

What mediates the impact of response alternatives on behavioral reports?

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What Mediates the Impact of Response
Alternatives on Frequency Reports of
Mundane Behaviors?

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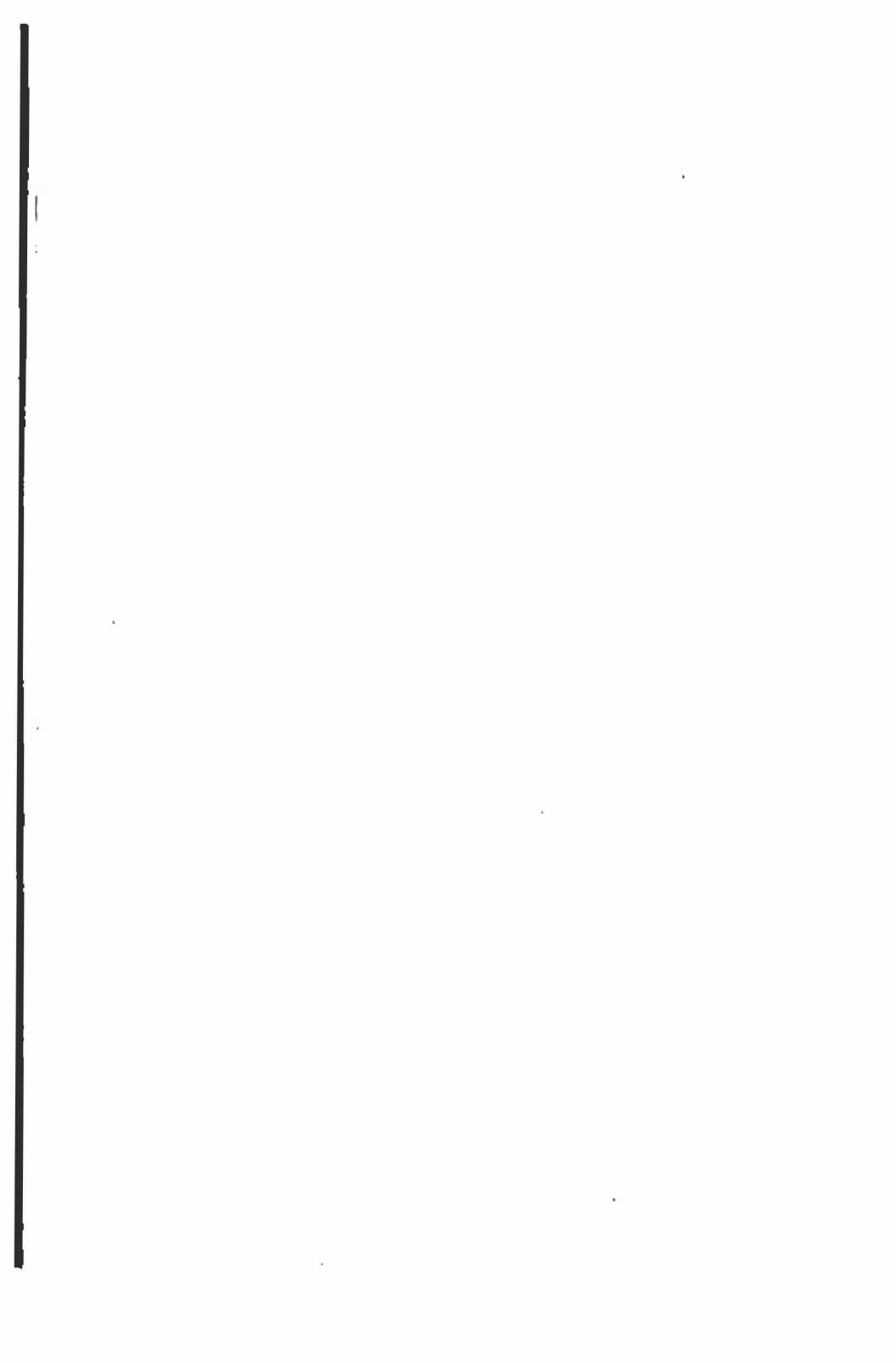
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What Mediates the Impact of Response Alternatives on Frequency Reports of Mundane Behaviors?

