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# Decomposing Attitude? What Structuring Beliefs about Food Leftovers Implies for General Attitudes, Intention and Behavior

## Abstract

This study aims to enhance the understanding about consumer food leftover behavior in an out-of-home setting by applying a decomposed perspective on attitudes and empirical data on 307 guests in a university canteen. Based on 12 belief statements, three attitude dimensions are derived: (1) Environment, (2) Self-Interest and (3) Resources. Path analyses on their interrelation with general attitude, behavioral intention and observed leftover behavior indicates that the dimensions have distinctive behavioral effects. Moreover, these effects differentiate when portion sizes as a situational determinant of plate leftovers are introduced as grouping variable.

**Keywords:** path analysis, ambivalent attitudes, food waste, plate leftovers, canteen

## 1 Thematic Background

A large body of research has considered attitudes as a major determinant of behavior, often mediated by behavioral intention, i.e. in the Theory of Reasoned Action or the Theory of Planned Behavior. Generally, attitudes may be described as a “summary evaluation of a psychological object captured in such attribute dimensions as good-bad, harmful-beneficial, pleasant-unpleasant, and likable-dislikable (Ajzen 2001, p.28). However, complementary to this aggregate perspective of attitudes, they may be interpreted as a summary of specific beliefs where “each belief links the behavior to a certain outcome, or to some other attribute such as the cost incurred by performing the behavior [and which is valued positively or negatively]” (Ajzen 1991, p.191). Thus, attitudes can compose of a set of complementary as well as potentially conflicting belief statements about consequences of a specific behavior (Fabrigar, MacDonald and Wegener 2005; Povey, Wellens and Conner 2001; Tourangeau, Rasinski and D’Andrade 1991). Modeling attitudes exclusively as a summary construct neglects potential ambivalence between different beliefs. In addition, the relevance of different beliefs in influencing attitude, behavioral intention and behavior may stand in relation to situational factors (Berndsen and Van der Pligt 2004; Brug, Lechner and De Vries 1995; Conner et al. 2002; Fabrigar et al. 2005). Exemplarily, Lozano et al. (1999) found that the feeling of hunger changes general food attitudes more for high-fat foods than for low-calorie foods. The authors could relate this finding to specific attitude ambivalences between aspects of taste versus health for high-fat foods.

Research on non-food consumer behavior (i.e. the acceptance of new and/or sustainable technologies) has suggested to apply intermediate classifications of beliefs which represent distinctive, decomposed attitude dimensions (Moons et al. 2009; Taylor and Todd 1995) to better account for the complexity of attitudes. By decomposing attitudes, these studies were able to improve the predictive power of this construct on behavioral intention. Findings by Sorensen et al. (2012) demonstrate that individuals’ attitude towards the pork production industry may be described as an interrelated system of different belief dimensions i.e. relating to animal welfare, natural environment or to local economy. This may provide reason to presume potential benefits from the consideration of decomposed attitudes also in food-related behavior research.

Though research on food- and sustainability-related behaviors such as food purchasing of organic foods (Arvola et al. 2008; Aertsens et al. 2009), regional foods (Lorenz, Hartmann and Simons 2015) as well as Fair Trade food (Langen 2011) emphasize the crucial role of attitude in understanding

behavioral intention and behavior, those studies model attitude as a summary construct. The same holds for research on consumers' food waste behavior such as household food waste behavior (Graham-Rowe, Jessop and Sparks 2015; Langen, Goebel and Waskow 2015) and recycling (Tonglet, Phillips and Read 2004; Tonglet, Phillips and Bates 2004).

The present study aims to investigate the relevance of decomposing attitude for understanding consumers' behavioral intention and behavior at the example of food waste behavior in a canteen setting. Since consumers contribute a relevant share to overall food waste and away-from home food consumption steadily increases in Europe, research in this area appears promising in reducing food waste and by this in contributing to more sustainable lifestyles (European Union 2016; Engström and Carlsson-Kanyama 2004; Katajajauuri et al. 2014). Moreover, for the specific case of a company canteen, research by Finkbeiner (2013) has already suggested that plate leftovers are associated with a number of different belief statements which cover both, positive and negative consequences of having plate leftovers or of clearing one's plate respectively. This is in line with qualitative findings on food waste behaviors in other settings that have been described as determined by complex, interlinked and potentially conflicting systems of attitudes and values (Evans 2011; Graham-Rowe, Jessop and Sparks 2014). Accordingly, it may be presumed that especially for consumers' food waste behavior an analysis on potential structures within those beliefs about plate leftovers and their interaction with general attitude measurements and behavioral intention provides insights on how attitude determines plate leftover behavior.

