Moving beyond gender differences in research on sustainable consumption

Evidence from a discrete choice experiment

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MOVING BEYOND GENDER DIFFERENCES IN RESEARCH ON SUSTAINABLE CONSUMPTION: EVIDENCE FROM A DISCRETE CHOICE EXPERIMENT

Abstract

Few empirical studies take gender into account when analyzing sustainable consumption and consumer behavior and those studies are not without shortcomings. Our paper introduces a new way of conceptualizing and researching gender and consumer behavior by investigating the results of discrete choice experiments with Swiss consumers. Analyzing stated preference data on decisions about buying washing machines, we move beyond analyzing gender as merely individual differences. Reviewing literature from gender and technology studies we suggest to broaden the perspective and taking gender relations and gender scripts into account. Our results show that while there were no gender differences in general preferences, the analysis of gender relations and gender scripts lead to significant findings. Furthermore, technological and ecological attributes together with price and brand provided distinctive patterns of decision making. In line with the literature on gender scripts thereby enabled us to differentiate a feminine and a masculine mindset. Differences between women as defined by gender relations showed as even more relevant. Women practicing what can be called a traditionally masculine way of life opted for the

masculine mindset while mothers and unemployed women opted for the feminine mindset. Overall, our findings show the relevance of gender relations and gender scripts for the analysis of gender effects in consumer behavior. Our results contribute to an understanding of gender in sustainable energy consumption and point the way for moving beyond the analysis of gender as individual differences and simple "body counting".

1 Introduction

Numerous environmental problems have threatened our environment over the last decades, including global warming, ozone depletion or water and air pollution, just to name a few. Given that overconsumption is one main cause of all these problems, a change in consumption patterns accompanied by the development of 'cleaner' and more efficient technologies will be necessary (Oskamp, 2000). However, while technical innovations have been successful in reducing the energy consumption of most products, the rising energy consumption of households has outweighed these gains and therefore forms a challenging problem (Brohmann et al., 2008). The European Environmental Agency report on 'Household consumption and the Environment' identifies the areas of food, housing, and personal travel/mobility, as well as tourism, as having the highest negative environmental impacts. The issues at stake are consumer behavior and buying decisions in private households, especially with regards to green energy consumption.

Focusing on green energy consumption and buying decisions, gender is entering the picture along several strands. Firstly, from a historical perspective, consumption has been associated with women and the private sphere while production is associated with men and the public (Cowan, 1987; Game & Pringle, 1979; Grazia & Furlough, 1996). Indeed, it is women who are responsible for 80% of the consumption decision in households (Barletta, 2003; Griffin, 2006; Kelan, 2008; Pettigrew, 2000) and represent the largest group of consumers shopping for the daily needs of their families.

Secondly, early ecofeminist writers elaborated on the claim that women, due to their 'female nature', their domestic and reproductive capacities, or their socialization, are more caring towards the environment (Merchant, 1995; Mies & Shiva, 1992; Shiva, 2002). Women are depicted as nurturing and peaceable (Mitscherlich, 1987), and nature is regarded as the 'feminine principle' (Shiva, 2002); meanwhile men are seen as powerful and destructive and engineering and technology as masculine fields and professions. Ecofeminism thereby provides a strong argument for gender differences in environmentally-friendly attitudes. Blocker and Eckberg (1989) even claimed that ecological issues were becoming women's issues.

Thirdly, we have ample evidence for gender differences in the behavioral patterns in the areas of food and mobility. For instance, women are not only mainly responsible for purchasing, planning and preparing the food consumed in private households (Statistisches Bundesamt, 2003; Vinz, 2005), they are also "more oriented towards the

healthiness and calorie content of food (…). Studies also show that men eat meat more often and in great quantities than women." (Vinz, 2009, p. 170). Also with regards to mobility gender differences are striking (Carlsson-Kanyama, Linden & Thelander, 1999). While men in Germany own 72% of the cars, women rather walk, use bicycles or public transport (compare Vinz, 2009, p. 166). Similarly in the rather gender equal society of Sweden. It is the group of men with high incomes that travel longer for their jobs and drive more powerful and hence energy demanding cars (Carlsson-Kanyama et al., 1999). Due to different responsibilities of women and men for reproductive and care work, women's mobility patterns also differ significantly from men's (Carlsson-Kanyama et al., 1999; Spitzner, 1999). While the often male breadwinner leaves the home in the morning and returns in the evening, primary caregivers are rather characterized by many short trips from and to the home (Vinz, 2009, p. 166-167). However, with regards to green energy consumption in private households, only few studies are taking gender into account.

Taken together, there are several reasons why an analysis of gender issues in green consumption behavior would be highly relevant (Grover, Hemmati & Flenley, 1999; Vinz, 2009; Weller, 2004). This paper addresses these significant shortcomings by investigating results of discrete choice experiments with Swiss consumers. We are looking at the long-term sustainable consumption decisions people make when

acquiring washing machines. The paper contributes to an understanding of the role gender plays in sustainable energy consumption

We argue in this paper that gender has not only been under analyzed, but dealt with in a very limited way. Reviewing the literature on gender differences in attitudes and behavior towards the environment in general and gender and energy consumption in private households, we discuss major shortcomings. Introducing the perspectives of gender relations and gender scripts we elaborate on moving beyond an approach of analyzing gender as merely individual differences. Operationalizing these concepts in our empirical analysis we take into account gender relations, the gendered division of labor and gender scripts leading to a gendered perception of technology. Our results show that gender relations and gender scripts are particularly important for the analysis of gender issues in sustainable consumption.

2 Ecological Issues as Women's Issues? Research on Gender And Sustainable Consumption

In this literature review we are looking at two kinds of literature bodies relevant to the roles gender plays in sustainable energy consumption in private households. The first group of studies looks at gender-specific attitudes and behavior towards the environment in general and the second group at energy consumption behavior in private households. While research on gender and environmental attitudes mainly supports the gender differences claimed in early feminist writings, it does not do so as

thoroughly for behavior. Gender differences seem to matter in some cases, but not in others.

