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Simplifying Three-way Questionnaires - Do the Advantages of Binary Answer Categories Compensate for the Loss of Information?

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Introduction

Attitude measurement is very common in marketing research: respondents are asked to state their satisfaction with, their expectations with regard to, and their perceptions of certain product attributes. Usually these questions are asked in such a way that the resulting data is a three-way data set (from the perspective of management, not the respondent). For instance, tourists in the decision phase might be asked how they perceive tourist destinations they are presently considering with regard to a set of 10 attributes, including such variables as “safe”, “family-friendly”, “stable weather”. Given the nature of this questionnaire, respondents have to evaluate each tourist destination for each one of the attributes. This is a time-consuming and tedious task. When it becomes too time-consuming and tedious, respondents might not answer properly at later stages of the questionnaire or may stop filling the questionnaire out, at the expense of both data quality and field work expenses (Drolet & Morrison 2001).

The main aim when developing questionnaires is therefore to design them in the shortest and simplest possible way without losing valuable information through over-simplification. Assuming that the number of objects and the number of attributes cannot be reduced, the only possibility for designing questionnaires in a more stress-free way is to switch from frequently used ordinal to binary answer format. Theoretically this procedure can be justified from the perspective of the model proposed by Bagozzi (1994) of how people answer questions, as the attitudes of interest are those that already exist rather than attributes constructed by respondents during the interview process. As compared to the ordinal answer format, binary categories have the major disadvantage of containing less information. However, the advantages are not only easier and faster processing by respondents (Scharf 1991), but also the availability of distance measures for binary data, whereas the computation of distances with ordinal data always requires the questionable assumption of metric-scale approximation.

The importance of understanding optimal answer formats in brand image surveys has long been recognized and investigated from various perspectives. Romaniuk & Driesener (2002) studied the effect of confronting respondents with either a ranking or a rating task. Other

studies focus on the effect of various factors (for instance, brand familiarity and market knowledge) on one particular aspect of brand image measurement, the stability of perceptual responses (Dall'Olmo Riley, Ehrenberg, Castleberry, Barwise, & Barnard 1997; Sharp & Romaniuk 2002a and 2002b). However, the effect of answer scale format itself has so far not been investigated independently of the answer format.

The aim of this project was to study empirically whether choosing a binary answer format is a reasonable simplification compared to the frequently-applied ordinal (rating) scale. The criteria used to investigate this question were: (1) answering speed (= cost), (2) answering ease, and finally (3) the results derived from different question formats regarding the content of findings. The findings clearly have major implications for brand image measurement. If the results do not differ significantly while answering speed and ease increase, binary scales should be preferred to ordinal scales.

Research Questions

The fundamental hypothesis is that the amount of information lost by using binary data is compensated for by the fact that respondents are confronted with an easier task, and data analysis can be conducted without questionable assumptions about scale characteristics. In this case, the managerial implication is clear: binary data should be used, especially for tedious questions, as is the case in three way format questionnaires.

The following hypotheses were therefore formulated and tested empirically:

H1: Respondents will need more time to complete the ordinal version of the questionnaire than the binary version.

H2: Respondents will perceive the ordinal questionnaire as more difficult.

H3: Derived object profiles will not differ to an extent that would lead to different managerial interpretations.

Methodology

The investigation of this question requires empirical data. A longitudinal approach was therefore chosen in order to avoid any possible distortions of results due to insufficient randomness of sampling. The same individuals were exposed to two versions of the same questionnaire: a binary version first and an ordinal version one week later. The respondents were asked to judge six objects (fast food chains) using 11 attributes (product category, brands and attributes derived from an exploratory phase prior to the survey). The wording of the question was as follows for the binary questionnaire version:

You will now see a table. Each fast food brand has its own column. There are 11 attributes that you can agree or disagree with for each brand. Please enter into each one of the cells in the yellow area "1" if the attribute applies to the brand and "0" if the attribute does not apply to the brand. e.g. if you put a 0 into the first cell, you are expressing that "McDonalds IS NOT yummy!"

In the ordinal version respondents were able to choose a level of agreement on a six-point scale. In both versions, a total of 66 evaluations were thus required in order for respondents to complete the questionnaire. A student convenience sample was used. However, this does not negatively influence the validity of results, as the research question can be investigated legitimately for a subset of the total consumer population. The convenience sample consisted of students enrolled in a compulsory third year subject for marketing majors at an Australian

University. The students were asked to fill out one questionnaire in the first and one in the second week of their tutorials, respectively. One hundred and forty eight respondents were successfully measured twice (137 answered all brand –attribute associations). The number of usable cases was lower than the number of enrolled students, because only those respondents who filled out both questionnaires were included. Students who missed either the first or the second tutorial and thus only produced answers to one version of the questionnaire had to be excluded.