More precisely, the present study investigates a set of 12 belief statements on consequences of having plate leftovers in a canteen with respect to the potential representation of different attitudinal dimensions and their interrelation to general attitudes, behavioral intention to not have plate leftovers and actual leftover behavior. In addition, it aims to explore whether different decomposed attitudinal dimensions may change in their interaction with general attitudes, intention and behavior based on two situational factors that are commonly stated to relate to plate leftovers: First, too large portion sizes and second insufficient taste of food (Dinis, Martins and Rocha 2013; Betz et al. 2014; Goebel et al. 2014).

## **2 Methodology**

Based on a survey conducted during three days (Tuesday to Thursday) in December 2015 (during the regular semester) at a university canteen, we applied an existing dataset composing of visual measurement of individual plate leftovers via photographs linked to answers in an online (smartphone optimized) questionnaire for 383 guests. The questionnaire composed of queries related to potential personal determinants of plate leftovers based on an extended Theory of Planned Behavior and, moreover, also covered personal determinants (i.e. general beliefs) of food choice and eating, specific perceptions of food related to the day of participation and sociodemographic characteristics.

### **2.1. Item Based Measurement of Constructs**

Given the research question on attitude dimensions and their interactions with general attitudes, intention and behavior under consideration of potential situational differences, our analyses will focus on three personal determinants covered in this questionnaire: First, on 12 belief statements to which participants stated their agreement on five-point Likert scales (see Table 1): "If I don't clear my plate in the university canteen... (1)...food is wasted. (2)...this causes environmental pollution. (3)...this creates avoidable waste. (4)...this has a negative impact on climate change. (5)...I'm wasting money. (6)...I start thinking of many people in the world who do not have enough to eat. (7)...this is better for my health. (8)...I'm feeling less stuffed. (9)...I will feel less tired after lunch. (10)...this is better for my shape. (11)...it's not that serious since food is low-priced. (12)...this does not represent an environmental issue since food is biodegradable." Those beliefs were based on associations with plate leftovers that Finkbeiner (2013) qualitatively determined for visitors in a company canteen. Second,

we applied a general measurement of (cognitive) attitudes based on three seven-point semantic differential scales that were an adaptation of Crites et al. (1994) and Ajzen (2006): “Imagine you are returning your tray in the university canteen and there are food leftovers on your plate. How would you generally describe this situation? (1) reasonable...unreasonable, (2) acceptable...unacceptable, (3) good...bad (see Table 2). Third, we measured behavioral intention by the stated agreement of respondents (again on five point Likert scales) to three items: Regarding my next lunch at the university canteen... (1)... it’s very likely that I will empty my plate completely. (2)...I will do my best to empty my plate. (3)...I generally will try not to leave any food on my plate (Table 2). These items are in accordance to general suggestions on the measurement of behavioral intention by Ajzen (1991).

To structure the beliefs towards plate leftovers, we applied an exploratory factor analysis (Principle Component Analysis) with Oblimin rotation ( $\delta=0$ ) in SPSS Statistics 23. Oblimin rotation was chosen due to the assumption that even potentially conflicting belief statements are part of a general attitude construct and hence cannot be fully uncorrelated (Ajzen 2001). Similarly, exploratory factor analyses were applied in order to convert the item-based measurement of attitudes and intention into single constructs and to check for the dimensionality of the measured scales. Out of the factor analyses, z-standardized factor scores were calculated for each supported construct.