2.1 Environmental attitudes and behavior in general

Research on gender and environmental attitudes assumes differences in attitudes with regards to the motives of caring for nature and showing concern for environmental issues. Research on environmental and technological risk perception shows a very robust gender difference: Women, compared to men, tend to be more anxious about technological and environmental hazards (Davidson & Freudenburg, 1996). This is not as clear cut for environmental attitudes and behavior in general. Here research in the 1980s found only meager and inconsistent relationships (Torgler, Valiñas & Macintyre, 2008; Zelezny, Poh-Pheng & Aldrich, 2000).

However, studies conducted since the late 1980s show a clearer picture concerning the gender-environmentalism relationship. One reason for that change might be that earlier studies more often relied on single items while later studies were conducted using the New Environmental Paradigm scale (NEP). Zelezny et al. (2000) conclude in their meta-review of 13 NEP-studies that women expressed significantly higher levels of environmental concern compared to men. However, the effect of gender on pro-environmental behavior was found to be small (between r=0.07 and r= 0.10) and three studies could not find gender differences in either environmental attitudes or behavior.

One study even reported reverse findings: men showed greater environmental concern (Zelezny et al., 2000: 444).

A recent study by Torgler et al. (2008) investigates several differences in preferences towards the protection of the environment. They used a large micro data set involving information from 33 Western and Eastern European countries. They used seven demographic categories as independent variables and looked, for instance, for differences explained by age, gender or parenthood. While parenthood did not turn out to be a significant variable, the results with regard to gender indicate "*that women have both a stronger preference towards the environment and a stronger willingness to contribute"* (Torgler et al., 2008, p. 26). Devries (1997) and Preisendörfer (1999) report similar findings. In both studies women expressed greater ecological awareness compared to men. Empacher et al. (2000) looked for gender differences with regards to motives and orientations underlying the consumption behavior. They found that while women more often refer to health and the environment, the orientations expressed by men were more often related to convenience (Empacher et al., 2000). Overall, although few studies could not find any differences, the research on gender and attitudes towards the environment does point in one direction: women show stronger pro-environmental attitudes than men.

Mitani and Flores (2008) explored gender effects in real and hypothetical payments. Their results are in line with previous studies on actual and stated behavior (Brown &

Taylor, 2000; Cadsby & Maynes, 1998). Although gender influences hypothetical payments, it has no effect on real payments. They suggest that women are more likely than men to express their values through hypothetical payments. This experimental evidence indicates that there might be no direct link between environmental attitudes and ecological behavior. Although women and men have clear gender differences in attitudes, this might not be the case in behavior.

2.2 Gender and energy consumption

Despite the increasing interest in consumer behavior with regard to energy consumption, little research has been conducted on gender effects. Most recent studies on energy consumption did not even analyze gender effects (cf. Baker, 1989; Banfi, Farsi, Filippini & Jakob, 2007; Jakob, 2007; Manzan & Zerom, 2006; Rehdanz, 2007; Schlomann, 2004). There are two exceptions: secondary data analyses from Germany based on the biannual surveys on environmental awareness and behavior of German citizens by the German ministry for environment (BMU) and the Federal Environment Agency (UBA). Preisendörfer (1999) re-analyzed the 1996 and 1998 surveys (Preisendörfer, 1996, 1998) and Empacher et al. (2001) re-analyzed the survey from 2000 (Kuckartz, 2000).

Preisendörfer (1999) analyzed gender differences in ecological awareness, attitudes and behavior. In particular he looked at attitudes and behavior in the areas of consumption, waste, energy and traffic. He found gender differences in all areas, both

in attitudes and behavior. Women did show higher ecological awareness and also more environmentally sound behavior. In contradiction to other studies, his findings show larger differences in behavior than in attitudes. Also, while men's attitudes and behavior more often diverged, women's behavior was more consistent with their attitudes. This is especially the case with regards to traffic behavior. However, this is not the case when looking at energy consumption behavior. He found no gender differences with regard to several ecologically sound practices: the use of energy-saving lamps, turning off lights when leaving a room, using water-saving equipment, reducing overnight heating levels, and aeration in wintertime. Only when it comes to showering he did find a difference between women and men: 52% of female participants turned off the water while soaping their skin and hair, but only 46% of the male participants (Preisendörfer, 1999, p. 139).

Empacher et al. (2001) found similar results with regards to energy- and water-saving measures. They also showed that men are more likely to reject green electricity than women: 45% of the male participants, compared to 41.5% of females, said they would not buy green electricity (Empacher et al., 2001: 38). However, when looking at the willingness to pay higher prices for energy-efficient appliances they could not find any gender differences. With the exception of Preisendörfer's (1999) study these results mainly support what others have found in experimental settings: little difference in attitudes, almost no difference in behavior (cf. Brown & Taylor, 2000; Cadsby & Maynes, 1998; Mitani & Flores, 2008).

2.3 Summary and discussion of major findings and shortcomings

Overall, we can state that researcher on gender as individual differences in attitudes and behavior have found differences in attitudes towards the environment, but not equivalently in behavior.

However, interpreting these results we have to take into account that studies are not only scarce, but also not without shortcomings. First of all much of the empirical research trying to identify gender differences with regard to the environment has relied on measuring (general) attitudes, whereas it would actually be more relevant to measure attitudes that are specific to environmental behavior. In order to further explore the link between general environmental attitudes, behavior and possible gender differences, more research on behavior and attitudes closely linked to behavior is necessary. Second, the research on gender and energy consumption has so far looked at everyday consumption but ignored the relevance of gender differences for equipment acquisition. However, given the importance acquisition decisions have on the structural possibilities for sustainability (Heiskanen & Pantzar, 1997), knowledge on gender differences would contribute substantially to a better understanding of sustainable consumption. Third, as we will elaborate now in greater detail, operationalizing gender as individual differences is a rather limited and problematic approach (Eagly, 1995; Wajcman, 1996).

