transitively, accordingly without contradictions in the procedure of evaluation or the act of decision. These circumstances only evoke in hypothetical situations. In reality, people not necessarily tend to be rational and also bear boundaries in computing capacity; consequently they are not capable of comparing several objects transitively. In the present study we aim to describe the phenomenon of intransitivity and to examine the impact of enhancing dimensions on its degree.

## COGNITIVE DISSONANCE IN CONSUMER BEHAVIOR THEORY

According to Brehm (1956) the core of FCP is the situation to choose among more alternatives, which do not substantially vary in their attractively (household appliances in the experiment of Brehm (1956)). This phenomenon is usually studied in experiments by having subjects rate an enhanced number of options, and then the participants are faced to choose between two highly similar alternatives (of approximately similar utility). After the one's choice has been made, researchers have observed a decrease in the rating of the refused object and an increase in the rating of the chosen one (Brehm, 1956; Bendersky & Curhan 2009).

The cognitive psychologists have been also bound up in the cognitive dissonance reduction (Dias, Oda, Akiba, Arruda & Bruder, 2009). Their problem statement was whether this is a characteristic phenomenon in an intrinsic manner for human mind and information processing, or this is the result of motivational contradictions. Dias et al (2009) argue that cognitive dissonance reduction is incorrectly thought of as a phenomenon of motivation, as recent results suggest that it is a process typical of the functioning of human mind in an inherent way. They proved this assumption by the findings that cognitive dissonance is present even in the absence of any stimuli in the system, moreover it works unconsciously.

A human tendency toward harmony (avoiding the affective argumentation of motivation), and to reduce contradictions in opinion, intransitive attitudes in decision, is leading to biases raise the question whether spreading in free choice paradigm can be explained by the theory of dissonance reduction at all? The limited mental computational capacity on its own leads the system to use heuristics (Eysenck & Keane, 2000) that incorporate biases. The question is that how large is the biasing effect, and what function describes its growth and change? We aim to answer this question using product attributes that participants rank as less important. Despite the low subjective importance of some

attributes, these features are present as differences of product realizations, and they could have an effect on decision. More than 40 years after Rosenthal's critics on experimenter bias, Chen and Risen (2010) raise methodological and mathematical arguments against the dissonance reduction in FCP detailed in the next section. This can lead to serious questions about FCP, dissonance reduction, and their application in marketing research.

In the paper by Chen and Risen (2010) it is supposed that if people's ratings/rankings are an imperfect measure of their *underlying preferences* and their choices are at least partially guided by their preferences, than their choice will measure positive change in spread, even if people's preferences remain perfectly stable.

The most important remarks on the Chen-Risen's model-scheme are as follows: 1) The *underlying preferences* are only theoretically existing (virtual) measures while the variables of the three stages of the FCP, i.e. the *rating-choice-rating* are present in the experiment. Therefore, unambiguous definitions are set concerning the elements and variables of the three stages while the *underlying preferences* leave room for interpretation. 2) The *underlying preferences* in their model are transitive. 3) There is an implicitly transitive ranking in stages 1 and 3 but this does not necessarily imply that participants' "guiding" (*underlying*) *preference* must be transitive as well. 4) According to the theory of the multi-criteria decision making we have good reasons to suppose that if the derivation of the system of *underlying preferences* is presented in such a way that each pair among 10-15 items are qualified as "better-worse" on the basis of some conflicting criterions, *underlying preferences* resulting in the vast majority of cases in these situations will necessarily be non-transitive.

Tarján and Veres (2012) investigated whether choices effect or reflect the underlying preferences for a much broader class of preferences i.e. also for the non-*transitive underlying preferences* (in this paper we will refer to them as *underlying preferences*) beside the *transitive underlying preference* notion used by Chen-Risen. They proved (in support of the more general *underlying preference* concept), that participants need not necessarily change their *underlying preferences* after the choice of FCP stage 2 so that a positive change in spread would finally happen. However the advantage of the evidence for the wider class than Chen-Risen stated may be that it is able to prove the same statement supposing less and to do it in a simpler way (parsimony). Tarján and Veres (2012) offer a possible alternative for those who are unwilling to accept some of Chen and Risen's (2010) assumptions. They have shown for *transitive underlying preferences* (i.e. for the narrow sense definition of preferences) that the positive spreading really proves to exist with a magnitude 5~10-times smaller than Chen and Risen have supposed it.