## **2.2. Path Analyses of Relationships between Constructs**

Based on the factor analysis results (including correlation matrices), we then conducted path analyses in Mplus to discover the relationships between factors representing belief-statements, general attitude, behavioral intention and the actual leftover behavior. The leftover behavior thereby was categorized in three groups (0=no leftovers, 1=leftovers equivalent to .5 servings of one food component, i.e. vegetables, starchy side dishes, 2=leftovers equivalent to more than .5 servings of one food component). To finally consider differences related to the situational perception of portion size and the taste of food in the university canteen, we applied grouping variables, with three categories each (regarding portion size: group 1=too small portion; group 2=just right portion; group 3=too large portion; regarding taste: group 1=rather good taste; group 2=average taste; group 3=rather bad taste); initial statements on seven point bipolar scales). Since plate leftovers as dependent variable were measured categorically, a weighted least squares estimator with adjustment of means and variances (WLSMV) was applied (for a detailed discussion on the application of WLSMV, see Yu (2002)).

## **3 Results**

From the initial sample of 384 guests, 76 participants were eliminated from the analysis due to missing values. Therefore, the final sample consisted of 307 guests (47% female, 53% male; 91% with student status; average age 24.3 years) and did not have any observable differences compared to the socio-demographics of excluded participants (47% female, 53% male; 91% with student status; average age 24.2 years) nor were there statistically significant differences<sup>1</sup> in food leftovers between the final sample and the excluded participants. In the following, results of the exploratory factor analyses will be presented, followed by the general and grouped results of the path analyses.

### **3.1. Exploratory Factor Analyses**

Conducting an exploratory factor analysis (EFA) for the 12 belief statements, a meaningful extraction of three factors was possible, representing 56% of variance. According to the structure matrix for factor loadings (see Table 1), each factor clearly represented a different perspective on food leftovers with sufficient reliability for two factors (based on Cronbach’s Alpha). Although the third factor did

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<sup>1</sup> Based on non-parametric Mann-Whitney-U Test at significance level  $\alpha \leq .01$ .

not indicate sufficient reliability, we decided to include it in the subsequent analyses since it provided an additional perspective on food leftovers that we wanted to consider in the path analysis: We interpreted **Factor 1 (Environment)** as a representation of moral and environmental consequences of food leftovers; **Factor 2 (Self-Interest)** as a representation of consequences for personal wellbeing and health related to food leftovers and finally **Factor 3 (Resources)** as a representation of perceived waste (both, personal and general) of resources related to food leftovers. Besides, factor analyses were conducted in order to assess the dimensionality and reliability of measured items for cognitive attitudes and behavioral intention. These results supported the presumed one dimensional item-based measurement (see Table 2). Accordingly, z-standardized factor scores were calculated for the three belief-based factors, cognitive attitudes and for behavioral intention.

### 3.2. General Path Analyses

Starting with an analysis of correlation between the extracted factors, Spearman's rho was applied due to the categorical nature of leftover measurement. Thereby, a theoretical assumption of general attitude as determinant of behavioral intention and of behavioral intention as a determinant of actual plate leftover behavior appeared being supported by our data since there were significant correlations between general attitude and intention as well as between intention and leftover behavior but not directly between general attitude and leftover behavior (see Table 3). With respect to the relationship between the three belief-based factors, it appeared that the Environment Factor as well as the Resources Factor were closer related to general attitude than to intention. In contrast, the Self-Interest Factor did not have this tendency (see Table 3). Approaches in the literature model food-related attitudes purely by belief-based measures (i.e. Wardle et al. 2004) or by applying beliefs and belief-based dimensions as determinants of general attitude measures (i.e. Aertsens et al. 2009; Sorensen et al. 2012). Based on the literature and our results regarding the correlation analysis we decided not to specify an exclusive influence of Factor 1-3 on either general attitudes or intention in our path model (see Figure 1). Results for a general estimation of the relationships in this model indicate a good overall model fit with a Weighted Root Mean Square Residual (WRMR)<sup>2</sup> of .382 and sufficient R<sup>2</sup> values for attitude (.210), intention (.171) and leftover behavior (.144). With regards to the assumed model, the general estimates support most of the suggested relationships (see Figure 2). Leftovers are determined by behavioral intention, intention is determined by attitudes and attitudes are determined by beliefs with respect to environmental and resource-related consequences of leftovers (Environment Factor and Resources Factor). What may be considered somewhat surprising is the fact that beliefs regarding personal wellbeing (Self-Interest Factor) are no significant determinant of individuals' general attitude towards leftovers but directly and – in contrast to the other two factors negatively (as expected) – influence behavioral intention (see Figure 2). Besides, also the Resources Factor appears to take a direct influence on intention, independent of its influence on attitudes.