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SUMMARY

Previous research demonstrated that respondents assume that the range of precoded response alternatives reflects the researcher's knowledge of the distribution of opinions or behaviours in the population. This assumption may influence respondents' reports in two ways: respondents may either use the range of the response alternatives as a frame of reference in estimating their own behavioural frequencies, or they may be reluctant to report frequencies that appear extreme in the context of the scale. Three experiments using reports of mundane behaviours, namely watching TV and drinking beer, were conducted to differentiate between the frame of reference and the self-presentation hypothesis. The results of all studies favour the frame of reference hypothesis, and suggest that the impact of response alternatives is the more pronounced the less episodic information about the behaviour is accessible in memory. Specifically, proxy-reports were found to be more affected by the range of response alternatives than self-reports (Experiments 1 and 2), and respondents with dispositionally low access to self-related information were found to be more affected than respondents with dispositionally high access to self-related information (Experiment 3). Implications for questionnaire construction are discussed.

In applied as well as in basic research, researchers are often interested in determining the frequency with which individuals engage in certain behaviours, ranging from mundane issues like media consumption or minor purchases to life-threatening experiences. The dominant way to assess these data is the use of direct questions in survey interviews or self-administered questionnaires. Unfortunately, however, research on the validity of direct behavioural reports indicated that behavioural frequencies are difficult to reconstruct from memory, and that respondents use a variety of heuristics that are likely to result in systematic biases (see Bradburn, Rips and Shevell, 1987; Strube, 1987 for reviews). Not surprisingly, behavioural reports have been found to be the more unreliable the more mundane and frequent the behaviour under study is (Bradburn *et al.*, 1987). Moreover, the validity of behavioural reports decreases when respondents are asked to report about the behaviour of others ('proxy-reports') rather than about their own behaviour ('self-reports'), as is often the case in household interviews where one member of the household is asked to provide information about other household members (Sudman, Schwarz and Blair, 1988).

Recent research suggests that the validity problems associated with behavioural frequency reports are further compounded by the use of precoded response alternatives. Specifically, respondents are usually asked to report their behaviour by checking one of several response alternatives provided to them by the researcher. Several studies (Schwarz, Hippler, Deutsch and Strack, 1985; Schwarz and Hippler, 1987; Schwarz and Scheuring, 1986; Schwarz, Strack, Müller and Chassein, 1988) demonstrated that the obtained responses are, in part, a function of the response alternatives provided.

For example, in one study (Schwarz *et al.*, 1985), respondents were asked how many hours per day they watch television. Depending on experimental conditions, they provided their report either in an open-response format or along one of two scales. The response alternatives of the precoded scales ranged either from 'up to ½ hour' to 'more than 2½ hours', or from 'up to 2½ hours' to 'more than 4½ hours'. Respondents reported a higher TV consumption when they were given the high rather than the low frequency scale. Specifically, 37.5 per cent of the respondents who were given the high frequency scale, but only 16.2 per cent of the respondents who received the low frequency scale, reported watching TV for more than 2½ hours per day.

To account for this and related findings, it has been suggested that respondents use the range of the response alternatives as a frame of reference in estimating the frequency of their own behaviour (Schwarz *et al.*, 1985). Specifically, respondents may be unlikely to have detailed episodic memories of behaviours that are as frequent and mundane as watching TV (cf. Bradburn *et al.*, 1987; Strube, 1987). To arrive at a memory-based answer they may have to use effortful strategies that allow the reconstruction of relevant behavioural episodes (cf. Bradburn *et al.*, 1987). However, humans as 'cognitive misers' (Taylor, 1981) may be unlikely to do so, in particular in a survey interview that is characterized by low motivation and high time pressure. Rather, they may use a 'satisficing' strategy, and may base their answer on salient information that allows the computation of a reasonable estimate. One source of pertinent information that is highly salient in the interview context is the range of the response alternatives provided to them. Accordingly, respondents may use the range of the response alternatives as a frame of reference to estimate their own TV consumption.