With our in-depth analysis of data from discrete choice experiments on purchases of washing machines, we are dealing with these three weaknesses in previous research.[1] We are looking at a) the stated preferences for one specific product type and therefore at attitudes (more) directly related to environmental behavior, b) the attitudes and behavior of consumers in the context of equipment acquisition rather than everyday consumption, and c) conceptualize gender on multiple levels of individual differences, gender relations and gender scripts. However, as gender and technology studies have a long history of conceptualizing gender beyond individual differences (Cockburn, 1985; Faulkner, 2001; Henwood, Parkhill & Pidgeon, 2008; Wajcman, 1991), we will shortly introduce this line of research and its operationalization of gender in our study in greater detail.

2.4 Moving beyond gender differences: The relevance of gender relations and gender scripts

Drawing on findings from gender and technology studies, we must broaden our scope when analyzing gender in sustainable consumption. Gender is problematic when reduced to individual differences due to biology or socialization without taking gender

[1] Another major shortcoming not further discussed in this paper but also applying to the study presented is the principal focus on individual decision making. In contrast, many consumer decisions are in fact taken by a combination of households and their suppliers, which often involves an interaction of male and female decision-makers. Therefore, rather than understanding individual attitudes and decisions, it would be more appropriate in these cases to investigate gender effects in the decision process (see Heiskanen & Pantzar, 1997; Shove, 2003).

relations into account. Indeed, Weller, Hayn and Schultz (2001) mention the importance of differences within the groups of men and women. In some cases, being male or female only has explanatory value for consumption patterns when combined with other socio-demographic variables. Among those are migration background, parenthood, single parenthood, or marital status. Preisendörfer (1999) found that the group of mothers and fathers with children under age of six showed higher levels of environmental concern than other groups. He also found that single parents (mostly women) aim at a level of environmentally conscious consumption behavior which they often cannot afford due to lack of financial resources. However, Torgler, Valinas and McIntire (2008) did not find any differences with regards to parenthood. Furthermore, within the group of single persons, women were found to be more ecologically aware than men (Empacher et al., 2000; Weller et al., 2001). These results indicate that gender may interact with other variables such as parenthood or lifestyle.

2.4.1 Gender Relations

Taking the example of Switzerland, biographies and everyday life for women and men still differ immensely although the differences in education at the primary level have vanished and are decreasing at the secondary and tertiary levels. According to the WEF Global Gender Gap Report (Hausmann, Tyson & Zahidi, 2007), the female-to-male ratio in labor force participation is 0.86 but the ratio for wage equality for similar work is only 0.68. Only 27% of legislators, senior officials and managers are female.

In parliament, only 25% of the representatives are women and among ministerial positions the ratio is even lower: 14%. While breadwinning and politics are still male-dominated fields, caring, children and household remain a female domain (BFS, 2008). In fact, 57% of the working women in Switzerland are working part time compared to only 12% of the working men. It is usually mothers who stay at home taking care of the children and the household (Nentwich, 2008). Of women living with a heterosexual partner in a household with children, eight out of ten are exclusively responsible for household chores (BFS, 2008, p. 16).

Any review that takes gender relations in Switzerland into account reveals major differences in women's and men's lifestyles, everyday life practices and biographies. For instance, comparing a male breadwinner to a career woman without children might show more similarities than comparing him to a mother working part time. This illustrates that biographies and lifestyles have diversified more for women than for men. The same is true for differences between generations. Although gender relations have been changing over generations, this is mainly true for women. Younger generations of women are not only better educated, but also less willing to give up their jobs when they become mothers (BFS, 2008). This is not equally true for men. Although an increasing number of fathers reduce their workloads and engage in child rearing, the so-called 'new fathers' are a fairly new phenomenon.

With regards to energy consumption, we have evidence for the relevance of parental status and knowledge about technology. For instance, Schahn and Holzer (1990) found that both knowledge and gender moderated the relationship between attitudes and self-reported behavior. In both samples, women showed greater environmental concern in areas related to household behavior whereas men scored higher in terms of knowledge about environmental problems. Preisendörfer comments that while women show higher emotional concerns for environmental issues, they score lower in terms of knowledge about the environment. However, Bang et al. (2000, pp. 449-450) put these findings into perspective stating that in general, consumers' environmental concerns and beliefs *"about renewable energy to date are more emotionally charged than fact- or knowledge-based."*

2.4.2 Gender scripts

The gendered division of labor also strongly influences the masculinities and femininities stereotypically associated with a certain technology (Cockburn, 1985; Wajcman, 1991). As most household technologies for cleaning and cooking are more commonly used by women and girls they are associated with femininity and not so much with technology (Schwartz Cowan, 1999), *"whilst those used in the non-routine tasks of home maintenance and gardening, plus the more 'high tech' music systems, are commonly used by men"* (Faulkner, 2001, p. 83) and associated with masculinity and 'real' technology. The non-association of femininity with technology and the

association of masculinity with technology is a typical pattern. For instance, in her illuminating study on shavers, Ellen van Oost (2003) showed how gender is inscribed in the design of shavers. The 'Philishave' device, intended for men, is characterized by its technical features, while the 'Ladyshave' design renders shaving an issue of cosmetics. Both assumptions - that masculinity is close to technology and that femininity is as distanced from it - are inscribed in the shaver as a technological artifact through the process of either emphasizing or downplaying its technological aspects. In a similar vein, Cockburn and Ormrod (1993) showed how the gendered division of labor produced the gendered scripts for buying a microwave oven. While men in the sample mainly showed an interest in the technical details, the women were mostly interested in its cooking benefits (Cockburn & Ormrod, 1993, p. 69ff.). (Gender-) scripts can also lead to the exclusion of certain user groups, *"if, for example, the designers' image of users represents only a selective set of competences, interests, attitudes, and values"* (Rommes, Oost & Oudshoorn, 1999, p.).