### 3.3. Grouped Path Analysis for Perceptions of Portion Size and Taste

In line with the findings that many guests in the university canteen did not have any plate leftovers, most canteen guests had ranked their food to be of (rather) good taste (N=151) compared to average taste ratings (N=64) and (rather) bad taste ratings (N=20). Similarly, most guests rated their portion size being just right (N=166) compared to a lower number who rated their portion sizes as too small (N=97) or too big (N=47). Repeating the estimation process for the suggested model (Figure 1), a grouped model based on portion size rating also provides sufficient model fit with a WRMR of .524 and R<sup>2</sup> values between .190 and .283 for attitude, between .113 and .381 for intention and finally

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<sup>2</sup> Reference values for good model fit under assumptions of a simple model, moderately non-normal data and a sample N>250 may be derived from Yu (2002), suggesting that the WRMR should be <.95.

between .067 and .160 for leftovers. The differences in standardized estimates for the three groups are displayed in Figure 3. Compared to the general estimation, our grouped results display similarities but also differences depending on the situational perception of portion size: The Environment Factor has in the aggregated model as well as in all three group models a direct impact on attitude (in three models the strongest, in one the second strongest) and no direct impact on behavioral intention. In addition, the Self-Interest Factor has in none of the models a direct impact on attitude. The impact of this factor on behavioral intention depends on the perceived portion size. Beliefs regarding personal well-being influence behavioral intention in the case of normal or large portion size but are of no relevance if portion size is perceived as rather small. Also the relevance of the Resources Factor as determinant for attitude and behavioral intention depends on the perceived portion size. When guests rate their portion size being rather small or adequate (and, hence, when the situational factor presumably is in favor of low levels of plate waste), their attitude towards leftovers is determined by the Environment as well as the Resources Factor, while the latter has no impact on attitude in the case of a perceived large portion size. However, in this case the Resources Factor influences behavioral intention directly.

To summarize: For respondents perceiving their portion size as small leftovers are determined by behavioral intention, intention is determined by attitudes and attitudes are determined by beliefs with respect to environmental and resource-related consequences of leftovers (Factors 1 and 3). Although there are significant relationships between beliefs, attitude, behavioral intention and actual leftover behavior, the  $R^2$  values for leftovers are especially in this model rather low (see Figure 3). For the majority of people who are rating their portion size as adequate, the model estimates remain similar although for them, the Wellbeing Factor becomes a significant determinant of behavioral intention and notably, the regression weight for the influence of attitude on intention becomes weaker (.234 compared to .187) whereas the influence of intention on behavior becomes stronger in its effect (-.258 compared to -.287). Finally, for those canteen guests who are rating their portion size as rather big (and who hence face a situational factor in favor of plate leftovers), attitude is solely determined by environment-related beliefs while the Self-Interest and Resources Factors now seem to independently determine behavioral intention. The tendency of decreased association between attitudes and intention as well as increased association between intention and leftover behavior intensifies and ultimately appears to result in an increased  $R^2$  for leftover behavior of .160 (see Figure 3). In contrast to the results for groupings based on portion size perception, a consideration of groupings for taste ratings does not result in a convincing overall model fit with a WRMR of .957. Therefore, these estimation results are not presented.

#### **4 Concluding Discussion**

Following the structure of results in the previous section, we will discuss first the results of the exploratory factor analyses for the beliefs that are associated with plate leftovers and their implications for our assumptions on the existence of different attitudinal dimensions towards plate leftovers in a canteen setting. Second, we will jointly discuss the results of the general as well as the grouped path analyses with respect to the relationship between belief dimensions, general attitude, behavioral intention and actual behavior and, moreover, with respect to differences in these relationships based on the presence of situational factors which may increase the occurrence of plate leftovers.