If so, the impact of response alternatives should be the more pronounced the less relevant behavioural information is easily accessible in memory. This implication of the frame of reference hypothesis will be tested in the present studies in two different ways. First, we will compare the impact of response alternatives on self- and proxy-reports of mundane behaviours (Experiments 1 and 2), based on the assumption that episodic information about one's own behaviour is more accessible than information about the behaviour of others. Second, using an individual difference approach, we will compare the impact of response alternatives on behavioural reports provided by individuals who are known to differ in the accessibility of self-relevant knowledge (Experiment 3).

In addition to testing an implication of the frame of reference hypothesis, these comparisons will also bear on an alternative account for the impact of response alternatives. Specifically, Bradburn and Danis (1984, p. 114) suggested that the impact of response alternatives may be due to respondents' self-presentation

concerns. They assume that respondents may be reluctant to check a response alternative that seems extreme in the context of the scale and thus reflects a presumably unusual behaviour.

Both hypotheses implicitly assume that the response alternatives constitute a source of information for the respondent. In fact, previous results (Schwarz *et al.*, 1985) indicated that respondents assume that the range of the response alternatives reflects the researcher's knowledge of, or assumptions about, the distribution of the behaviour in the real world. Specifically, respondents assume that the 'typical' or 'average' behaviour is reflected in the middle range of the response alternatives, and that the extremes of the response alternatives reflect the extremes of the distribution.

However, the two process hypotheses differ in their assumptions about how the information that is provided by the range of response alternatives is used. The estimation hypothesis assumes that respondents use the range of the scale as a frame of reference in estimating their own behavioural frequencies. For example, a respondent who assumes that his TV consumption is 'average' may check a value in the middle range of the scale, independent of the specific numbers given. In contrast, the self-presentation hypothesis assumes that respondents may have accurate knowledge about their actual behavioural frequencies but may be unlikely to report these frequencies if that requires that they check a value at the extremes of the scale. In summary, the self-presentation hypothesis assumes that the impact of the response alternatives occurs at the editing stage, that is, when the respondent gives his or her report, whereas the estimation hypothesis assumes that the impact occurs at the judgement stage, that is, when the respondent computes his or her 'private' estimate.

These two process assumptions are not mutually exclusive. Rather, both may operate under different conditions. On the one hand, it seems plausible that self-presentation concerns that are elicited by highly threatening questions in face-to-face interviews may be compounded if the respondent discovers that his or her report requires the endorsement of a response alternative that seems extreme in the context of the list. This possibility, while interesting in its own right, will not be explored in the present paper. It is conceivable, however, that respondents may hesitate to present themselves as extreme with regard to any behaviour. In fact, even highly desirable behaviours, such as working hard, are evaluated negatively if they are pushed to the extreme. Accordingly, we will limit our investigation to reports of mundane, non-threatening behaviours, which are unlikely to elicit self-presentation concerns *unless* the response alternatives do prompt them, as suggested by Bradburn and Danis (1984).

From an applied point of view, the two process assumptions discussed above have different implications for questionnaire construction and for the use of precoded response alternatives for different research tasks. The frame of reference hypothesis suggests that the impact of response alternatives on the obtained reports will be the more pronounced the less respondents can retrieve relevant information about their behaviour from memory. Thus, response alternatives should influence reports of frequent and mundane behaviours more than reports of rare and important behaviours, which are likely to be better represented in memory. Moreover, response alternatives should be particularly influential when proxy

respondents are interviewed for whom the behaviour of the target person may be especially difficult to retrieve. If the impact of response alternatives is mediated by self-presentation considerations, on the other hand, these memory-related issues may be of little importance. Rather, the impact of response alternatives would be the more pronounced the more respondents are concerned about their self-presentation, independent of whether they do or do not have adequate knowledge about their behaviour. In addition, precoded response alternatives should be more likely to affect self-reports rather than proxy-reports, because respondents are presumably more concerned about their self-presentation than about the presentation of others. Accordingly, the two process assumptions suggest different recommendations for the use of precoded response alternatives.