Overall, these findings do suggest that the gender inscribed to the technology can have different consequences for the women and men buying the device. Buying a lawnmower or a washing machine, a microwave or a solar panel should make a big difference in terms of how gender is made relevant in this specific context. Therefore, any effort to analyze gender in sustainable consumption must take into account how the consumed object respectively aspects of the objects are gendered in the first place

and how this interacts with the gender of the user or consumer and. With regard to the study presented in this paper, we have to assume that due to gender relations in Switzerland, washing machines are mainly operated by women and therefore are gendered as feminine. Therefore, women should have more experience and knowledge about the daily use of the technology and will use this information when buying a machine. Hence, they should rather focus on energy and water consumption than on price. However, as technology in general is gendered masculine, men should focus more on technological features and, without detailed knowledge on everyday use, estimate the initial price for acquisition as important criteria.

2.4.3 Hypotheses

Based on the literature review we identified the following central hypotheses which seem to be of theoretical as well as practical relevance when analyzing the stated preferences for the purchase of washing machines. We are analyzing gender as individual differences, gender relations and gender scripts. Our analysis is based on a data set collected at the point-of-sale through a survey including choice experiments. The choice experiments were conducted by surveying customers who were actually in the process of making a purchase decision for a washing machine (Sammer & Wüstenhagen, 2006). With this approach it is possible to measure not only abstract attitudes, but real preferences and decision intentions of consumers. Arnberger &

Haider (2007) emphasize this advantage of discrete choice modeling of going beyond preference elicitation and clearly extracting a behavioral intention. Therefore, buy presenting respondents with realistic choices in a format similar to one that they may actually encounter in their real lives, discrete choice analysis boasts high validity and ability to successfully predict individual behavior (Louviere & Timmermans, 1992).

1) With regards to **gender differences**, we can summarize that women should show higher environmental concerns compared to men. However, our literature review also shows that there are no differences to be expected in behavior. As we assume that the methodology of assessing stated preferences is closer to actual behavior than the traditional measurement of an attitude questionnaire, we hypothesize to find no gender differences in choice sets.

Hypotheses 1: Environmental attributes have no stronger influence on women's than on men's actual preferences

2) Considering **gender relations** in Switzerland, we have to take into account gendered everyday practices of men and women. According to the gendered division of labor, we assume that parenthood and employment status will account for significant differences. However, testing the hypotheses we have been limited by the possibilities of the data set which has not specifically been collected for an analysis of

gender relations. Mirroring the general situation in Switzerland, there are only 4% men working part time in our sample and the seven unemployed men were rather senior citizens than active fathers. Analyzing gender relations, we therefore focused on the relevant subgroups in the sample of women.

Hypotheses 2a: Mothers will judge environmental-related attributes as more important than women without children.

Hypotheses 2b: Employed women will judge environmental-related attributes as less important than women not being in paid work

3) Taking the literature on **gender scripts** into account, we have to assume that the gender inscribed to the specific technology is playing a major role for consumer behavior. As gender is inscribed in a binary way, we should find differences between the relevance of attributes associated with technology and attributes associated with ecology.

Hypotheses 3a: Technology and ecology account for differences in clusters of attributes.

Furthermore, we hypothesize that attributes of the washing machine highlighting the machine's technological character will be preferred by men and, according to gender

relations, also women with a masculine way of life. Accordingly, attributes of the washing machine related to ecology such as saving water and energy will be preferred by persons with a feminine way of life.

Hypotheses 3b: Technology related attributes of the washing machine will be preferred by persons with a masculine way of life (men, women without children and women with paid employment).

Hypotheses 3c: Ecological related attributes of the washing machine will be preferred by persons with a feminine way of life (mothers and women without paid employment).

3 Consumer Preferences For Washing Machines: An In-depth Aanalysis With Discrete Choice Experiments

To investigate gender issues in consumer preferences on washing machines we use discrete choice experiments (DCE). DCE can be used to analyze consumers' responses by measuring the degree of preference for a defined set of (product) alternatives and for the characteristics describing them. In each choice task consumers are asked to choose one product from a small number of product alternatives. Purchase decisions usually require tradeoffs between different product characteristics; when asked about individual attributes by market researchers, consumers can often circumvent the

evaluation and weighting of competing product features. DCE, however, forces consumers to choose one product; they must decide which characteristics are the most important and they have to make tradeoffs between different levels of product attributes. This method allows to indirectly determine preferences in quasi-realistic purchasing situations where the decision-making criteria are presented not separately but simultaneously (Orme, 2006; Lilien, Rangaswamy & De Bruyn, 2007; Huber, 2005).

Discrete choice models are based on random utility theory. It is assumed that each respondent faces a choice among J alternatives in each of T choice situations and chooses the alternative with the highest utility (Huber and Train, 2000). If there is heterogeneity among individuals, hierarchical Bayes (HB) can significantly improve the analysis of preferences in comparison to traditional aggregate models. With multinomial logit analysis (MNL), as it was applied for the first analysis of the current dataset on washing machines (Sammer & Wüstenhagen, 2006), it is not possible to examine the importance of modeling heterogeneous preferences. Within a Bayesian framework, the distribution of coefficients (part-worths) across the population is estimated and combined with the information on individuals' choices to derive posterior or conditional estimates of the individual´s values (see Allenby and Rossi, 2003; Train and Huber, 2000 for a more detailed discussion of hierarchical modeling).