Reviewing the results of the factor analysis for the belief items, we could summarize 12 belief statements that were based on qualitative research (Finkbeiner 2013) into three constructs which represent positively as well as negatively evaluated consequences of plate leftovers as attitude

dimensions. On the one hand, there are two factors which appear to refer to negative consequences of plate leftovers and food waste in the form of environmental and moral concerns and in the form of monetary and resource based avoidable wastage (Environment Factor and Resources Factor). On the other hand, the third factor considering personal physical conditions of plate leftovers appears to be related to positive consequences of plate leftovers or at least to the prevention of negative consequences from avoiding plate leftovers: feeling full or tired and being in shape and healthy (Self-Interest Factor). It should be noted that although the solution of three distinctive dimensions was considered sufficient for further analyses and provided a sound differentiation between aspects of plate leftovers, a two-dimensional solution may as well have been applicable related to unclear assignment of two belief statements relating plate leftovers (1) negatively to the general waste of food and (2) rather neutrally to irrelevant losses due to low food prices. With regards to suggestions of differentiation between more hedonic and more utilitarian attitudes in relation to consumer attitudes for different goods (including different foods) (Voss et al. 2003), it may be worth to consider a potential two-factor solution as alternative system in future analyses.

Combining the three belief dimensions to determine general attitude towards plate leftovers, behavioral intention not to have plate leftovers and actual plate leftover behavior, the assumption of a useful distinction between those dimensions is supported by their different relationships in the model. While the Self-Interest Factor negatively correlates with the general attitude factor and the intention not to have food leftovers, the Environment and Resources Factor positively correlate with a general attitude and with the intention. Thereby, our results extend findings on more general value conflicts that have been found to exist for other food-waste related behaviors, such as the use of doggy bags in restaurants (Sirieix et al. 2017) or behaviors related to household food waste (Graham-Rowe et al. 2014) to decomposed attitudes towards plate leftovers in a canteen setting. In line with research on multidimensional and ambivalent attitudes in food choice behavior related to sustainability topics such as animal welfare (Schroder et al. 2004) or health (Raghunathan, Naylor and Hoyer 2006), we moreover find potential conflicts between more general, morally oriented beliefs (Environment and Resources Factor) and more hedonic beliefs (Self-Interest Factor).

Based on the additional results on the influences of the three different belief factors on general attitudes, intention and behavior in a path analysis, we also find that the more morally oriented Environment Factor is a significant determinant of general attitude but not directly of intention whereas the Resources Factor (which may be regarded a representation of a mixture between general, moral waste considerations and personal monetary considerations) is a determinant of both and the Self-Interest Factor as clear representation of personal consequences is only a significant direct determinant of intention but not of general attitude. One area of research for which comparable results exist is the consumption of meat where Berndsen and van der Pijlt (2004) found that a general attitude towards meat consumption was determined by moral and affective beliefs but not by health beliefs and that in a stepwise regression general attitude as well as health beliefs independently had a direct impact on current meat consumption, whereas moral and affective beliefs did not have a direct impact.

Our results may add to discussions on belief-based multidimensional perspectives on attitudes, decomposed attitudes and on ambivalence in attitudes (Ajzen 2005; Olsen 1999). For the specific behavior of having food leftovers in a university canteen, it appears that a general measurement of attitude did not cover all of the belief dimensions that individuals indicated to relate to this behavior. Instead, general attitude measurements for food leftovers appear to strongly represent beliefs about general morally relevant consequences of behavior while excluding personal and more hedonic consequences. Accordingly, we cannot support an attitude structure where common (cognitive)

attitude statements compose of the sum of (potentially conflicting) belief statements. Relating this finding to other research stating ambivalence to attenuate attitude-intention or attitude-behavior consistency by effects such as lower certainty about attitudes or neutrality (Conner et al. 2002; Olsen 1999) it appears that the existence of conflicting beliefs as potential cause of ambivalent attitudes in our study did not result in less consistent or less certain general attitude statements but that the general measurement of attitude simply ignored one relevant aspect of behavior-related beliefs. This finally lead to weaker attitude-intention relationships especially when situational factors interacted with the relative importance of different belief dimensions: Whereas general attitude was a significant determinant of behavioral intention in a setting where portion sizes supported tendencies to not have food leftovers anyways, an increasing relevance of the Self-Interest Factor for participants who perceived large portion sizes that supported tendencies to have food leftovers was not represented in general attitude measures and therefore led to the attenuation of the relationship between attitude and behavioral intention.