To evaluate the implications of both hypotheses for frequency reports of mundane behaviours, we conducted three experiments that tested competing predictions derived from the self-presentation and the frame of reference hypotheses.

EXPERIMENTS 1 AND 2: SELF-REPORTS AND PROXY-REPORTS

On first glance the most straightforward way to test both process assumptions may seem to be a comparison of the impact of scale range on reports of different behaviours that are either highly desirable, highly undesirable or neutral. However, this approach would require that these behaviours are equally memorable. This problem is further compounded by the possibility that various strategies that respondents may use to reconstruct behavioural frequencies (cf. Bradburn *et al.*, 1987; Blair and Burton, 1987) may be differentially effective for different behaviours. The prerequisite of equal memorability is therefore difficult to meet.

A more promising way to differentiate between the two proposed mechanisms is to compare the impact of response alternatives on self-reports and on proxy-reports of the *same* behaviour. In general, the two process assumptions lead to opposite predictions for both types of reports. If the impact of response alternatives is mediated by self-presentation concerns, scale effects should be *stronger* when respondents report their own behaviour than when they report the behaviour of friends or distant acquaintances. This follows from the assumption that they are presumably more concerned about their own self-presentation than about the image they present of others.

If respondents use the values presented in the scale to compute an estimate, on the other hand, the impact of scale range should be the more pronounced, the less other information is available that could be used to compute an answer. Therefore, the effect of scale range should be *smaller* when respondents report their own behaviour than when they report the behaviour of friends or distant acquaintances, because they can draw upon a broader base of information that allows the reconstruction of relevant episodes for self-reports.

Accordingly, the impact of scale range on self- and proxy-reports of a relatively neutral behaviour, watching TV, and a somewhat undesirable behaviour, drinking alcohol, was tested in two independent experiments.

Experiment 1: Self- and proxy-reports of TV consumption**Method**

One hundred and forty-five University of Illinois undergraduates, who were randomly drawn from a population of undergraduates enrolled in introductory psychology, participated in the study as part of a class requirement. Three respondents provided incomplete data, leaving 142 in the analyses. The data were collected anonymously by self-administered questionnaires in a classroom setting.

Respondents were randomly assigned to conditions and asked to report either their own 'average weekly TV consumption', the 'average weekly TV consumption' of a close friend, or of a 'typical U of I undergraduate', by checking the appropriate response alternative on the scale provided to them. Two scales with different response alternatives were used, as shown in Table 1, and respondents had as much time as they wanted to complete the questionnaire. These manipulations resulted in a 3 (target person) \times 2 (response format) factorial between subjects design.

Table 1. Response alternatives for weekly TV consumption

Low frequency scale	High frequency scale
() up to 2½ hours	() up to 10 hours
() 2½ to 5 hours	() 10 to 15 hours
() 5 to 7½ hours	() 15 to 20 hours
() 7½ to 10 hours	() 20 to 25 hours
() more than 10 hours	() more than 25 hours

Respondents' reports on these scales were coded to reflect an estimate of more or less than 10 hours per week, and the proportion of respondents who reported a TV consumption of more than 10 hours per week is used as the dependent variable. These proportions were analyzed by a procedure suggested by Rosenthal and Rosnow (1985) that allows the computation of planned comparisons.

Results and discussion

As predicted by the frame of reference hypothesis, the impact of scale range was *most* pronounced when respondents estimated the TV consumption of a 'typical U of I undergraduate', as shown in Table 2. Specifically, 71 per cent provided estimates of more than 10 hours per week on the high frequency response scale, but only 13 per cent did so on the low frequency scale, resulting in a difference of 58 percentage points, $z = 2.85$, $p < .003$, one-tailed. The impact of scale range was least pronounced, and not significant, on the other hand, when respondents reported their own TV consumption, with a difference of 32 percentage points, $z = 1.48$, $p < .07$, one-tailed. This pattern of results is opposite to the one predicted by the self-presentation hypothesis, which holds that self-reports should be most strongly affected. Reports about the behaviour of close friends fell in between these extremes, as both hypotheses would predict, with a difference of 37 percentage points, $z = 1.91$, $p < .03$, one-tailed.

