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THE EFFECT OF QUANTIFICATION ON THE ACCURACY OF PROENVIRONMENTAL BEHAVIOR SELF-REPORTS*

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ABSTRACT

One hundred and thirty individuals, living at a Northwestern Mexican city, self-reported A) how frequently (always, often, sometimes, never) they engaged in activities of reuse and recycling, and B) how many reused and recycled objects they had at home. A) was considered as *reported frequency of reuse/recycling*, while B) was taken as *reported quantity of reuse/ recycling*. In addition, observations of reused/recycled products were conducted at the individuals' household. Correlation analysis of these three methods were done on the reuse and recycling of several products. These correlations revealed higher associations between observed reuse/recycling and the quantitative self-reports of such behaviors, than between the self-report of frequency and the quantitative self-reports or between the observations and the frequency reporting. The higher correlations of observations and the quantitative verbal report were found only in those cases where the action of reuse/recycling was more salient. A path analysis modeling the correlation between an index of observed reuse/recycling behavior and quantitative and frequency indexes of self-reports replicated the results of the correlations for each separate activity. It was concluded that quantifying the products of self-behavior may enhance the accuracy of self-reports of conservation behavior.

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Self-reports are among the most used methods in assessing proenvironmental behavior (PEB). They include questionnaires and interviews and have the advantage of collecting wide information related to varied and diverse aspects of PEB. Other features making self-reports attractive methods for researchers are their low cost and their being easily obtained when collecting data [1]. In a typical study, people are asked to report how frequently they engage in activities considered as proecological. They point out if they "always," "often," "sometimes," or "never" display actions such as reuse, recycling, saving water, etc. The resulting information is considered as an accurate indicator of PEB.

However, many researchers point out problems related to the use of self-reports. A number of studies has shown a disparity between measures of overt behavior, such as observations or traces of conduct, and self-reports of PEB [2-5]. Contrasting both categories of methods produces small and sometimes non- significant correlations [2, 4]. Since observations of people activity are usually valid measures of behavior [1], obtaining so low correlations should be a concern for researchers who frequently use verbal reports as measures of proenvironmental conduct, and other kinds of behaviors as well.

Possible explanations for the disparity between results of self-reports and measures of overt behavior have been discussed: One is the reactivity caused by the pressure to appear socially responsible when talking about own pro-ecological behavior [3, 6], as well as the subject's lack of willingness to answer correctly [7]. In addition, some authors, mention the effects of time and memory, and the lack of knowledge, which may lead to incorrect self-reports [7]. It is possible that all these sources explain at least partially why self-reports are biased indicators of instrumental behavior.

Reactivity caused by social pressure is present in every research context where verbal reports are used. By definition, such verbal context is social in nature and little can be done in order to minimize the biased responses of subjects. Something similar occurs regarding to individuals who are not willing to answer correctly. In such a case it would be preferable to use an alternative method of data collection.

However, sometimes people's reports of their behavior could not be accurate because of the qualitative nature of their answer. Since many self-reports consist of qualifying frequency of actions in terms of "always," "often," "sometimes," or "never" do some activity, it is possible that this qualification be a combination of expectations, beliefs, or perceptions, rather than an objective summary of actions [8]. This means that, for some individuals, "often" could significantly be "more frequent" than for other, while "sometimes" could mean "rarely" for someone and "much" for others. Although qualitative indicators of one's own behavior are useful assessments of how people perceive their effort or capacities, they could be pointing out a "reality" or facet of behavior having more to do with personal beliefs or social desires, than with actual instrumental behavior [4, 5, 8].

If qualification is a characteristic of the bias (toward social desire) of self-report, then an alternative way of requesting verbal reports should be used. In order to prove its efficacy, this alternative method should increase the correlation between self-report and observation of PEB. Therefore, it would be possible to enhance the accuracy of self-reports if a *quantitative* rather than a frequency/qualitative indicator of conservation behavior is used. By quantification, we mean to use numbers instead of words, in order to report how much one individual engaged in a specific kind of proecological activity.

