

## **Roles or Values? Gender Differences in Opposition to Nuclear Power**

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### **Abstract**

*Research on the relationship between gender and attitudes toward nuclear power has consistently revealed that women are more skeptical toward nuclear power than men. Studies of how gendered experiences shape attitudes toward nuclear power focus on two types of explanations. The first emphasizes differences in social roles associated with men and women, with specific reference to gender differences in childrearing responsibilities. The second kind of explanation focuses on gender differences in values acquired through socialization. Drawing on data from the Eurobarometer 72.2, this study utilizes measures of both gender roles and gender values to predict women's opposition to nuclear power. It finds that women with more traditional gender values are more likely to oppose nuclear power, but only when they do not care for dependent children. Women living with children are more likely to oppose nuclear power than women who do not live with children, and more likely to oppose nuclear power than men living with children. For women who live with children, gender values have no significant effect on opposition to nuclear power.*

**Key Words:** gender; nuclear power; risk perception; gender roles; social values; European Union

### **1. Introduction**

Research on the relationship between gender and attitudes toward nuclear power has consistently revealed that women are more skeptical toward nuclear power than men (Mobley and Kilbourne, 2013; Keller et al., 2012; Whitfield et al., 2009; Davidson & Freudenburg, 1996; Stern et al., 1993). Studies of how gendered experiences shape attitudes toward nuclear power focus on two types of explanations. The first emphasizes differences in social roles associated with men and women. Because women are primarily responsible for childbearing and childrearing, the argument goes, they are more likely than men to consider the negative consequences out of concern for the well-being of children and family (e.g., Greenbaum, 1995). Furthermore, because women are disproportionately responsible for reproduction (Sandelowski, 1993), they are also concerned for the consequences that technologies will have for their own reproductive bodies (e.g., Napolitano & Ogunseitan, 1999). I will refer to this as the “safety hazards” hypothesis. The second kind of explanation focuses on gender differences in values acquired through socialization. According to this explanation, from childhood women are taught that science and technology are not compatible with femininity, steered away from it, and consequently are less enthusiastic about it than men are (e.g., Visschers & Siegrist 2012; Tenenbaum & Leaper, 2003). I will refer to this as the “feminine values” hypothesis.

While both of these explanations are compelling, and are supported by empirical evidence, there has been little attempt to disentangle the separate effects of roles and values. In many cases these concepts are conflated under the rubric of “gender socialization” (e.g., Mobley & Kilbourne, 2012; Zelazny et al., 2000; Davidson & Freudenburg, 1996) and it is unclear which kind of explanation the researcher is drawing upon. No doubt women accept roles because they are socialized to, and those roles imply particular perspectives on social issues due to their responsibilities. However, social roles and social values are theoretically distinct concepts that may co-vary but are not coextensive. Roles refer to the responsibilities inherent in interactions between different positions in a social structure (Stryker, 1968, 1980), while values are psychological orderings of socially relevant phenomena (Messick & McClintock, 1968). To what extent do gender roles and gender values work independently, and together to produce attitudes toward nuclear power? In this paper I will attempt to disentangle the separate effects of gender roles and gender values, and will also explore how they work together to shape women's evaluations of nuclear power.

Drawing on the Eurobarometer 72.2, I utilize separate measures of gender values (measured as views on the appropriateness of women's participation in the labor market) and gender roles (whether or not respondents are actively responsible for caring for a child) to predict attitudes toward nuclear power for both men and women.

## **2. Review of Literature**

### **2.1. Gender and Nuclear Power**

Women are consistently found to be more skeptical about the benefits of nuclear power than men are (Mobley and Kilbourne, 2013; Keller et al., 2012; Whitfield et al., 2009; Davidson & Freudenburg, 1996; Stern et al., 1993). There are two explanations typically offered for the gender gap in support for nuclear power. The "feminine values" hypothesis holds differences in values to be responsible, and the "safety hazards" hypothesis focuses on the differing social roles associated with men and women.