The average part-worths are based on the individual part-worths estimated with the hierarchical Bayes method. Basically, part-worths measure the contribution of attribute levels to the overall utility of a product. For the computation of part-worths we do not estimate continuous but dummy variables in order to determine consumer preferences for each attribute level. We use effect coding; a method where the sum of part-worth values equals zero, in contrast to the traditional estimation and presentation with dummy variables where one attribute level is set to zero. A negative part-worth value for a certain attribute level does not indicate that this attribute level is unattractive, but it shows that it is less preferred than a level with a higher part-worths value. Part-worths for each attribute levels are displayed in Table 4.

A market simulator can be used to convert individual part-worths from HB estimation into simulated market choices and to compute shares of preferences for competing products alternatives. Market simulation models are used to analyze consumer choices for a defined set of products and their specific product features. Share of preference can be defined as the percentage of respondents that would prefer one of the specified products. For our analysis, we applied a randomized first choice simulation method to estimate share of preference. A ‘‘maximum utility rule’’ is assumed, which predicts that respondents would choose the option with the highest composite utility. Randomized first choice simulations estimate then the choices of each participant, adding random error to the utility values at each of 100,000 iterations and averaging

those predictions across iterations and respondents. See Huber and Miller (1999) and Orme (2006) for more detailed discussions of the computation of randomized first choice simulations.

This study is based on results of a survey of potential buyers of washing machines and utilized an existing data set collected through a survey of 151 respondents in Switzerland. Aspects of the data collection process are described in detail by Sammer and Wüstenhagen (2006). Demographic characteristics of the study sample are presented in Table 1.

Table 1: Description of the sample

Characteristics	Total		Women		Men	
	Number	Percent	Number	Percent	Number	Percent
Total	151		95	62,91	56	37,09
Under 45 years	90	59,60	55	36,42	35	23,18
Over 45 years	61	40,40	40	26,49	21	13,91
With children	41	27,15	25	16,56	16	10,60
Without children	110	72,85	70	46,36	40	26,49
Unemployed	45	29,80	38	25,17	7	4,64
Employed outside the home	106	70,20	57	37,75	49	32,45

All respondents received a series of 11 choice tasks involving comparisons of different washing machines with varying levels of attributes. Each choice task presented three different washing machines. Respondents had to choose their preferred alternative; if they did not like any of the three washing machines they could choose the option 'I wouldn't buy'. The attributes and the attribute levels that were presented in the choice tasks are listed in Table 2; a typical choice task is displayed in Table 3.

Table 2: Attributes and attribute levels in the choice tasks

Attribute	Attribute Levels			
Brand	AEG	VZUG	Miele	Iberna
Equipment version	Simple	Middle	De luxe	
Water consumption	39 l / wash cycle	47 l / wash cycle	58 l / wash cycle	
Energy consumption	0.85 kWh	1.00 kWh	1.3 kWh	
Energy efficiency rating	A	B	C	
Price	980 CHF	1890 CHF	2650 CHF	3780 CHF

Table 3: Sample choice task (translated from the original in German, see Sammer and Wüstenhagen 2006, p. 199)

If you bought a washing machine today, which product would you choose (assuming a 5 kg wash load capacity)?		
AEG	V-Zug	Miele
Equipment version: simple*	Equipment version: middle*	Equipment version: middle*
Water consumption: 39 l/wash cycle	Water consumption: 39 l/wash cycle	Water consumption: 58 l/wash cycle
Electricity consumption: 0.85 kW h/wash cycle	Electricity consumption: 1.3 kW h/wash cycle	Electricity consumption: 1.3 kW h/wash cycle
Energy efficiency rating C	Energy efficiency rating A	Energy efficiency rating B
1890 CHF 	3780 CHF 	CHF 2650 CHF 
* Equipment Version: • Simple: spin speed up to 1000 rpm, basic wash programs • Middle: spin speed up to 1400 rpm, basic wash programs, energy saving programs,		

’easy iron’ program, hand wash program for wool, quick wash program • Luxus: spin speed up to 1600 rpm, basic wash programmes, energy saving programmes, ’easy iron’ program, hand wash program for wool, quick wash program, pre-wash program
Which of these three models would you buy? Please tick a box! 1 ☐ 2 ☐ 3 ☐ None of them ☐

4. Results

In this section we present the estimated part-worths for different segments of the sample and conduct hypothetical market simulations in order to test our hypotheses. We explore the differences in utility values between subgroups. Consistent with theories of utility maximization, the preferred washing machine (i.e., the one with the greatest overall utility), across most subgroups, was the one that had the attribute levels with the highest utility value within each attribute (Miele, equipment version de luxe, 39 l / wash cycle, 0.85 kWh/wash cycle, energy efficiency rating A, 980 CHF). Interestingly, women show an inferior preference for the lowest price level than for the next higher price level. Here we can only assume that they perceive higher prices as a

signal for the high-quality of the product, similar to other signals, such as the brand name. Another interesting result is that women under 45 with children and women without paid employment prefer a medium equipment version over the "de luxe" version. This result can be ascribed to the fact that women in these two subgroups are more cost sensitive due to significantly lower income per capita. This can explain why they do rather not choose products that are labeled luxurious.