The indicators of PEB used in this study are reuse and recycling behavior, two instances of conservation behavior. Reuse implies using an object in a different, additional way than originally intended when the object was acquired/purchased. In reuse, objects are neither discarded nor re-processed (as in recycling), they keep their original form. The only thing that changes is their use or the person using them, as in the case of reused clothing, for example. Reuse practices are common in traditional and poorer societies—as the one investigated in this study—where consumerism has not fully been adopted as a common lifestyle or where economic constraints do not allow higher rates of purchasing products.

Recycling, in turn, refers to treating or processing discarded objects so as to make them available for use in the original or some other form. In recycling, a special treatment is required to re-convert the recycled object. Thus, energy is required, and although recycling saves resources, it may produce pollution in the re-conversion process.

The purpose of this study was to compare differences between qualifications of frequency, and quantitative self-reports of reuse and recycling behavior. Such differences were assessed by comparing the correlation between each type of self-report and the observation of reused and recycled objects.

METHOD

Subjects

One hundred and thirty persons from Hermosillo, Mexico, a medium-sized city (population = 600,000) in Northwestern Mexico, were the subjects for this study. Families were randomly selected from three samples, representative of low (n = 70), medium (n = 50), and high (n = 10) social class neighborhoods at the city, and three members of each family were interviewed (2 adults and a juvenile between 12 and 18 years). Subjects were forty males and ninety females. Their age had a mean of 35.2 years (*S.D.* = 0.6), and their average-monthly family income was $780,000 U.S. dollars (*S.D.* = $582.00). Family size had a mean of 4.5 (*S.D.* = 0.6) members. Both, age and family size were normally distributed within the sample, while income presented a positive skewness (as an effect of the sampling procedure). In Mexico, a distribution of higher income in a limited number of families is a population characteristic [4].

Instruments

A questionnaire investigating reuse and recycling practices was used. Two kinds of questions referring to these practices were employed. The first one investigated the self-reported amount of reuse and recycling of clothing, plastic bags, cardboard, glass, newspaper, aluminum cans, steel, and paper, with four response options: "never," "sometimes," "often," and "always." This section was named *frequency self-report.* The second included questions asking each individual to respond how many objects he/she (and no one else at the household) has reused/recycled. They had to indicate a number as their response (for example, "I have 20 aluminum cans ready to recycle"), so that this section was the *quantitative self-report.* The instrument also included a section where the researchers noted the number of reused/recycled objects they observed at the household. Finally, demographic data (age, gender, family size, and family income) were recorded in the instrument (see Appendixes 1 and 2).

Procedure

Subjects' consent to participate in the study was obtained. In every case, this consent was given by an adult (the housewive or the *pater familia*), even if the interviewed individual was a minor. They were told this study's goal was to investigate conservation practices at the city, and that it would be required their permission to observe, throughout the household, the kind and amount of conserved products they had. None refused to participate in this study. Frequency self-reports for every conservation practice were obtained first, then the quantitative reports, and finally, the observations were made.

Data Analysis

Data from frequency self-reports were recorded for analysis: "Never" = 4, "sometimes" = 3, "often" = 2, and "always" = 1. This coding assigns lower numeric ranks to higher levels of reuse and recycling behavior. Means of quantitative self-reports and observed behavior were computed and bivariate correlations between the three kinds of reuse/recycling assessments were obtained. These correlations included comparisons for all reuse and recycling practices (i.e., every single practice). Indexes of reuse and recycling behavior were constructed by averaging the results of each type of assessment. Since some of the conservation practices (reuse of aluminum and steel; recycling of glass, steel, cardboard, and paper) produced marginal means, these variables were not included in the corresponding index. Thus, indexes of self-reported frequency of reuse and recycling, quantitatively self-reported reuse and recycling, and observed reuse and recycling were available for contrast.

These indexes were included in a path analysis, where the correlation between observed reuse/recycling and the results of the frequency and quantitative

self-reports were estimated. In addition, the value of the correlation between the index of reuse and recycling was obtained, and it was also estimated the correlation between the errors of the frequency reporting of those conservation practices, and between the errors of the quantitative reuse and recycling.