Many scholars argue that because women are socialized to hold more benign attitudes toward environmental issues (Mobley & Kilbourne, 2012; Bryant & Pini, 2006; Zelezny et al., 2000), this predisposes them to be more concerned about the risks of nuclear power than men are. That is, there is supposed to be a particular set of "feminine values" which make women especially skeptical of technologies that have the potential to disrupt the balance of nature and to harm living things (Zelezny et al., 2000), both human and nonhuman. Because as children girls are socialized to be emotional, caring, and attentive to the connections between living things, while boys are socialized to be aggressive and competitive (Thorne, 1993; Fagot et al., 2000), as adults women are more likely than men to evaluate environmental issues such as nuclear power based on their effects on other living things. This explanation has been refined by ecofeminists (e.g., Merchant, 1990; Malory, 2006; Bryant & Pini, 2006), who have drawn connections between the domination of nature inherent in science and technology, and the domination of women by men. While women are socialized to identify with "nature," men are socialized to identify with "culture", including technological progress (Jackson, 1993). The ecofeminist position is that femininity is inherently more environmentally friendly because it values nature over technology, while masculinity favors the domination of nature by technology (Salleh, 1984). One review of environmental attitudes pointed to women's particularly strong embrace of altruism as the basis for gender differences in environmentalism (Dietz, et al. 2005).

Quantitative studies of attitudes toward nuclear power have largely supported the "gender values" hypothesis. In a study of college students' attitudes toward nuclear power, Stern et al. (1993) concluded that the gender difference could be explained, in part, by differential concern for nonhuman aspects of the environment. In a structural equation model of support for nuclear power, Whitfield et al. (2009) found that the gender difference in support for nuclear power could be explained by gender differences in values, which were correlated with the perceived risk of nuclear power.

The second explanation for gender differences in attitudes toward nuclear power emphasizes gender differences in social roles. Women's reproductive responsibilities and familial roles are supposed to incline them to be more conscious of the risks of nuclear power out of a greater concern for the safety of children (Greenbaum, 1995). Because women are disproportionately responsible for childbearing (Sandelowski, 1993) and childrearing (Hochschild, 1989), they are more likely than men to be attuned to the risks that nuclear power poses to those roles. This "safety hazards" hypothesis posits that women's skepticism toward nuclear power is not a consequence of an alternative set of values, but of a vested interest in nuclear risks because of their roles as mothers. As Dorothy Nelkin has remarked, women are more likely to distrust nuclear power because of "the special effects radiation has on the health of women and on future generations" (1981: 15).

Several empirical studies have drawn upon the "safety hazards" hypothesis as an explanation of gender differences in support for nuclear power. Using two Harris surveys, Brody (1984) found that women's greater concern for the safety of nuclear power explained the gender difference in attitudes, which he attributed to "the reproductive and nurturant [*sic*] roles of women" (p. 211). Freudenberg and Davidson (2007) explored the interaction of economic, parental, and gender roles on attitudes about a proposed nuclear waste site for an existing nuclear plant in Nebraska. They found that the biggest differences in concern between those who lived near the proposed nuclear waste site and those who lived at a distance from it was among employed mothers: 90% of mothers living near the site expressed high levels of concern while 90% of mothers living at a distance from the site expressed low levels of concern.

While not studying nuclear power specifically, in three separate case studies Hamilton (1985a, 1985b) found that concern about the environmental impacts of toxic waste was especially high for women with dependent children living at home. This “motherhood mentality” (McCright, 2010: 71) is hypothesized to render women more likely than men to oppose nuclear power because of their roles as mothers and nurturers.

## 2.2. Roles and Values

One recurring theme throughout the literature on gender and nuclear power is a failure to clearly differentiate between roles and values. The explanation for gender differences in attitudes often vacillates between gender differences in values and social roles within the same report, incorporating them together under “gender socialization” with little attempt to theoretically or empirically differentiate the two (e.g., Mobley & Kilbourne 2012; Zelazny et al. 2000; Davidson & Freudenburg, 1996). However, roles and values *are* theoretically and empirically distinct phenomena, and it is unclear from the literature on gender and nuclear power the degree to which each influences attitudes independently of the other.