Results

Duration of the questionnaire

The average duration of the binary questionnaire version was four minutes, while respondents needed six minutes on average to complete the ordinal questionnaire (Table 1). A paired sample *t*-test was conducted on the data, leading to a 2-tailed *p*-value of 0.000, indicating that this difference is highly significant. This finding is of high relevance to practitioners, as it indicates the potential for dramatic fieldwork cost reduction.

Table 1: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
minutes ordinal version	6.07	137	1.860	.159
minutes binary version	4.15	137	1.607	.137

H1 thus cannot be falsified. It took respondents significantly longer to complete the three-way questionnaire on an ordinal scale than on a binary scale.

Perception of the difficulty of the questionnaire

Frequency counts (Tables 2) indicate that more respondents felt the binary questionnaire was easy (around 70 percent) than this was the case for the ordinal version (around 40 percent). The Wilcoxon rank test (see Table 3 for the ranks and Table 4 for the test statistic) was chosen because of the ordinal nature of the question. The test indicates that this observed difference is highly significant (at the 99.9 percent significance level).

Table 2: Difficulty of Answering the Questionnaire

	Frequency (ordinal)	Valid Percent (ordinal)	Frequency (binary)	Valid Percent (binary)
easy	66	45	101	70
ok	78	53	43	30
difficult	3	2	1	1
Total	147	100	146	100

Table 3: Ranks

	N	Mean Rank	Sum of Ranks
Negative Ranks	48 ^a	29.19	1401.00
Positive Ranks	9 ^b	28.00	252.00
Ties	88 ^c		
Total	145		

a difficulty of answering the questionnaire in the binary version < difficulty of answering the questionnaire in the ordinal version
b difficulty of answering the questionnaire in the binary version > difficulty of answering the questionnaire in the ordinal version
c difficulty of answering the questionnaire in the ordinal version = difficulty of answering the questionnaire in the binary version

Table 4: Wilcoxon Signed Rank Test Statistics

	difficulty of answering the questionnaire in the binary version - difficulty of answering the questionnaire in the ordinal version
Z (based on positive ranks)	-5.164
Asymp. Sig. (2-tailed)	.000