Table 4: Part-worths estimates for different subsamples (hierarchical Bayes models with all normally distributed part-worth)

Part Hierarchical Beyses models						
Attribute Level	**Women**	**Men**	**Women under 45 with children**	**Women under 45 without children**	**Unemployed women**	**Women employed outside the home**
N	**95**	**56**	**22**	**33**	**38**	**57**
Brand						
AEG	**-0.18** (1.25)	**-0.14** (1.26)	**-0.29** (1.22)	**-0.30** (1.26)	**-0.17** (1.22)	**-0.19** (1.27)
VZUG	**0.52** (1.44)	**0.41** (1.48)	**0.70** (1.45)	**0.66** (1.47)	**0.36** (1.42)	**0.62** (1.44)
Miele	**1.20** (1.34)	**0.98** (1.35)	**1.13** (1.34)	**1.16** (1.39)	**1.50** (1.32)	**1.00** (1.36)
Iberna	**-1.53** (1.34)	**-1.25** (1.35)	**-1.55** (1.36)	**-1.52** (1.37)	**-1.68** (1.30)	**-1.44** (1.36)
max.-min. (asd)	***2.73** (1.34)*	***2.23** (1.36)*	***2.68** (1.35)*	***2.68** (1.37)*	***3.18** (1.32)*	***2.43** (1.36)*

Equipment version						
Simple	**-1.28** (1.49)	**-1.55** (1.50)	**-1.34** (1.44)	**-1.71** (1.59)	**-1.25** (1.42)	**-1.30** (1.53)
Mittle	**0.61** (1.18)	**0.69** (1.19)	**0.70** (1.16)	**0.73** (1.21)	**0.72** (1.17)	**0.53** (1.20)
De-luxe	**0.67** (1.38)	**0.86** (1.39)	**0.65** (1.35)	**0.98** (1.42)	**0.53** (1.34)	**0.77** (1.40)
max.-min. (asd)	***1.95** (1.35)*	***2.41** (1.36)*	***2.04** (1.32)*	***2.69** (1.41)*	***1.97** (1.31)*	***2.07** (1.38)*
Water consumption						
39L	**0.56** (1.15)	**0.50** (1.15)	**0.61** (1.15)	**0.63** (1.18)	**0.55** (1.11)	**0.57** (1.17)
47L	**-0.01** (0.96)	**-0.05** (0.95)	**0.04** (0.96)	**-0.11** (0.99)	**-0.01** (0.93)	**-0.01** (0.98)
58 Liter	**-0.55** (1.08)	**-0.44** (1.11)	**-0.65** (1.07)	**-0.52** (1.11)	**-0.54** (1.04)	**-0.56** (1.11)
max.-min. (asd)	***1.11** (1.06)*	***0.94** (1.07)*	***1.26** (1.06)*	***1.15** (1.09)*	***1.09** (1.03)*	***1.13** (1.09)*
Energy consumption						
0.85 kWh	**0.27** (1.05)	**0.29** (1.05)	**0.36** (1.06)	**0.24** (1.05)	**0.48** (1.03)	**0.13** (1.07)
1.00 kWh	**-0.06** (0.95)	**-0.14** (0.97)	**-0.03** (0.96)	**-0.07** (0.95)	**-0.11** (0.94)	**-0.03** (0.96)
1.3 kWh	**-0.20** (1.04)	**-0.14** (1.03)	**-0.33** (1.04)	**-0.17** (1.07)	**-0.36** (1.03)	**-0.10** (1.05)
max.-min. (asd)	***0.47** (1.01)*	***0.43** (1.02)*	***0.68** (1.02)*	***0.40** (1.02)*	***0.84** (1.00)*	***0.23** (1.02)*
Energy efficiency rating						
Energy rating A	**1.08** (1.20)	**1.06** (1.20)	**1.10** (1.18)	**0.92** (1.24)	**1.16** (1.16)	**1.02** (1.23)
Energy rating B	**0.09** (0.99)	**0.29** (1.03)	**-0.02** (0.97)	**0.22** (1.01)	**0.04** (0.95)	**0.13** (1.01)
Energy rating C	**-1.17** (1.24)	**-1.35** (1.25)	**-1.08** (1.21)	**-1.14** (1.30)	**-1.20** (1.20)	**-1.15** (1.27)
max.-min. (asd)	***2.25** (1.14)*	***2.41** (1.16)*	***2.18** (1.12)*	***2.06** (1.18)*	***2.36** (1.10)*	***2.18** (1.17)*

Price						
980 CHF	**2.93** (2.45)	**4.18** (2.50)	**2.43** (2.33)	**3.50** (2.59)	**2.95** (2.39)	**2.92** (2.49)
1890 CHF	**3.07** (1.74)	**2.69** (1.80)	**3.03** (1.73)	**3.05** (1.77)	**2.46** (1.70)	**3.48** (1.77)
2650 CHF	**-0.92** (1.46)	**-1.45** (1.51)	**-0.75** (1.42)	**-1.36** (1.54)	**-0.86** (1.44)	**-0.96** (1.48)
3780 CHF	**-5.09** (2.34)	**-5.42** (2.43)	**-4.71** (2.31)	**-5.19** (2.42)	**-4.55** (2.25)	**-5.45** (2.39)
max.-min. (asd)	***8.16*** *(2.00)*	***9.60*** *(2.06)*	***7.74*** *(1.95)*	***8.69*** *(2.08)*	***7.50*** *(1.95)*	***8.93*** *(2.03)*
NONE	**-2.64** (4.13)	**-1.51** (4.01)	**-2.78** (4.05)	**-1.31** (4.23)	**-1.81** (3.80)	**-3.19** (4.35)

Note: Average part-worths can only be compared within one attribute. Average part-worths are bolded and average standard deviations (asd) are shown in parentheses.

In general, the range from the minimal to the maximal part-worth value within attributes is a measure of the attribute's relative importance on choice decisions (Orme, 2007). The higher the standard deviation of a part-worth in comparison to the difference between minimal and maximum part-worth, the higher the variance of consumer preferences for the lowest and highest attribute level within this attribute. By analyzing part-worths we are able to identify tendencies (e.g. men accord a higher importance to the equipment version than women and women under 45 without children are more price sensitive than mothers under 45). However, we cannot test whether differences among subgroups are significant because it is not possible to compare part-worths between choice models of non-unique subgroups. To determine

whether differences between two segments are significant or not, we conduct market simulations using individual-level part-worth estimates to calculate share of preferences.