## MATHEMATICAL ASSUMPTIONS

First of all, it is supposed that for all pairs of the (finite) set of products, to be investigated, the relation "better-worse evaluated" can or is to be applied. If the number of products is *n*, then on the set of products, in principle, exactly $2^{n(n-1)/2}$ distinct relations (>) can be given since an *n* element set has got $n(n-1)/2$ distinct pairs and each pair can be judged in two ways because one can judge each of the pair to be better than the other ("indifferent" or "cannot be judged" answers are not permitted). If we assume that the relations (>) are transitive (which is called consistent, as well) i.e. for any triplet *A*, *B*, *C* of the set of *n* products "*A* is better than *B*" and "*B* is better than *C*" implies that "*A* is

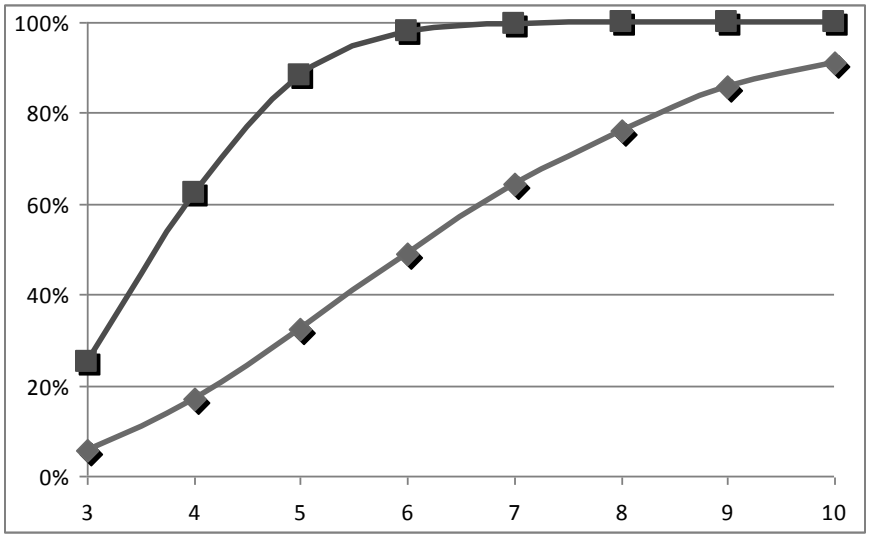
better than *C*" (A > B & B > C □ A > C), the total number of distinct relations is much smaller: *n*! The proportion of the number of the transitive relations compared to total (transitive + intransitive relations) is $n!/2^{n(n-1)/2}$, which quickly decreases as *n* increases. The transitivity assumption is only relevant if the elements of product pairs are considered to be superior or inferior only by one product attribute (or more, but harmonious and consistent to each other). For example: suppose John prefers (*A*), a Ferrari to (*B*), a Mercedes, in the dimension of superior elegance, and (*B*) to (*C*), a Buick, in the same dimension, but *C* to *A* in a different dimension: durability. Of course, such an empirical finding would be inconsistent with the above transitivity axiom. (Since here *A* > *B* & *B* > *C* & *C* > *A* holds.) (see e.g. Hodgson, 2001). Nevertheless - because of the limited mental capacity - smaller number of products and attributes to take into account leads to a more conscious and reliable decision.

The example above shows that regarding transitivity the gap is situated between one and several product attributes, and furthermore we show that regarding product numbers the jump is between categories of two and three candidates. Namely pair wise comparison of products (when product number is between 10-15) is not an easy task for the human mind even if there are only few and well defined attributes. Regarding transitivity all the product-triplets should be classified under three categories: "best-medium-worst" in order to be able to exclude 3-length cycles from the relation (>). This categorization must be carried out for just $n(n-1)(n-2)/6$ product-triplets. Exclusion of 3-length cycles suffices, (see e.g. Chartrand, Lesniak & Zhang, (2011, p. 157): „A tournament is transitive if and only if it is acyclic") since all cycles longer than three in the relation (>) necessarily contains a 3-length cycle as well and thus had already been excluded. The aforementioned example shows that there is a jump between 2 and 3 products.

Intransitivity under majority rule (Flood, 1980) can be applied first to 3 product attributes. Stating it otherwise, in the case of 3 different transitive orders of *n* products the individual makes the decision that *A* is better than *B* if in at least two cases of the three transitive product orders *A* proves to be better than *B*. The question is: what is the proportion of transitive relations compared to the total (transitive + intransitives), under majority rule, in function of *n*?

The results of our calculations are summarized in Table 1 and in Figure 1, from *n* = 3 to 10 products (see horizontal axis). On the lower curve one can find the ratio of the intransitive outcomes (under majority rule) as compared to the theoretically possible total, while the upper curve refers to the proportion of the intransitive relations as compared to the total. In other words the lower curve is the probability that the transitive orders of 3 attributes may result in an intransitive order under majority rule while the upper curve shows the probability of an intransitive tournament. Our *a priori* hypothesis is that the frequency of consumer choice is approximately equal to the lower curve.