Although our results indicate differences in the relevance of specific belief dimensions based on situational factors, the conducted analyses do not enable us to distinguish whether these differences relate to individuals' adaptation of relevancies within personally ambivalent attitudes based on portion size perceptions or whether those individuals in our sample who perceived portion sizes as (too) large generally put more emphasis on beliefs related to the self-interest. Accordingly, subsequent research should qualify our results with regards to individual-based measures of conflict or ambivalence in beliefs about the consequences of having plate leftovers. In reference to extensive research stating substantial effects from ambivalence on attitude-behavior relationships, such considerations may provide additional insights in the behavioral effects found in our study. Finally, our analyses should be extended for settings different from a university canteen and for consumers different from a student sample in order to see whether decomposing attitudes provides additional insights in consumer behavior at a more general level.



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**Table 1. Structure Matrix and Cronbach's Alpha for EFA on Belief Statements (N=307)**

If I don't clear my plate in the university canteen...	Component		
	Factor 1: Environment	Factor 2: Self-Interest	Factor 3: Resources
...this causes environmental pollution.	<b>.854</b>		.281
...this has a negative impact on climate change.	<b>.724</b>		.115
...food is wasted.	<b>.685</b>	-.171	.546
...this does not represent an environmental issue since food is biodegradable (R).	<b>.672</b>	-.326	
...I start thinking of many people in the world who do not have enough to eat.	<b>.567</b>		.502
...it's not that serious since food is low-priced (R).	<b>.468</b>	-.230	.146
...this is better for my shape.	-.173	<b>.826</b>	
...this is better for my health.		<b>.815</b>	
...I will feel less tired after lunch.	-.125	<b>.720</b>	
...I'm feeling less stuffed.		<b>.667</b>	
...I'm wasting money.			<b>.816</b>
...this creates avoidable waste.	.547		<b>.642</b>
<b>Cronbach's Alpha</b>	<b>.770</b>	<b>.754</b>	<b>.407</b>

Note: Only factor loadings greater than .1 are listed. R=reversed coded.

**Table 2. Component Matrices and Cronbach's Alpha for EFA on Attitude and Behavioral Intention**

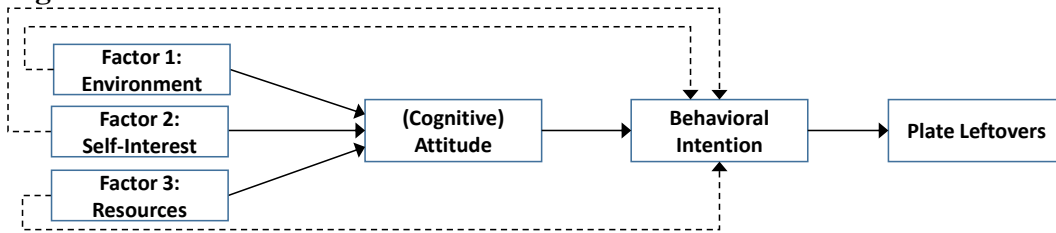
Component Matrix Attitude towards Plate Leftovers		Component Matrix Intention to Prevent Plate Leftovers	
Attitude: reasonable...unreasonable	.888	Intention: I generally will try not to leave any food on my plate.	.856
Attitude: acceptable...unacceptable	.850	Intention: I will do my best to empty my plate.	.792
Attitude: good...bad	.793	Intention: It's very likely that I will empty my plate completely.	.737
<b>Cronbach's Alpha</b>	<b>.792</b>	<b>Cronbach's Alpha:</b>	<b>.711</b>