Table 2. Reported weekly TV consumption as a function of scale range and target person

Scale Range	Target person		
	Self	Friend	Typical undergraduate
High range	.44	.51	.71
Low range	.12	.14	.13

Note. Figures show the proportion of respondents who reported a TV consumption of more than 10 hours per week. The number of respondents per condition ranges from 24 to 26; proportions are rounded.

A test of the interaction of target person and response format, however, failed to reach significance, $z = .91$, n.s., despite the differential strength of the comparisons within each target condition.

In combination, these findings suggest that respondents used the range of the response alternatives as a frame of reference in estimating behavioural frequencies, and that they were the more likely to rely on this frame the less other information they had, a conclusion that will be corroborated by additional analyses presented below. In this regard it is informative to note that most of the respondents who were asked to report the behaviour of a close friend chose their room-mate as the target person. It therefore comes as little surprise that their estimates of their friend's behaviour were only slightly more susceptible to scaling effects than their self-reports. In fact, a separate analysis of the five respondents who did *not* choose their room-mate as the target friend reveals a difference of 69 percentage points.

Experiment 2: Self- and proxy-reports of alcohol consumption

Experiment 2 provides a partial replication of the first study, using respondents' alcohol consumption as the target behaviour. While this behaviour is likely to differ from TV consumption by being somewhat less desirable in a general population, there is little reason to assume that drinking alcohol is particularly undesirable for the population of male undergraduates used in the present study.

Method

Eighty male University of Illinois undergraduates, who were randomly drawn from the population of male undergraduates enrolled in introductory psychology, participated in the study as part of a class requirement. The data were collected anonymously by self-administered questionnaires in a classroom setting.

Respondents were randomly assigned to conditions and reported either their own alcohol consumption or the alcohol consumption of a close friend in a self-administered questionnaire. The wording of the question was, 'How many glasses of beer do you (does your friend) usually drink when you go out (when he goes out) to a bar?' The reports had to be provided along one of the two scales shown in Table 3, resulting in a 2 (target person) \times 2 (response format) factorial between subjects design. Respondents were given as much time as they wanted to complete the questionnaire.

Table 3. Response alternatives for alcohol consumption

Low frequency scale	High frequency scale
() none	() four glasses or less
() one glass	() five glasses
() two glasses	() six glasses
() three glasses	() seven glasses
() four glasses	() eight glasses
() more than four glasses	() more than eight glasses

Respondents' reports on these scales were coded to reflect an estimate of more or less than four glasses of beer, and the proportion of respondents who reported drinking more than four glasses is used as the dependent variable.

Results and discussion

Overall, the results replicate the findings of Experiment 1. Under self-report conditions, 40 per cent of the respondents reported drinking more than four glasses of beer if given the low frequency response alternatives, resulting in a non-significant difference of 15 percentage points, $z = .98$, n.s. Under proxy-report conditions the impact of scale range was more pronounced, with 35 per cent of the respondents reporting a usual consumption of more than four glasses of beer along the low frequency scale but 80 per cent along the high frequency scale, resulting in a difference of 45 percentage points, $z = 3.23$, $p < .007$, one-tailed. This pattern is reflected in a non-significant interaction of target person and scale range, $z = 1.45$, $p < .08$, one-tailed.

Combined analysis

While the obtained patterns of proportions are in line with predictions derived from the frame of reference hypothesis, neither the impact of scale range on self-reports nor the interaction of scale range and target person reached significance in either one of the experiments. However, the probability of obtaining parallel, although non-significant, results in two independent studies is considerably lower than the probability of the individual results. A procedure suggested by Rosenthal (1978; see also Cooper, 1979; Rosenthal and Rubin, 1979) allows a test of the probability that the overall pattern of results obtained in independent studies is generated by chance. The application of this test to the findings of Experiments 1 and 2 reveals a significant impact of scale range on self-reports, $z = 1.74$, $p < .05$, one-tailed, and indicates that the impact of scale range is significantly higher for proxy-reports than for self-reports, $z = 1.67$, $p < .05$, one-tailed, for the interaction contrast.