*Figure 1:*
The results of our calculations




*Source: Own compilation*

*Table 1:*
The results of our calculations

| ***n*** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|
| **Intransitive MR3** | 0,056 | 0,170 | 0,324 | 0,490 | 0,643 | 0,760 | 0,860 | 0,911 |
| **Intransitive/Total** $(1- n!/2^{n(n-1)/2})$ | 0,250 | 0,625 | 0,883 | 0,978 | 0,998 | 1,000 | 1,000 | 1,000 |

*Source: Own compilation*

## A MARKETING SCIENCE PERSPECTIVE

Following the simplified microeconomic preference model marketing science and especially corporate marketing practice accept the more comfortable transitivity premise. Consumer preferences are defined as the subjective tastes, as measured by utility, of various bundles of goods. They permit the consumer to rank these bundles of goods according to the levels of utility they give the consumer. In other words, the consumer has different preferences over the different combinations of goods defined by the set of commodity bundles. A latent assumption about the consumer's preferences is consistency in rankings, i.e. transitivity. Nevertheless, transitivity stereotype became deeply rooted in the industrialized market research as well. Companies routinely test the market to find out what customers like and dislike about their products and competitors' product. This is outsourced to a market research firm. After gathering information, the next step for the company is to determine what it means. Analysis of the information may lead the company to change the formula, packaging, color, size or some other feature of the product.

It must be realized that automatic assumption of transitivity can be range among such mental stereotypes as e.g. repurchase willingness of satisfied customers or the natural development of firms‘ orientation from manufacturing to marketing (Brown, 1995; Reinoso, 2011). Such a simplification can be understood if we think of the daily decision pressure at management level. Without easily applicable rules of thumb the operation of the firm could be paralyzed. Some techniques estimate consumer preference functions by representing „consumer utility" as a function of the product's attribute levels. Such techniques are useful in the product design because they indicate the relative effects of changes in the attributes of that product. Conjoint analysis is an effective technique to measure ordinal preference functions, and this method has been considered for long time as a research mass-product establishing numerous managerial decisions. Traditional technique of conjoint analysis has been quite successful in marketing, but its application can be improved. If for example it were extended by the use of intensity measures for preference, it would be possible to gather more information per question. And naturally a more subtle approach to intransitivity could be another chance for improvement. As regards the methodological development in such directions only sporadic attempts can be found until now in the marketing research literature (see e.g. Hauser & Shugan, 1980 or Bouyssou & Pirlot, 2002).

## RESEARCH AIMS

In the present study we aim to investigate the probability of intransitive ratings on marketed subjects. From the perspective of marketing science this question is crucial: can we model the human as capable of rating/ranking transitively, or do we have to accept that human beings rating/ranking necessarily comprises a certain probability of intransitivity, and if yes, what is this probability? We examine the preference ratings of three product groups (on three levels of complexity).

## HYPOTHESES

Based on the summarized research literature, on our mathematical assumptions and on marketing practice we formulate three hypotheses.

At first (H1) in accordance with Hodgson's (2001) opinion, we suppose that intransitivity is rational. It is also part of human mental functioning, like the heuristics in decision making (see Eysenck & Keane, 2000). Thus we expect to find intransitive preference rankings or ratings in the result data of our study.

Concerning our second hypothesis (H2) we suppose, that rating and ranking is inherently intransitive by nature. Although, there are some deviations from this default setting of intransitivity in special cases. Thus we aim to turn around the way of thinking about intransitivity. The aforementioned special cases, where natural intransitivity does not appear are the situations where (1) there is a dominant dimension in rating/ranking (which guides or dominates the decision), and when (2) the rating or ranking is very simple. We suppose that natural intransitivity is not limited to products, but it is valid for any object in general that can be described by attributes.

And finally the third hypothesis (H3) concerns the link between the complexity of an object and the probability of intransitivity when rating/ranking it. The more complex

(described by more attribute dimensions) an object is (a product in our case), the higher is the probability that one will produce intransitive ratings/ranking (comparing different realizations of the product in our case). We assume, according to the work of Festinger (1957) and FCP studies (Brehm, 1956; Chen & Risen, 2010), that *less important attribute dimensions* (causing more similarly perceived product realizations) play a role in enhancement of intransitive preferences. There is always some proportion of intransitive ratings/rankings of a decision, but presenting less important attributes we expect to observe intransitivity with higher probability.