The path analysis was performed by using the EQS statistical software [9], which provides goodness of fit indicators for a model of relations between variables. A low and non-significant chi-square, as well as values higher than .90 for practical goodness of fit indicators (Bentler-Bonett Normed Fit Index, Bentler Bonett Non Normed Fit Index, Comparative Fit Index) are considered as evidence of goodness of fit for a given model [9, 10].

RESULTS

Table 1 exhibits the means of observed reused objects and quantitative reports of reuse. According to Table 1, most reused products were paper, plastic bags, clothing, newspaper and glass, while cardboard, steel, and aluminum were marginally found and quantitatively reported as reused objects. Table 1 also shows the correlations between the observation of reused objects and the frequency and quantitative reporting of reuse. In general, the highest correlations were found between quantitative reporting and observations, although significant associations were not infrequent between frequency reporting and its corresponding quantitative self-report and observation.

Table 2, in turn, shows that the most observed and quantitatively-reported recycled objects were aluminum, newspaper, and clothing, with the rest of the objects having minimal participation in the recycling effort of investigated people. As in the case of reuse, more salient correlations were found between observations and the quantitative reporting. However, in some cases frequency reporting was associated more significantly to quantitative self-report or observations. Those cases corresponded to the lower levels of recycling (i.e., the smallest means for observed and quantified recycling).

In Figure 1, the correlations between the three methods assessing conservation practices are modeled, using the indexes for reuse and recycling. As it is shown, in both reuse and recycling cases, the observed practice predicts more saliently the corresponding quantitative reporting. The observed reuse and the observed recycling do not significantly covariate, while the errors associated to self-reports only covariate in the cases of frequency reporting. The goodness of fit indicators for this model shows its adequacy. This seems to indicate that this model of relationships is supported by the data.

DISCUSSION

Results of this study seem to demonstrate that in regard to reuse and recycling practices, quantitative reporting is closer to a measure of overt behavior

Table 1. Correlations between Frequency and Quantitative Self-Reports and Observations of Reused Objects. Means of Observed (OBS) and Quantitatively Self-Reported (QSR) Reused Objects are Included

		Frequency S-R	Quantitative S-R
A) Clothing reuse			
Quantitative S-R		.40****	—
Observation		.34****	.57****
OBS mean	QSR mean		
8.1	8.6		
B) Bags reuse			
Quantitative S-R		.19*	—
Observation		.15	.44****
OBS mean	QSR mean		
16.7	16.6		
C) Cardboard reuse			
Quantitative S-R		.35****	—
Observation		.31***	.49****
OBS mean	QSR mean		
3.6	3.0		
D) Glass reuse			
Quantitative S-R		.45****	—
Observation		.32***	.56****
OBS mean	QSR mean		
5.17	3.9		
E) Newspaper reuse			
Quantitative S-R		.18*	—
Observation		.15	.57****
OBS mean	QSR mean		
6.6	5.0		
F) Aluminum reuse			
Quantitative S-R		.39****	—
Observation		.17	.03
OBS mean	QSR mean		
1.3	3.2		
G) Steel reuse			
Quantitative S-R		.53****	—
Observation		.47****	.66****
OBS mean	QSR mean		
2.8	2.0		
H) Paper reuse			
Quantitative S-R		.32***	—
Observation		.21*	.51****
OBS mean	QSR mean		
19.2	21.8		

*$p < .05$
**$p < .01$
***$p < .001$
****$p < .0001$

Table 2. Correlations between Frequency and Quantitative Self-Reports and Observations of Recycled Objects. Means of Observed (OBS) and Quantitatively Self-Reported (QSR) Recycled Objects are Included