Social roles involve *interactions* between people in different locations in a social structure (Merton, 1968; Stryker 1968, 1980; Burke, 2003). Each position in a social structure carries *responsibilities* for acting, and individuals who successfully enact their roles are entitled to rewards (Biddle, 1979). In the case of gender, social roles mean that men and women are expected to engage in different kinds of activities, and have mutual though differing responsibilities to each other (Eagly et al., 2000). The masculine role is economic (Aryee & Luc, 1996; Lamb, 1995; Maurer et al., 2001; Pleck, 1976), as men are expected to, and feel responsible for providing material resources for their families (Murphy, 2002). The feminine role is domestic, with responsibilities for caring and nurturing both husband and children (Weitzman et al., 1972; Kroska, 1999; Leatherby, 1994; for a discussion of both male and female roles within the context of family see Coontz, 2006).

Whereas roles refer to standards of behavior in interactions, values are *psychological* orderings of socially relevant phenomena (Messick & McClintock, 1968; Rokeach, 1973). Values refer to “conceptions of the desirable” (Schwartz & Bilsky, 1987), in which people rank-order characteristics of the social world that they consider to be preferable. However, values are not just psychological states, but have been demonstrated to influence behavior (Parks, 1994). People pursue courses of action, in part, because of the value systems that they hold. With reference to gender, much research has demonstrated a gender difference in value systems, differentiating between the “*agentic* orientation, typical of men, which emphasizes instrumental self-protection, self-assertion, isolation, and repression of emotion, and the *communal* orientation, typical of women, which emphasizes connection with others, cooperation, openness, and nurturing” (Lyons et al. 2005: 766, emphasis in original).

Of course, men and women are socialized to hold values that are consistent with their social roles (Correll, 2001, 2004; Jacobs et al., 2002), and so gender values and roles are correlated. But they are not coterminous. Research has shown that women who reject traditional gender roles still strongly identify with elements of femininity, such as nurturing and romantic relationships with men (Zwerman, 1992). Alternatively, a woman may take primary responsibility for caring for children because she and the father assume that it is her role to do so, even if the woman is neglectful, abusive, or otherwise self-centered (i.e., does not espouse traditional “feminine values”).

The “feminine values” and “safety hazards” hypotheses draw upon separate causal mechanisms. The former states that women have unique *belief systems* that are incompatible with technologies that are potentially disastrous to the environment such as nuclear power, independent of whatever social roles they may occupy; the latter that women are more likely to oppose nuclear power because of their unique *responsibilities* as mothers and caretakers, independent of whatever personal values they may have. The “feminine values” hypothesis draws upon a *psychological* explanation, emphasizing how women *think* about the world. The “safety hazards” hypothesis draws upon a *sociological* explanation (specifically, role theory), emphasizing the responsibilities that women have *to others*. If two women have identical value systems, but one cares for children and the other does not, will they differ in their attitudes toward nuclear power? If two women each care for children, but have significantly different value systems, will these women differ in their attitudes toward nuclear power? To date, the literature on gender and nuclear power does not address such questions.

### 3. Hypotheses

To begin to address the problem of disentangling gender roles and values in support for nuclear power, several hypotheses may be advanced. If traditional gender values predispose women to reject nuclear power, then we would expect traditional gender values to be significantly correlated with opposition to nuclear power for women, and we would expect that correlation to be positive.

**H1:** There will be a statistically significant and *positive* correlation between traditional gender values and opposition to nuclear power for women.

However, traditional gender values are supposed to predispose only women to opposition to nuclear power and *not* men. The especial altruistic and communitarian dispositions associated with traditional feminine values that are supposed to render women more likely to be in opposition to nuclear power should not appear in men with traditional gender values.

**H2:** There will *not* be a statistically significant correlation between traditional gender values and opposition to nuclear power for men.

The “safety hazards” hypothesis states that it is women’s role as mothers and caregivers that predisposes them to reject nuclear power. Previous research has suggested that mothers are among the most concerned about nuclear power (Hamilton, 1985a, 1985b, Freudenberg and Davidson, 2007). Therefore we would expect that living with children should be an important predictor of opposition for women.

**H3:** There will be a statistically significant and *positive* correlation between living with dependent children and opposition to nuclear power for women.