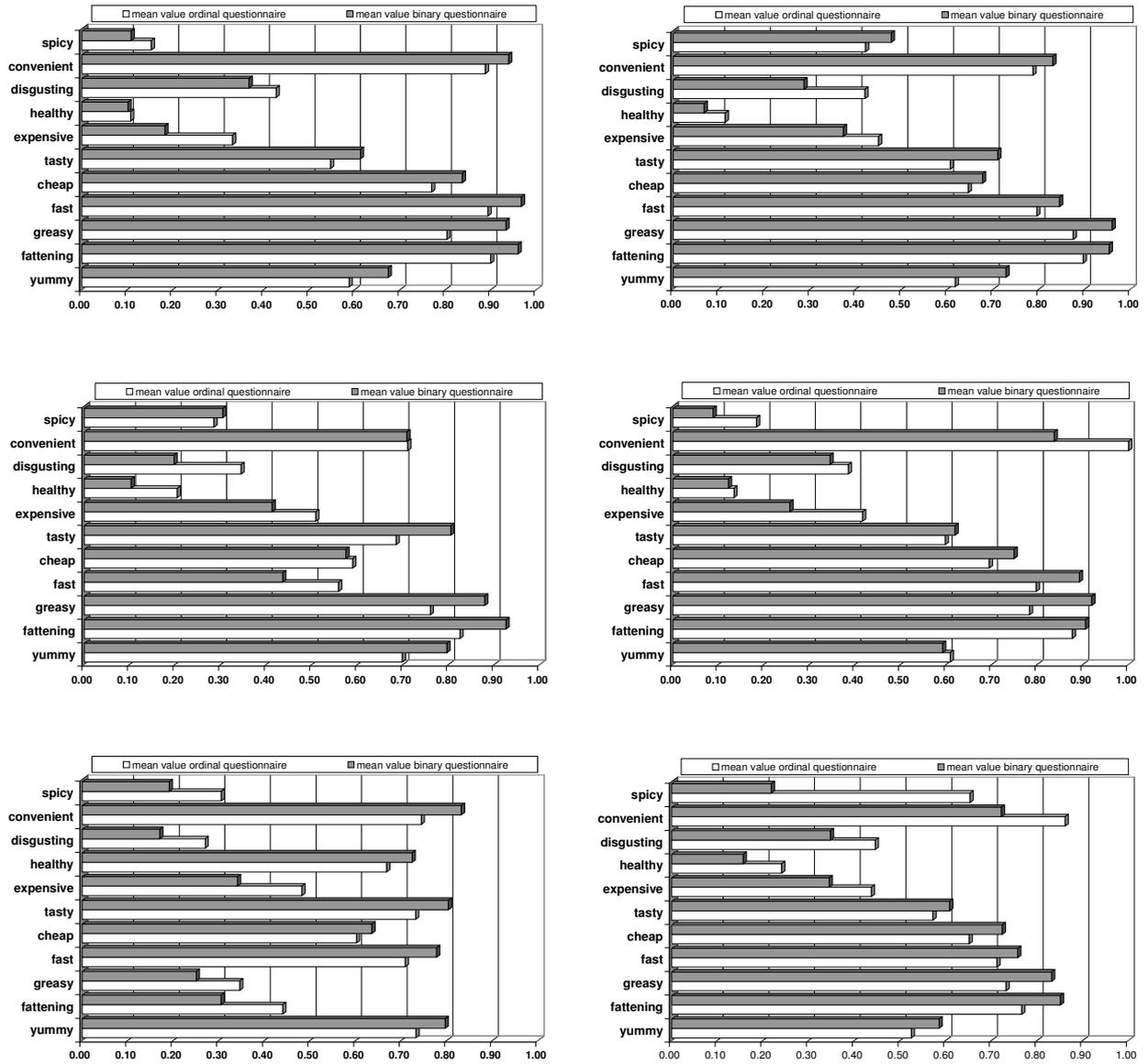
It can thus be concluded that the respondents perceived the binary version of the brand questionnaire as easier than the ordinal version. H2 cannot be falsified.

Object profiles

Managers typically interpret three-way data by looking at the marginals (average profiles for each object). In the case of binary data the average is equal to the percentage of agreement among respondents. The ordinal scale of 1 to 6 was transformed into equidistant intervals between 0 and 1 to make average values directly comparable. Both the assumption of equidistant intervals as well as the assumption that there are no interpersonal differences in the perception of ordinal scale values are very strong assumptions about the data, which can potentially distort market information. This is, however, assumed in this study for the purpose of providing a benchmark for the binary results because it represents the typical procedure in marketing research.

The object profiles derived in this way are provided in Figures 1, where both the binary and the ordinal results are plotted. As can be seen from the figures, the profile interpretation is completely independent of the answer format. In one single case (this is one attribute with respect to one object) would the interpretation differ in terms of managerial conclusions: The bottom right object in Figure 1 was evaluated as much more associated with attribute a11 in the case of the ordinal answer format than in was the case in analysing the binary data. Thus, one out of 66 object-attribute evaluations differs with regard to managerial interpretation.

Figure 1: Object profiles



H3 thus has to be partially rejected. While the object profiles did not differ in general, this one attribute (a11) does potentially lead to a different managerial implication.

Conclusions And Future Work

The results of this empirical investigation indicate that the findings from ordinal scaled questionnaires do not generally differ sufficiently in terms of object profile interpretation to justify the use of ordinal (rating) scales, which are perceived as significantly more difficult to answer and take significantly more time to complete (leading to significantly higher fieldwork expenditures). Given prior findings on how respondent fatigue negatively influences data quality, this leads to the conclusion that binary answer format should be favoured in the case

of three-way data generating questionnaires that require a large number of questions to be answered by respondents.

Future work should aim at investigating the impact on object profile findings if consumer heterogeneity is taken into consideration (for instance, comparison of favourite brand evaluations only). Also, the study should be replicated with a representative sample of the population to exclude the possibility that the student sub-sample chosen functions in a systematically different way with regard to survey answering behaviour than the total Australian population. Furthermore, the research design in such a study could be improved by splitting the sample into an experimental group and a control group, where the control group enables testing of the influence of repeated measurement and both groups are further split into subgroups with different exposure order of the questionnaire version. Finally, a cross-cultural study would be needed to investigate whether these findings can be generalised to apply to other cultural settings. These research questions are currently under investigation.

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