		Frequency S-R	Quantitative S-R
A) Recycled cloth			
Quantitative S-R		.35***	—
Observation		.13	.18
OBS mean	QSR mean		
2.63	2.33		
B) Recycled glass			
Quantitative S-R		.48****	—
Observation		.15	.40****
OBS mean	QSR mean		
1.5	1.0		
C) Recycled newspaper		.38****	—
Quantitative S-R		.46****	.71****
Observation	QSR mean		
OBS mean	4.46		
4.58			
D) Recycled aluminum		.47****	—
Quantitative S-R		.41****	.76****
Observation	QSR mean		
OBS mean	22.9		
23.8			
E) Recycled steel		.25**	—
Quantitative S-R		.41****	.29***
Observation	QSR mean		
OBS mean	22.7		
0.96			
F) Recycled cardboard		.29****	—
Quantitative S-R		.07	.13
Observation	QSR mean		
OBS mean	0.54		
0.24			
G) Recycled paper		.37****	—
Quantitative S-R		.35****	.66****
Observation	QSR mean		
OBS mean	1.70		
1.07			

*$p < .05$
**$p < .01$
***$p < .001$
****$p < .0001$

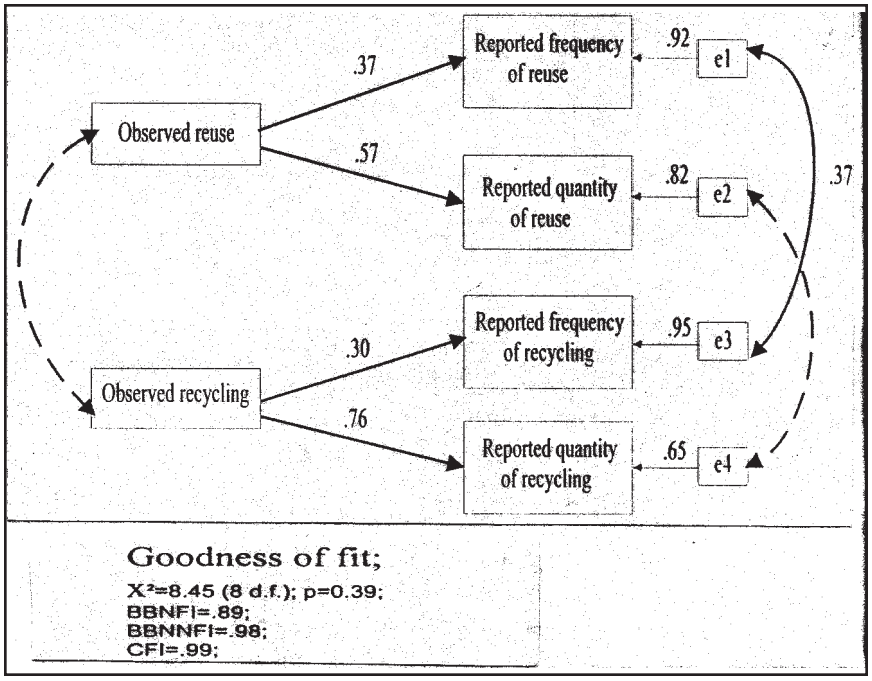

Figure 1. Relations between indexes of observed reuse/recycling and the frequency and quantitative versions of self-reported conservation behavior. Dotted lines represent non-significant correlations.

(observation) than is the classic frequency self-report, which uses words instead of numbers. Although more than half of the correlations between frequency reporting and observations were significant, they were less salient and less frequent than the ones produced between observations and quantitative self-reports. This would indicate that, at least in the context of conservation practices, quantitative reporting is a better indicator of actual conservation behavior than the classic verbal report of frequency.

Possible reasons for these results can be mentioned. One has to do with the qualitative nature of the frequency self-report used in this study. By qualifying the frequency of their behavior, it is possible that subjects were reporting perceptions of social desirability [11] rather than their actual conservation behavior. This situation would be responsible for the lower correlation between this kind of self-reports and the observations of reuse and recycling.

Other explanation considers that since results from observations and quantitative self-reports are quantities (numbers) representing conservation behavior, this would explain why these two methods produce similar results. However, studies

in other areas indicate that quantification seems to interfere with the accuracy of self-reports. For example, Hartley reported that the accuracy of activity data of office workers decreased as more quantitative information was requested [12]. In the present study, we found the contrary effect: The accuracy increased.