**Table 3. Correlation between Measured Constructs**

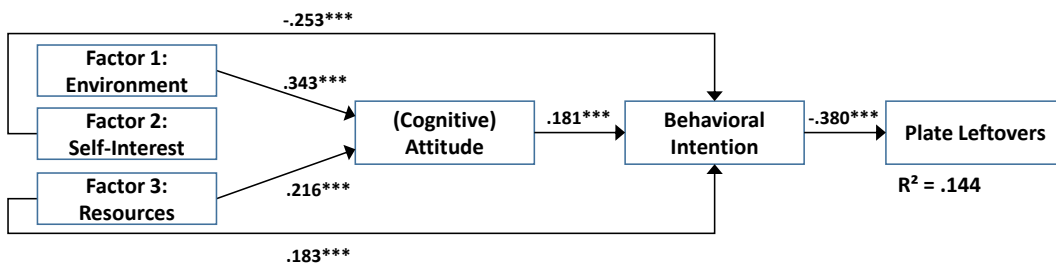
Correlation Coefficients (Spearman-Rho)						
	Factor 1: Environment	Factor 2: Self-Interest	Factor 3: Resources	(Cognitive) Attitude	Behavioral Intention	Plate Leftovers
Factor 1: Environment	1.000					
Factor 2: Self-Interest	-.149***	1.000				
Factor 3: Resources	.213***	-.007	1.000			
(Cognitive) Attitude	<b>.407***</b>	<b>-.115**</b>	<b>.302***</b>	1.000		
Behavioral Intention	<b>.246***</b>	<b>-.234***</b>	<b>.255***</b>	<b>.275***</b>	1.000	
Plate Leftovers	-.017	.123**	-.051	-.056	<b>-.282***</b>	1.000

significance level:  $\alpha \leq$  \*.10 | \*\*.05 | \*\*\*.01

**Figure 1. Path Model**



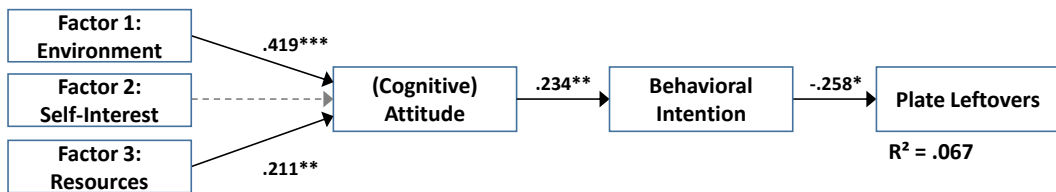
**Figure 2. General Standardized Estimates for the Path Model (N=307)**



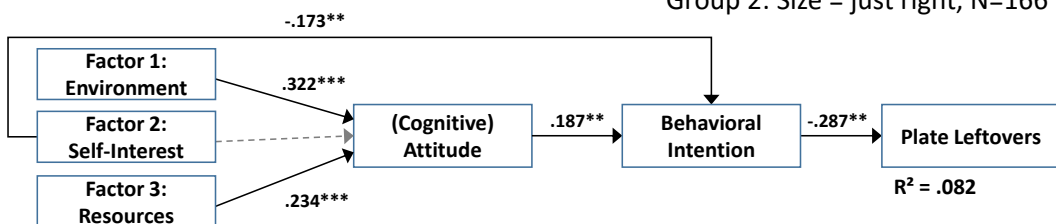
significance level:  $\alpha \leq$  \*.10 | \*\*.05 | \*\*\*.01

**Figure 3. Standardized Estimates for a Grouped Path Model**

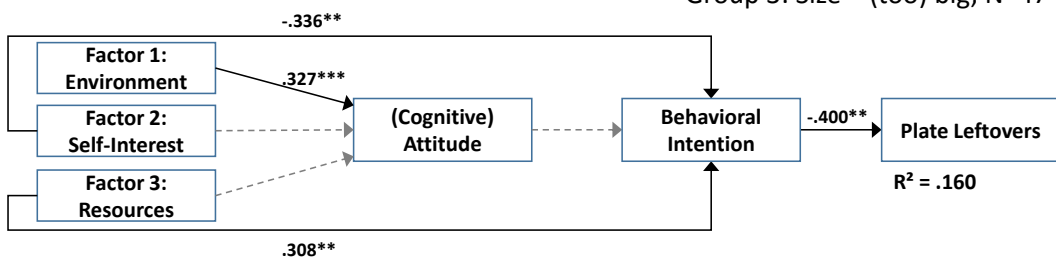
Group 1: Size = (too) small, N=93



Group 2: Size = just right, N=166



Group 3: Size = (too) big, N=47



significance level:  $\alpha \leq$  \*.10 | \*\*.05 | \*\*\*.01