To test for a significant difference between a product's share of preference for two unique segments, we computed a t-statistic. The preference share of respondent group 2 (e.g. men) is subtracted from the preference share of respondent group 1 (e.g. women). The difference then is divided by the square root of the sum of the squares of the standard errors of both shares.

$$t = \frac{Share_1 - Share_2}{\sqrt{(SE_1^2 + SE_2^2)}}$$

The subscripts 1 and 2 refer to the respondent groups 1 and 2, and SE refers to the standard error of the shares. A t-value of the absolute magnitude greater than 1.96 indicates a significant difference at the 95% confidence level.

4.1 Gender differences (H1)

Looking at the path-worths we did find only small differences between women and men. For example, the brand “Iberna”, a high water consumption of “58 l/wash cycle” and a high energy consumption of “1.3 kw h/wash cycle” are more strongly disliked

by women than by men; meanwhile the high part-worths for the attribute levels “de luxe equipment version” and a low price of 980 CHF indicate that men are particularly responsive to that levels.

In order to test hypothesis 1 assuming that female and male consumers judge environmental related attributes as similar important ,we conducted a hypothetical market simulation with an environmentally sound washing machine (low water and energy consumption, and the highest energy efficiency rating) and a washing machine with high water and energy consumption and a lower energy efficiency rating. The levels of the remaining attributes were held constant at moderate/intermediate levels. Overall shares of preferences for these two washing machines - presented in table 5 - are about the same: 74% of women and 73% men preferred the environmentally sound washing machine. Therefore, hypothesis 1 can be confirmed. We tested for significant differences between shares of preferences of unique respondent groups and computed t-statistics. The t-statistic for differences between men and women amounts to 0.23 indicating that shares are definitely not significantly different from each other.

Table 5: Shares of preferences for environmentally sound washing machine: Men versus women

Attribute	Environmentally sound	Non-environmentally sound

	washing machine		washing machine	
Brand	AEG		AEG	
Equipment version	Middle		Middle	
Water consumption	39 l / wash cycle		58 l / wash cyle	
Energy consumption	0.85 kWh		1.3 KWh	
Energy efficiency rating	A		B	
Price	2650 CHF		2650 CHF	
Subgroup:	Share (%)	SE (%)	Share (%)	SE (%)
Women (n=95)	74%	3.44%	26%	3.44%
Men (n=56)	73%	4.58%	27%	4.58%

Note: Assuming that there are only these two products available, the share of preference (percentage) represents the number of respondents who prefer or chose a certain washing machine.

4.2 Gender relations (H2)

As we have argued earlier, looking only for gender differences fails to acknowledge the complexity of gender relations. We therefore took a closer look at different subgroups of women: mothers under 45 and unemployed women compared to women under 45 without children and women in paid employment.

Table 6: Shares of preferences for environmentally sound washing machine: Women in different living circumstances

Attribute	Environmentally sound washing machine		Non-environmentally sound washing machine	
Brand	AEG		AEG	
Equipment version	Middle		Middle	
Water consumption	39 l / wash cycle		58 l / wash cyle	
Energy consumption	0.85 kWh		1.3 kWh	
Energy efficiency rating	A		B	
Price	2650 CHF		2650 CHF	
Subgroups:	Share (%)	SE (%)	Share (%)	SE (%)
Women under 45 with children(n=22)	78%	5.89%	22%	5.89%
Unemployed women (n=38)	79%	4.54%	21%	4.54%
Women under 45 without children (n=33)	71%	6.04%	29%	6.04%
Women in paid employment (n=57)	73%	5.17%	27%	5.17%

Indeed, motherhood and paid employment seemed to influence preferences. While we did also find general differences between mothers and non-mothers in general, the

results were even more explicit when looking at women younger than 45. Here we assume that mothers under 45 are living in the same household with their children. The fact of living with children proved more important than the biological fact of motherhood. Mothers under 45 are more likely to choose an environmentally sound washing machine (preference share of 78%) than women under 45 without children (preference share of 71%). About 73% of women without paid employment would choose the environmentally sound product in comparison to 79% of women without paid employment. As the sample size is very small the t-statistics of the differences between preferences shares of the four segments are not significant (0.85 for mothers under 45 and women under 45 without children, and 1.08 for employed women compared to women without paid employment). Therefore, hypothesis H2a and H2b cannot be confirmed. However, it can be expected that by quadrupling the sample size (which cuts the standard error in half) the differences in preferences shares among the subgroups would become significant. An economical explanation for the difference between employed and non employed women could be that women without employment are more cost sensitive than women with paid employment due to tighter budget constraints. We can also state with some accuracy that mothers pay more attention to environmental aspects of washing machines. Possible explanations could be that mothers are more engaged in sustainability because they want to save the planet for the future of their children. Or, mothers simply do more laundry and are therefore more sensitive to the costs and environmental impacts.

4.3 Brand-oriented ecological versus price-oriented technological mindsets (H3)

Testing hypothesis three we looked for differences in the relevance of ecological attributes (low energy and water consumption, highest energy efficiency rating) and technological attributes (equipment). While we did not find significant differences analyzing the hypothesized importances, the results of the part-worths show a pattern that could be called a "price-oriented technological" and a "brand-oriented ecological" mindset (see table 7). While the latter mindset assigns greater importance to brand, low energy and water consumption and the highest energy efficiency rating (A), the former mindset prioritizes stronger distinctive features of the machine such as the equipment version and price. Ecological and technological related attributes are highly relevant when combined with brand and price. Therefore, hypotheses 3a can be confirmed.

Furthermore, the mindsets are significantly connected to gender relations. Those persons with a typical masculine way of life (men, women without responsibilities for children and women with paid employment) opted for the price-oriented technological mindset while the brand-oriented ecological mindset is applied by persons with a typical feminine way of life (mothers and women without paid employment). We assume that in the analyzed sample, gender differences are more relevant in terms of

gender relations – the amount of care and paid work practiced – than individual gender differences.