## METHOD

In our experimental study we are investigating intransitivity occurring in participants' preferences during selection between simple, medium complex, and complex products. In the phase of preliminary data collection, our sample consists of 200 participants (balanced by age) recruited from a business school and a technical university.

## MATERIAL

The material consists of three product groups, of three levels of complexity. Levels of complexity are operationalized in the number of attribute dimensions (see in Table 2). The realizations of these product groups are regularly consumed or owned by the participants in the experimental group. The "simple product" group contains everyday bakery products that bear 4 attribute dimensions. The medium complex product group contains fruit yoghurts, bearing 7 attribute dimensions (selected based on the results of Hlédik, Hámornik & Lógó (2011)). Finally the complex product group contained mobile phones, with 11 attribute dimensions.

*Table 2:*
Attribute dimensions

| **Product group** | **Attribute dimension** | **Examples of Attribute values / realizations** |
|---|---|---|
| Everyday bakery product (simple) | Raw material (main ingredient) | Water&flour, milk&flour, whole-bread |
| | Shape | Round, longish |
| | Flavor | Plain, cheesy, salty |
| | Mode of production | Mass produces, house-made-like, hand made |
| Fruit yoghurt (medium complex) | Flavor | Strawberry, forest fruits, peach |
| | Fat % | 0,01%, 1,5%, 3,7% |
| | Taste experience | Creamy, light |
| | Consistence | Fruit flavored, contains fruit pieces, contains cereals |
| | Healthiness | Bio, probiotic |
| | Mode of production | International brand's mass products, local brand's product, hand made |

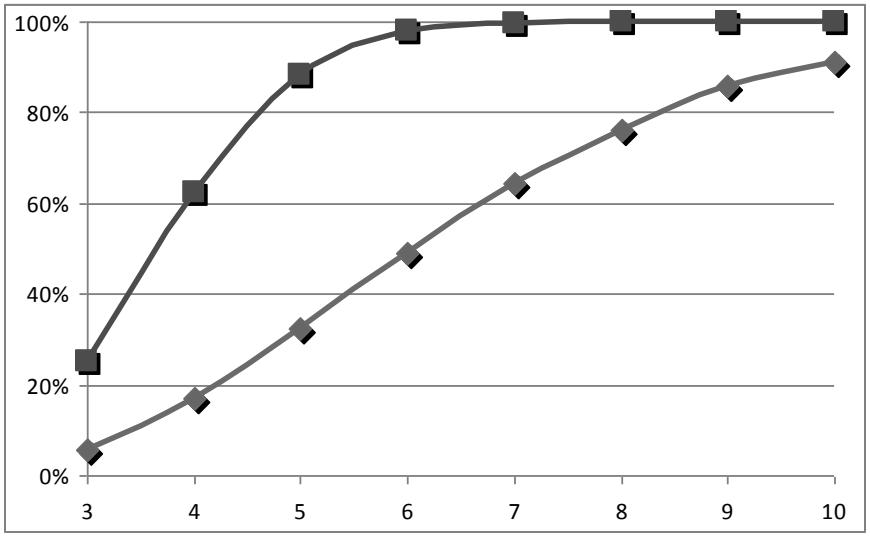
| Product group | Attribute dimension | Examples of Attribute values / realizations |
|---|---|---|
| | Brand | Danone, Jogobella, Cserpes |
| Mobile phones (complex) | Shape | Classic, flip, slide, touchscreen |
| | Brand | Apple, Samsung, Nokia |
| | Thickness | Thin, medium, thick |
| | Color | Metal, black, vivid color |
| | Style | Fancy, simple, elegant |
| | Usage | Simple, multifunctional, easy-to-use |
| | Camera | Under 2 MP, 2 to 3 MP, above 3 MP |
| | User interface | Classic keyboard, QUERTY keyboard, touchscreen only |
| | Entertainment | Radio, music player, applications to download |
| | Internet | None, WIFI, 3G |
| | Connectivity | USB, Bluetooth, Infra-port |