Nonetheless, in most cases where observations revealed a marginal conservation activity (i.e., little reuse and recycling) the opposite trend was manifested: The correlation between observation and quantitative reporting was lower than the one observed between the two forms of self-reporting. In these cases, quantification *decreased* the accuracy of self-reports. Thus, quantification seems to be useful only on those cases where salient information exists regarding people's own behavior. Since only the most practiced reuse/recycling activities were used to create the indexes of conservation activity in the path analysis, the ability of observation to predict quantitative reporting was significantly higher than in predicting frequency self-report.

Consistency of behavior is often a form of conduct that is relevant. In the context of conservation behavior, the higher frequency of reusing clothing or recycling aluminum, for example, seems to indicate that these are important activities for the studied individuals. Although our study did not offer empirical evidence to demonstrate such an assumption, previous research has shown that individuals engaged in continuous reuse and recycling of different products assigned higher levels of "motives" or "reasons" for conserving, than those who reuse and recycle less [5, 13]. If this motivation indicates relevancy, then there is a plausible explanation of why people report their own behavior with more accuracy: They remember better because what they do is relevant or salient for them. Salience of information is an important feature of a good retrieval of autobiographical memory [14]. If memory plays a role in explaining the inaccuracy of self-reports [7], then making salient the information to self-reporting would be a suitable strategy for increasing its accuracy. Quantifying frequent conservation behavior would be one procedure to achieve this goal.

An unexpected result of this study were the high correlations found between the classic frequency reporting and observations. These were higher than those reported in previous studies [4, 5], using the same methods and items. A possible explanation for this disparity could be found in the fact that, in this study, people were told in advance that observations would be conducted on the products of their conservation practices. Thus, they might be more willing to admit their effort (or lack of it) when qualifying their own reuse/recycling behavior, because they knew the traces of their own behavior would be observed. Nonetheless, a stronger effect on the accuracy of self-reports seemed to be operating due to quantifying the conservation practices.

Although some limitations of this study are evident (a limited number of participants was investigated, people did not point out what reuse activities were the most relevant), its results could indicate a potential and fruitful strategy for increasing self-report accuracy. Quantifying salient activity of people could be a

useful way of collecting more valid information regarding their conservation behavior.

APPENDIX I
Self-Report Questionnaire

House # _____ Household members: Adults _____ Children _____
Income $ _____ Age of respondent _____ Gender _____

	NEVER	*SOMETIMES*	*OFTEN*	*ALWAY*	*# OF OBJECTS* (*)
I. **REUSE**					
1. Reuses sides of writing paper	____	_____	_____	_____	_____
2. Reuses clothing items	____	_____	_____	_____	_____
3. Reuses plastic grocery bags	____	_____	_____	_____	_____
4. Reuses cardboard boxes	____	_____	_____	_____	_____
5. Reuses glass objects	____	_____	_____	_____	_____
6. Reuses newspaper	____	_____	_____	_____	_____
7. Reuses aluminum cans	____	_____	_____	_____	_____
8. Reuses steel/iron	____	_____	_____	_____	_____
Ib. **RECYCLING**					
I. **REUSE**					
1. Recycles sides of writing Paper	____	_____	_____	_____	_____
2. Recycles clothing items	____	_____	_____	_____	_____
3. Recycles cardboard boxes	____	_____	_____	_____	_____
4. Recycles glass objects	____	_____	_____	_____	_____
5. Recycles newspaper	____	_____	_____	_____	_____
6. Recycles aluminum cans	____	_____	_____	_____	_____
7. Recycles steel/iron	____	_____	_____	_____	_____

(*) Quantitative self-report

APPENDIX II
Observations of Reused and Recycled Objects

ITEM	Number of Reused Objects
1. Writing paper	_____
2. Clothing items	_____
3. Grocery bags (plastic)	_____

4. Cardboard boxes _____
5. Glass objects _____
6. Newspapers _____
7. Aluminum cans _____
8. Iron/steel products _____

ITEM	Number of Recycled Objects
1. Writing paper	_____
2. Clothing items	_____
3. Cardboard boxes	_____
4. Glass objects	_____
5. Newspapers	_____
6. Aluminum cans	_____
7. Iron/steel products	_____

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