In combination, the obtained findings support the frame of reference hypothesis and suggest that the impact of response alternatives on behavioural reports is not mediated by self-presentation concerns. From an applied point of view, the findings suggest that precoded response alternatives are particularly likely to bias behavioural reports when proxy respondents are used. Moreover, the size of the response effect is likely to increase the less the respondent has detailed episodic knowledge about the behaviour of the target person.

EXPERIMENT 3: THE IMPACT OF PRIVATE AND PUBLIC SELF-CONSCIOUSNESS

While the first two studies manipulated the availability of relevant information by assessing self-reports or reports of others' behaviour, the third study used an individual difference approach. Previous research in personality psychology indicated that individuals who focus their attention on the self provide more accurate self-reports, presumably because relevant self-knowledge is cognitively more accessible to them (cf. Wicklund, 1982 for a review). This suggests that these individuals should be less influenced by the range of the response scale provided to them because they may have better access to relevant episodic information.

Such a finding would parallel the results of Experiments 1 and 2, and further support the hypothesis that the impact of scale range decreases as the availability of episodic information, or information that allows the reconstruction of episodes, increases.

However, individuals differ not only in the extent to which they pay attention to their own behaviours and feelings, but also in the extent to which they pay attention to the impression they give to others. According to the self-presentation hypothesis, individuals who care a lot about their public image should be more affected by scale range than individuals who pay less attention to what others think of them.

Accordingly, we assessed both individuals' disposition to pay attention to what others think of them and their disposition to focus on their own behaviours and feelings, using the well-established 'public' and 'private self-consciousness' scales developed by Fenigstein, Scheier and Buss (1975).

Method

One hundred and forty-seven University of Illinois undergraduates, who were randomly drawn from the population of undergraduates enrolled in introductory psychology, participated as part of a class requirement. As in the previous studies, the data were collected anonymously by self-administered questionnaires in a classroom setting.

Respondents were randomly assigned to conditions and reported their weekly TV consumption along one of the two scales used in Experiment 1 (see Table 1). Respondents were given as much time as they wanted to complete the questionnaire.

In addition, their public and private self-consciousness was assessed (Fenigstein *et al.*, 1975), and respondents who scored above the median of the respective scale were grouped as 'high' on public or private self-consciousness, respectively, while those who scored below or equal to the median were grouped as 'low' on the respective trait.

Results and discussion

Overall, a higher proportion of respondents reported watching TV for more than 10 hours when given the high (41 per cent) than when given the low (15 per cent) frequency range scale, with responses given in an open format falling in between (20 per cent). This pattern is reflected in a significant contrast corresponding to the

main effect of scale, $z = 3.67$, $p < .0002$, one-tailed. To explore the impact of public and private self-consciousness, two separate analyses were conducted.

Public self-consciousness. The first part of Table 4 shows a breakdown of respondents' reports as a function of scale range and respondents' public self-consciousness scores, that is, their disposition to pay attention to the public impression they give to others. This breakdown reveals that the impact of the high and low frequency range scales is virtually identical for both levels of public self-consciousness, with a difference of 27 percentage points under high, and 26 percentage points under low, public self-consciousness. Accordingly, no significant interaction of public self-consciousness and scale range was obtained ($z = 0.07$, n.s.). Additional comparisons within each scale condition also failed to reveal any significant differences as a function of respondents' public self-consciousness scores (z values = 0.43, and 0.04, n.s., for the high and low range scale conditions, respectively). Thus, respondents' disposition to pay attention to the public image they give to others did not affect the impact of scale range, contrary to predictions derived from the self-presentation hypothesis.

Table 4. Reported weekly TV consumption as a function of scale range and self-consciousness

	Scale range	
	High range	Low range
A. Public self-consciousness		
Low	.39 ($n=41$)	.13 ($n=38$)
High	.44 ($n=32$)	.17 ($n=36$)
B. Private self-consciousness		
Low	.51 ($n=37$)	.13 ($n=45$)
High	.31 ($n=36$)	.17 ($n=29$)

Note: Figures show proportion of respondents who reported a TV consumption of more than 10 hours per week. The number of respondents in each cell is given in parentheses; proportions are rounded.