*Source: Own compilation*

**1st Phase: Rating The Importance Of Attributes**

As we previously pointed out, to support the investigation of intransitivity, we decided to use less important attribute dimensions in pair wise decisions. Importance is a subjective label, which differs from person to person. The Q method was developed by Stephenson in the 1930's as an alternative research method that aims to preserve individual subjectivity, but also measures subjectivity in a quantitative way that is appropriate for statistical analysis (see Stephenson, 1953; Izsó & Horváth, 2006). This methodological approach gained importance in the past few years, as an alternative, as a correction of the widely used survey method, the R method, that blurs the subjectivity in order to spare quantitivity (see for example Danielson, 2009). In this research we only use a small methodological fragment of the Q method: the forced choice grid answer interface instead of a Likert scale attribute dimension rating scale. In Q method, the participants are obliged to use all the attribute dimensions (rate all), and they are forced to choose a fixed quantity for each level of importance. The number of attributes can be placed in a given importance level which approaches normal distribution (this appears on the grid of Figures 2, for the complex product). By this method we gain the same number of less important (middle level) attribute dimensions for all participants. The scale of importance ranges from highly important, through less important (in the middle level) to highly unimportant, in order to cover all the possible answers. To keep the individual information (reference level) for every participant, the attribute dimensions that the participant rated in the grid as less important (middle) give the attribute dimensions when comparing the product realizations pair wise in the next phase.

*Figure 1:*
Attributes in a given importance level




*Source: Own compilation*

**2nd Phase: Pair Wise Comparisons**

The participants' task is to make pair wise comparisons of preference between specific realizations of each product group. The product realizations that the participants receive for comparison differ in those attribute dimensions that they rated less important in phase 1 (middle in the grid). For the pair wise comparisons the participants are instructed to *"Choose the preferred one among the two presented! Imagine that you can win it as a prize, and imagine that price in indifferent, and equal in this case!"* The test terminates when the participant gives the first intransitive answer, or if the participant finishes comparing all possible pairs. In this phase, we count with the number of comparisons without intransitivity (the comparisons accomplished until the first intransitive reply) as a dependent variable. To analyze the effect of product complexity on intransitivity, we are going to use a one-way ANOVA design (with levels of simple, medium complex and complex product groups). Participants are blind to the aim of the experiment until the end of the procedure. The test lasts for maximum 20 minutes including debriefing. Participants complete the tasks on computers with built-in data collection in both phases.

## PRELIMINARY RESULTS AND CONCLUSIONS

We conducted a pilot testing in order to underpin the usage of the forced choice grid selection method concerning attribute dimensions with 73 participants (students of a business school). We could have pretested the attribute dimensions on a large sample, then we could have built our study using the averages from the distribution of responses, choosing those dimensions that were selected by most of the participants. Contrarily, in the present study we dedicate more importance to subjectivity, thus we chose to use the forced choice grid from Q-method.

### Pilot Test Procedure and Results

In the process of importance rating of attribute dimensions we used the grids described above. The participants received the task on paper and they had to fill the importance-

grid with the letter symbols of the attribute dimensions listed in Table 2. This pilot test lasted for 15 minutes, than the participants received debriefing. We summed up the data for the middle column of the importance grid ("less important or indifferent"). If we had followed the logic of the R-method, we would have chosen the top 2 or 4 or 6 (respectively) attributes from each product group to use in the further research phases. By doing this, we would have neglected the responses of a high proportion of participants that can lead to artifacts in the following research steps. To illustrate this loss of subjectivity, Table 3 shows the percentages of responses agreeing with this maximum-rule compared to the rest (do not meeting the rule, thus their responses are neglected).

*Table 3:*
Percentages of responses

| | **Simple** | **Medium complex** | **Complex** | **Average** |
|---|---|---|---|---|
| **Included %** | 69,12% | 50,24% | 54,65% | 58,00% |
| **Neglected %** | 30,88% | 49,76% | 45,35% | 42,00% |

*Source: Own compilation*

According to these results, in average the 58% of individual responses would have been included, and 42% would have been neglected in the attributes' selection. By this, we would neglect the subjective value of 42% of the responses, thus it would highly contribute to biasing the future results.

Using the Q-method's logic, if every participant receives the products to compare in phase 2 based on their own (previous) importance ratings, subjectivity is thoroughly preserved, and thus the biasing effect can be decreased. Based on this preliminary result, we are going to carry on data collection by the method described above to investigate the proportion of intransitivity in choices.

## FURTHER RESEARCH

In this paper we present the preliminary results in the ongoing phase of our work. We are conducting experimental tasks reaching a wider sample of participants (approximately 200). Currently we are using a computer based experimental design including a web-based application, which performs the procedure detailed above (see Veres et al. 2012a; 2012b). By this, every participant has the personalized attribute set (that they rated less or medium important) for the pair wise comparisons.

An important limitation and a perspective to study in the future are the aspect of temporality and previous experience. We did not count with the participants' previous experiences concerning the used products. We have chosen widely known product groups, and attributes but thus we still found effects on transitivity-intransitivity ratings/rankings of previous experience, which we did not control for. Also the dimension of time is excluded from our experiment, but it would be interesting to investigate whether or not these probabilities are stable across time, or there are differences in stability that can be embraced by a function? We aim to control these two aspects in a further research.

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