But because gender roles relieve men of much of the duty of caring for children, we would also expect that living with children would have little effect on men’s positions on nuclear power, especially since the male role of economic provider should predispose men to focus more on the economic benefits of nuclear power and less on the risks to human health.

**H4:** There will *not* be a statistically significant correlation between living with dependent children and opposition to nuclear power for men.

Moreover, if gender values and roles are really separate causal mechanisms, and if the “feminine values” and “safety hazards” hypotheses are *both* correct, then Hypotheses 1 and 3 should hold independently of each other. That is, for women, the effect of traditional gender values on opposition to nuclear power should be positive and significant while controlling parenthood status, and the effect of caring for dependent children on opposition to nuclear power should also be positive and significant when gender values are held constant.

**H5a:** For women, the effect of traditional gender values on opposition to nuclear power will be positive and significant when parenthood status is held constant.

**H5b:** For women, the effect of caring for dependent children on opposition to nuclear power will be positive and significant when gender values are held constant.

One final consideration is the extent to which gender values and roles work together to shape women’s attitudes toward nuclear power. It may be the case that, because social roles call for the activation of a particular set of values, the effect of gender values will be amplified in instances in which women are responsible for children. In such a scenario women are placed in a situation in which they are responsible for caring for children, and therefore the gender values associated with such a role would become more salient, and hence more strongly correlated with opposition to nuclear power than for women without dependent children. I will refer to this as the “values amplification hypothesis”.

**H6a:** There will be a statistically significant and *positive* interaction effect between traditional gender values and caring for dependent children predicting opposition to nuclear power for women.

While Hypothesis 6a is plausible, because the current literature on gender and nuclear power does not address the separate effects of values and roles, there is no precedent to follow in making predictions about a values-roles interaction.

An alternative hypothesis might predict that, instead of the effect of values being amplified when women are responsible for children, it may instead be suppressed. It may be that concern for the immediate safety of children is enough to make women skeptical about nuclear power, and that variation in value systems does not further affect the impetus to opposition for women living with children. In such a scenario, the responsibilities inherent in caring for children are enough to make women oppose nuclear power. The role responsibilities may “trump” the effects of the value system when women occupy a feminine role, and so women with children would be opposed to nuclear power, and the separate effect of their value systems will be suppressed. I will refer to this as the “values suppression hypothesis”.

**H6b:** There will be a statistically significant and *negative* interaction effect between traditional gender values and caring for dependent children predicting opposition to nuclear power for women.

#### 4. Data and Methods

##### 4.1 Sample

The Eurobarometer 72.2 is a suitable dataset to test these hypotheses because it features items on support for nuclear power, traditional gender values, and whether or not respondents are living with dependent children. This Eurobarometer survey is a representative sample of 26,663 respondents from twenty-seven European Union nations.<sup>1</sup> Data were collected between the 11th of September and the 5th of October 2009 by TNS Opinion and Social on behalf of the European Commission from household members 15 years of age and older. It utilized a probabilistic, stratified sample design in which each nation was stratified first by region, then municipality. In each country, a number of sampling points were drawn with probability proportional to population size and to population density. Finally, households were chosen within each municipality. The survey was administered at the homes of the respondents (Eurobarometer 72.2 2009:66).

##### 4.2 Dependent Variable

The purpose of this study is to investigate gender differences in attitudes toward nuclear power. The Eurobarometer 72.2 features a question in which respondents were asked whether they think the risks of nuclear power outweigh the benefits, or the benefits outweigh the risks. All respondents who indicated that the risks outweigh the benefits were coded as 1, while all of the respondents who indicated that the benefits outweigh the risks were coded as 0. This dependent variable is therefore a measure of *opposition* to nuclear power. All respondents who answered “don’t know” or “neither” were coded as missing.

##### 4.3 Independent Variables

The independent variables of primary theoretical interest are gender, traditional gender values, and whether or not the respondent is living with a child. All respondents of the Eurobarometer 72.2 indicated that they were either male or female. The sample was split by gender (see the “Analytic Strategy” sub-section below) and so males and females were not assigned specific coding. The survey also asked a marital status question that required respondents to indicate whether or not they are living with a child (i.e., “living with the child of this marriage”, “living with the child of a previous marriage”, “married but not living with children”, etc.). All respondents living with children were coded as 1, while respondents not living with children were coded as 0.