Table 7: Brand-oriented ecological versus price sensitive technological mindset

Feminine **brand-oriented ecological mindset**	**Masculine** **price-sensitive technological mindset**
brand energy consumption water consumption energy efficiency label	price equipment
women	men
young mothers Women without paid employment	young women without children Women employed outside the home

In order to test our findings, we conducted a hypothetical market simulation scenario with two competing washing machines which were designed according to the preferred attributes of the brand-oriented ecological and price-sensitive technological mindsets. The "branded ecological laundry helper" was a Miele washing machine featuring simple equipment layout, the lowest possible energy and water consumption (0.85 kw h/39l per wash cycle) and the highest energy efficiency rating (A). Naturally, a popular brand implies a high price (2650 CHF). Machine number two, the "bargain

gadget-o-mat" featured the lowest-valued brand (Iberna), the highest energy and water consumption levels (1.3 kw h/58l per wash cycle), a low energy efficiency rating (B) and a low price (980 CHF). Almost all features of this washing machine correspond to the lowest-valued attribute levels, except of a de-luxe equipment layout. As washing machines with an energy efficiency rating C had a very small market share in 2004, the bargain gadget-o-mat carries the energy efficiency rating B.

Overall, women in our sample were more likely to choose the "branded ecological laundry helper" (51% versus 33% for men). Comparing segments of women according to motherhood and paid employment, the results pointed in the same direction and were even more distinctive. 51% of all women, 61% of mothers under 45 and 63% of unemployed women favored the washing machine from Miele, a high value brand, with low water and energy consumption, a basic equipment version, and a significantly higher price. We can conclude that women living as mothers or without paid employment do prefer the brand-oriented ecological mindset which is in line with a gender script associating feminine characteristics.

Table 8: Product specifications and share of preferences

Attribute	Ecological branded laundry helper	bargain gadget-o-mat

Brand	Miele		Iberna	
Equipment version	Simple		De luxe	
Water consumption	39 l / wash cycle		58 l / wash cyle	
Energy consumption	0.85 kwH		1.3 kwH	
Energy efficiency rating	A		B	
Price	2650 CHF		980 CHF	
Share of Preference:				
Unemployed women (n=38)	63%	7.22%	37%	7.22%
Women under 45 with children(n=22)	61%	9.44%	39%	9.44%
Women (n=95)	51%	4.71%	49%	4.71%
Women employed outside the home (n=57)	42%	5.97%	58%	5.97%
Women under 45 without children (n=33)	32%	7.55%	68%	7.55%
Men (n=56)	33%	5.80%	67%	5.80%

Note: Assuming that there are only these two products available, the share of preference (percentage) represents the number of respondents who prefer or chose a certain washing machine.

In contrast, men were more likely to choose the "bargain gadget-o-mat" (67% versus 49% for women). This in line with the gender script highlighting technological aspects and associated with masculinity. We found similar results for employed women and women under 45 without children. All t-statistics for the differences between shares of preferences of unique respondent groups have an absolute magnitude greater than 1.96 indicating a significant difference at the 95% confidence interval.

These findings indicate that women without children, employed women and men prefer the price-sensitive technological mindset (H3b), while mothers, unemployed women and women in general opted for the ecologically sound and branded version (H3c). We can therefore confirm our hypothesis saying that parenthood and employment of women have a significant influence on preferences (H3b and c) for features of household appliances that are in line with gender scripts (H3a).

5 Discussion

Looking at the long-term sustainable consumption decisions people make when acquiring washing machines, this paper contributed to an understanding of the role gender plays in sustainable energy consumption. We argued that gender in sustainable consumption literature has so far not only been under analyzed, but dealt with in a

very limited way. Reviewing the literature on gender differences in attitudes and behavior towards the environment in general and gender and energy consumption in private households, we discussed major shortcomings. Studies have so far focused on everyday consumption, the relevance of attitudes and gender as a variable. Our analysis of discrete choice experiments on purchases of washing machines dealt with these three weaknesses in previous research.

Focusing on the acquisition decision when buying washing machines and using stated preference methodology, we focused on the long-term effects of sustainable consumption and measuring attitudes that are more contextualized in the concrete alternatives of the decision making process and therefore closer to behavior. Introducing the perspectives of gender relations and gender scripts we elaborate on moving beyond an approach of analyzing gender as merely individual differences. According to insights from gender and technology studies we operationalized gender not only as individual differences but also as gender relations and gender scripts. Investigating the relevance of ecological and technological attributes on mindsets and the variables of motherhood and employment status in the subsample of women we can show the importance of gender relations and gendered division of labor practiced in Switzerland for understanding sustainable consumption.

Overall, the results point in one direction: segmenting according to gender relations in society and the household is more successful in explaining gender issues than a one-dimensional gender variable. Operationalizing gender as gender relations and gender scripts has allowed for a more sophisticated explanation of gender differences in the preferences for energy and water conservation. Our analysis has shown that differences within the group of women are more important than the differences between the groups. Hence, the gendered practices of everyday life seem to be the relevant variables when analyzing gender differences. However, for giving valid statements about possible gender effects in the purchasing decisions that determine resource consumption with an environmental impact, we have to consider structural effects resulting from a gendered division of labour and the gendering of technology and ecology. Future studies should include variables capturing the involvement in paid labour and unpaid care work as well as.

Furthermore, the two mindsets clearly differentiated not only between women and men, but also between women with a more masculine and a more feminine way of life. Although women and men are rather similar when looking at the overall consumption patterns, these differences in mindsets point to significant differences on a symbolic level that interrelate with the particular way of life. However, further research is needed on the subgroup of men comparing fathers and men working part-time and househusbands to the equivalent subsamples of women. As washing machines are

clearly connected to feminine chores in the household, it would be interesting to see if gender is made relevant in a different way when individuals are deciding on buying a car, a computer, or air conditioning equipment. Investigating the relevance of the femininity or masculinity of the technology for gender differences in consumer behavior would be an important step for further research.

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