Private self-consciousness. The second part of Table 4 shows an analogous breakdown of the same sample as a function of scale range and respondents' private self-consciousness scores; that is, their disposition to focus attention on their own behaviours and feelings.

Separate analyses at each level of private self-consciousness reveal that the effect of scale range is only reliable for respondents who scored *low* on private self-consciousness, $z = 3.94$, $p < .00005$, one-tailed. Specifically, 51 per cent of the respondents who were given the high frequency range scale reported watching TV for more than 10 hours per week while only 13 per cent of the respondents given the low frequency range scale did so, resulting in a difference of 38 percentage points.

In contrast, respondents who scored *high* on the private self-consciousness scale were not significantly affected by the range of the response scales provided to them ($z = 1.35$, $p = .09$, one-tailed), though the pattern of the proportions is similar to the one discussed above, with a difference of 14 percentage points. Overall, this pattern is reflected in an interaction of scale range and private self-consciousness, $z = 1.69$, $p < .05$, one-tailed, as predicted by the frame of reference hypothesis.

Discussion. In summary, respondents who scored high on the disposition to focus attention on the self, as assessed by the private self-consciousness scale, were less influenced by the range of the response alternatives provided to them than respondents who scored low on this disposition. This finding presumably reflects the higher accessibility of self-related information under high self-consciousness. Specifically, it suggests that respondents who scored high on the self-consciousness scale used information about their behaviour that they recalled or reconstructed from memory, rather than information provided by the scales, to determine their TV consumption. Thus, the present results parallel the findings of the previous studies as they indicate that the impact of the response alternatives decreases with increasing accessibility of other information.

In addition, the present data provide further support for the observation that behavioural reports are more valid under self-focused attention (see Wicklund, 1982 for a review) by demonstrating that respondents with dispositionally self-focused attention are less susceptible to question form effects. This finding, as well as previous laboratory results (see Wicklund, 1982), raises the interesting possibility that the validity of self-reports may be increased if self-focused attention is actively induced, rather than assessed as an individual difference variable. It may be a fruitful avenue for future applied research to experiment with manipulations that may induce self-focused attention in a survey context.

CONCLUSIONS

In combination, the present findings support the hypothesis that the impact of response scales on behavioural reports is mediated by their informative function. Respondents use the range of the response alternatives as a frame of reference in estimating their behavioural frequencies. Accordingly, the impact of response alternatives was the more pronounced the less relevant episodic information was easily available. Thus, response scale effects were more pronounced when respondents reported the behaviour of others rather than their own behaviour (Experiments 1 and 2). Moreover, the impact of scale range was moderated by individual differences in the degree of self-focused attention, and respondents with a high chronic accessibility of self-relevant information were not significantly affected by the response alternatives (Experiment 3).

None of the obtained findings could be derived from the hypothesis that the impact of scale range is mediated by self-presentation concerns, which would, in fact, predict opposite results for Experiments 1 and 2. Note in this regard, that respondents' alcohol consumption was assessed in Experiment 2, that is, the behaviour that prompted the self-presentation hypothesis in the first place (Bradburn and Danis, 1984). Moreover, individual differences in respondents' concern about their public image did not moderate the impact of response scales (Experiment 3). Thus, self-presentation concerns do not seem to play a major role in the present non-threatening context, which is typical for the majority of behavioural reports assessed in surveys. However, more threatening questions may activate these concerns, and their impact may be compounded if the response scale suggests that the respondent's behavioural frequency is unusual. In addition, self-presentation concerns may vary as a function of mode of data collection, and may

be more pronounced in face-to-face interviews than when the data are collected by self-administered questionnaires (e.g. Smith, 1979). These possibilities await further research.