The variable measuring gender values was derived from a set of two questions asking respondents about the appropriateness of gender inequality in labor force participation. These items capture the extent to which respondents value the traditional domestic-economic division of labor between men and women. It is important to note that whether or not respondents actually occupied these roles is a separate question; these items capture what respondents *value* in terms of gender. It is acknowledged that these variables do not directly capture altruism or communitarianism, the key values that the “feminine values” hypothesis says explain women’s greater opposition to nuclear power. Considering research that suggests that traditional gender values tend to hang together (Frable 1989, 1997), the gender values variables used here can be considered a reasonable proxy for gender values in general.

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<sup>1</sup> These nations are: Belgium, Bulgaria, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, United Kingdom, Austria, Sweden, Finland, Republic of Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, and Romania (Eurobarometer 72.2 2009:67).

As Ashomre notes, gender values are “the structured set of gendered personal identities that results when the individual takes the social construction of gender and the biological ‘facts’ of sex and incorporates them into an overall self-concept” (1990: 512). Because gender identity is an “overall self-concept” that incorporates a collection of gendered norms and values, it seems justifiable to assume that women who believe that women’s place is in the home would have other traditionally female values such as altruism and communitarianism, though a direct measure of these values would be preferable.

The items measuring gender values are: “it is normal that women work less than men”, and “the number of working women in our country is too low”, with response options being “totally agree”, “tend to agree”, “tend to disagree”, and “totally disagree”. These items were combined into a single latent variable via factor analysis. Each item loaded onto a single latent variable with factor loadings of .713 for each item. Higher scores on this variable indicate more traditional gender values, while lower scores indicate more liberal gender values.

Several control variables were also utilized. One was marital status. This is a particularly important control variable because marital status is highly correlated with whether or not one lives with children. If there is a correlation between gender values or living with children and opposition to nuclear power, perhaps it is really reflecting the effect of being married and not necessarily of living with children. All respondents who are married were coded as 1, and respondents who are not married were coded as 0.

Financial strain is one alternative explanation of a child care-nuclear opposition correlation. That is, the effect of living with a child on attitudes toward nuclear power may be explained by the increased financial burden associated with caring for children. Because the Eurobarometer is a survey of more than two-dozen countries, with varying currencies, income distributions, and degrees of inequality and poverty, a standard income measure in which respondents indicate the amount of money they make was not considered to be appropriate. Instead, financial strain was operationalized by making use of a question in which respondents were asked how often they have difficulty paying bills; respondents who said they have difficulty paying bills “most of the time” were coded as 1; all other respondents were coded as 0.

Because knowledge of nuclear power, having a nuclear power plant in one’s country, and the extent of direct contact with a nuclear power plant have all been shown to affect attitudes toward nuclear power (European Commission, 2007), these “knowledge and experience” variables were also controlled for. The knowledge variable was constructed by calculating the percentage of correct answers each respondent scored out of four possible questions on nuclear power. For example, if a respondent answered three out of four questions correctly, they would be coded .75 for the knowledge variable. The variable representing the extent of contact with nuclear power is a latent variable constructed by a factor analysis of a series of questions concerning respondents’ experience with nuclear power (“visited a nuclear power plant”, “lived within 50 kilometers of a nuclear power plant”, and “worked on nuclear energy issues or have known somebody working on them”). All three items loaded on a single component, with factor loadings of .723, .668, and .740, respectively. Higher scores on this latent variable represent *greater distance* from nuclear power, while lower scores represent *lesser distance*.

The Eurobarometer 72.2 does not feature a variable that indicates whether a respondent lives in a nation with a nuclear power plant. To create a variable which indicates whether or not a respondent lives in a nation with a nuclear power plant, a list of all European Union nations which have a nuclear power plant was located (WNA, 2011a). All respondents who live in a nation with a nuclear power plant were coded as 1, and all other respondents were coded as 0.

The demographic controls include age, education, and occupation. The age variable is simply the numeric age of the respondent without any recoding. The Eurobarometer’s education measure captures the age in which a respondent quit school. This variable was recoded into a series of dichotomous variables: the respondent quit school between the ages of 0 to 14 (“Edu. 0-14”), the respondent quit school between the ages of 15 to 18 (“Edu. 15-18”), the respondent quit school between the ages of 19 to 21 (“Edu. 19-21”), the respondent quit school at the age of 22 or older (“Edu. 22+”), and the respondent is still studying (“still studying”). The Eurobarometer’s occupation variable features a set of eighteen fairly detailed response categories. The occupation variable was recoded into separate dichotomous variables representing manual and non-manual occupation categories, along with a dichotomous variable representing unemployment.

#### 4.4 Analytic Sample

The Eurobarometer 72.2 features a total of 26,663 respondents. All respondents who were missing on any of the variables were omitted from the analysis. This left 19,390 respondents (10,194 females, and 9,196 males). A weight was also applied to the data to compensate for the stratified sampling design. The weight used was “Weight Euro 27”, which accounts for all 27 countries represented in the sample.

#### 4.5 Analytic Strategy

The goal of the analysis is to test the extent to which gender values and gender roles can predict women’s support for nuclear power. Because the hypotheses require comparing males and females, and females with children to females without children, the sample was first split by gender. The female sample was then split into women with children and without. The dependent variable is dichotomous (support or oppose nuclear power), and so logistic regression was used to test the hypotheses. Separate logistic regression models were run, first for males and females, then separately for females with and without children. Odds ratios are reported in the regression tables.

### 5. Results

Table 1 shows means and standard deviations for analytic variables by gender. Females are both more likely to oppose nuclear power than men are, and are also more likely to be living with children than their male counterparts. Women are also less knowledgeable about nuclear power, and have more distance from it than men.

Table 1. Means and standard deviations for analytic variables by gender

Variable	Minimum	Maximum	Females		Males	
			Mean	Std Dev	Mean	Std Dev
Nuclear Power: Risks Outweigh Benefits	.00	1.00	.66	.47	.53	.50
Traditional Values (factor score)	-2.30	2.18	.04	.99	-.01	.95
Living with children	.00	1.00	.42	.49	.35	.48
Knowledge	.00	1.00	.48	.29	.56	.28
Distance (factor score)	-4.49	.44	.09	.86	-.17	1.19
Nuclear Plant in Country	.00	1.00	.69	.46	.69	.46
Married	.00	1.00	.51	.50	.54	.40
Edu. 0-14	.00	1.00	.17	.37	.14	.35
Edu. 15-18	.00	1.00	.41	.49	.40	.49
Edu. 19-21	.00	1.00	.18	.39	.17	.38
Edu. 22+	.00	1.00	.16	.36	.19	.39
Still Studying	.00	1.00	.09	.28	.10	.30
Occ. Non-manual	.00	1.00	.34	.47	.42	.49
Occ. Manual	.00	1.00	.32	.47	.25	.43
Occ. Unemployed	.00	1.00	.34	.47	.33	.47
Difficulty Paying Bills	.00	1.00	.09	.29	.08	.27

N = 10,194 (females)

N = 9,196 (males)

Table 2 shows results for a series of logistic regressions predicting opposition to nuclear power. Models 1-5 show results for the female sample, and models 6-10 show results for the male sample. H1 predicted that traditional gender values would be significantly correlated with opposition to nuclear power for women, and that the correlation would be positive. Model 1 confirms this hypothesis: each incremental increase in traditional gender values increases the odds of being opposed to nuclear power by nearly 6 percent. H2 predicted that gender values would not be significantly correlated with opposition to nuclear power for men. Model 6 confirms H2: having more traditional gender values decreases the odds of opposing nuclear power for men, but the effect is so slight that it is not significantly different from 0. H3 predicted that living with children would be significantly correlated with opposition to nuclear power for women, and that the correlation would be positive. Model 2 confirms H3: the odds of opposing nuclear power are nearly 22% greater for women living with children compared to women not living with children. H4 predicted that living with children would not significantly affect the odds of opposing nuclear power for men, and model 7 confirms this hypothesis.