Turning to the applied implications of the present findings, it needs to be emphasized that the impact of response alternatives on frequency reports of non-threatening behaviours increases as the accessibility of relevant episodic information decreases. Therefore, response scale effects on behavioural reports are particularly likely to be obtained if proxy respondents are used, and if the behaviour under study is frequent and mundane, thus decreasing the accessibility of distinct episodes in memory. Under these conditions, researchers may be well advised to use open-answer formats to obtain data on behavioural frequencies. As Sudman and Bradburn (1982, p. 115) noted, 'there is no difficulty in coding such responses, since the data are numerical and can easily be processed without need for additional coding'. For this reason, the major disadvantages of the open-ended format—time, cost, interviewer variability, coding, and analytical problems—are not of considerable concern in the assessment of frequencies. Precoding the responses, on the other hand, may introduce systematic bias because response scales are not only 'measurement devices' but serve informative functions as well.

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Book Reviews

BRAIN SYSTEM DISORDERS AND PSYCHOTROPIC DRUGS. H. Ashton, Oxford University Press, 1987. No. of pages: 547. ISBN 0 19 261436 3 (cloth). Price: £40.00.

Three complex topics are described within this volume: functional brain systems, disorders within these systems and associated behavioural problems, and lastly the effects of psychoactive drugs upon these systems. A text covering just one of these topics would be complex enough, but Heather Ashton has succeeded in presenting an excellent integrative account on all three. The text is subdivided into five parts: arousal and sleep, reward and punishment, learning and memory, depression and mania, and lastly schizophrenia. In each part the brain systems involved in the functions are described first, then the disorders are covered, while final chapters cover drug effects. This structure makes it useful as a reference volume for cognitive psychologists. Thus, for a researcher interested in arousal, Part 1 (Arousal and sleep) would indicate current understanding on: neuroanatomy, neurotransmission, EEG measures, arousal/performance relationships, disorders of arousal or sleep, and an analysis of the effects of different drug classes on all the above aspects. The author manages to present the information clearly and succinctly, without simplifying areas of uncertainty.

There are, however, difficulties which stem from the behavioural model used to structure the book. This is described in the introduction: 'The behaviour of man is governed by three main functional systems, for arousal, for reward, and for learning and memory' (p. 1). This is a rather basic, and more importantly non-comprehensive, model of human behaviour. Hence the two final parts are defined by clinical disorder (Part 4: Depression/mania; Part 5: Schizophrenia), rather than by functional system. This conceptual confusion also creates problems over where particular functions, disorders, or drugs should be covered. For instance, anxiety, benzodiazepine, and barbiturate drug effects, are treated in the section on arousal and sleep, while alcohol is covered in the section on reward and punishment. Several important areas are absent. Ashton acknowledges that aggression, sex, and feeding are omitted. The concept of attention is only briefly mentioned, despite its importance as a psychological function, its alteration in many behavioural disorders, and the numerous drugs which affect it. Higher cognitive functions such as thinking and problem-solving are also hardly raised, even in the section on schizophrenia. A more comprehensive model of behavioural functions would therefore have strengthened this book.

The other problem for a book on this topic is the interrelatedness of brain functions. This creates insoluble organizational problems, no matter which model had been used. In each section Ashton firstly has to summarize the topic covered in the next few pages, then itemize where that topic is also covered in related sections. This is skilfully performed, and Ashton places commendable emphasis on the interrelatedness of brain systems. However, the sheer volume of cross-referencing leads to some conceptual fatigue. To take one example: 'Depression and mania can be viewed as disorders of reward and punishment systems, with features in common with drug dependence and chronic pain syndromes . . . such disorders also have secondary effects on arousal and sleep and on cognitive, autonomic and endocrine function' (p. 283). Interrelatedness with 'affect' is also discussed at length. Thus chapters 11 and 12 are cross-related to most of the previous chapters. It is interesting that one area not cross-referenced with depression is schizophrenia. Yet clinically they often overlap, as in depression with delusional aspects, and the schizo-affective disorders. As an aside, it may be noted that current conceptual models for these 'psychotic' disorders are quite distinct. Different neurochemical systems, brain tracts, and brain areas, are implicated in each. Changes in clinical diagnosis may well follow this conceptual distinctness (have diagnoses of shizo-affective disorder decreased recently?). The introduction of lithium, as a treatment for mania, led to an increase in the incidence of diagnoses for that disorder. It is therefore worrying that conceptual models based on neurochemistry often seem to take precedence