H5a predicted that, for women, the effect of traditional gender values on opposition to nuclear power would be positive and significant when parenthood status is held constant. Moreover, H5b predicted that the effect of caring for dependent children on opposition to nuclear power will be positive and significant for women, even when gender values are held constant. Model 3 confirms both H5a and H5b: when both gender values and parenthood status are included in the same model, both significantly predict opposition to nuclear power independently. Model 4 adds the knowledge and experience, and demographic controls to the female model. Controlling for all of these variables, the odds of women opposing nuclear power increase by about 8% with each incremental increase in traditional gender values, and by about 16% when women are caring for children. It is important to note that the gender values and living with children coefficients are not significant in any of the male models.

Table 2. Logistic regressions predicting opposition to nuclear power for females and males separately

	Females					Males				
	Model 1	2	3	4	5	6	7	8	9	10
<i>Gender Roles and Values</i>										
Traditional Values (factor score)	1.057**		1.048*	1.079**	1.130***	.972		.971	.991	.975
Living with children		1.217***	1.208***	1.164**	1.169**		1.004	.961	1.040	1.039
Values x Children					.894*					1.044
<i>Knowledge and Experience</i>										
Knowledge				.518***	.518***				.530***	.530***
Distance (factor score)				1.158***	1.156***				1.183***	1.183***
Nuclear Plant in Country				.711***	.712***				.717***	.717***
<i>Demographics</i>										
Married				.864**	.865**				.871**	.872**
Still Studying				.698***	.964***				1.287**	1.288**
Edu. 0-14				1.175	1.179*				1.786***	1.789***
Edu. 15-18				.877*	.876*				1.229**	1.229**
Edu. 19-21				.975	.975				.976	.975
Edu. 22+ (reference)										
Occ. Manual				1.181**	1.178**				1.100	1.099
Occ. Unemployed				.959	.957				.922	.921
Occ. Non-manual (reference)										
Difficulty Paying Bills				1.189*	1.194*				.969	.970
N = 10,194 (females)										
N = 9,196 (males)										
Nagelkerke R Square	.01	.01	.01	.042	.043	.01	.01	.01	.058	.058

H6a and H6b were formulated as competing hypotheses about a possible interaction effect between roles and values on the odds of opposing nuclear power. H6a, the “values amplification hypothesis”, predicted that the interaction effect would be positive: caring for children would make traditional gender values more salient, and their effect on opposition to nuclear power would be amplified. Alternatively, H6b, the “values suppression hypothesis”, predicted that responsibilities of caring for children would be enough to make women skeptical of nuclear power, and that having traditional gender values would add no additional impetus to that opposition. The “values suppression hypothesis” therefore predicted that the interaction effect would be negative. Model 5 tests these hypotheses by adding an interaction term to the full model with the knowledge and experience, and demographic controls. The results show that interaction to be significant and negative, supporting the values suppression hypothesis. The interaction term is not significant for the male sample (model 10).

To further illustrate the values suppression hypothesis, Table 3 shows separate logistic regression results for women with children, and women without children. The value-suppression hypothesis states that the responsibility that women incur for caring for children in the household should provide enough impetus to oppose nuclear power, and therefore the variation in gender values among females caring for children will have less of an effect on opposition than for women not caring for children. The negative values-parenthood interaction observed in Table 2 supported the value-suppression hypothesis, but the separate models for women with and without children display the suppression hypothesis in greater relief. For women who are not living with children, each incremental increase in traditional gender values multiples the odds of being opposed to nuclear power by about 12%. But for women who care for children, gender values have no significant effect on opposition to nuclear power.

Table 3. Regressions predicting opposition to nuclear power for females living with children and females not living with children separately.

	No Children	Children
<i>Gender Values</i>		
Traditional Values (factor score)	1.124***	1.013
<i>Knowledge and Experience</i>		
Knowledge	.537***	.496***
Distance (factor score)	1.230***	1.065
Nuclear Plant in Country	.755***	.661***
<i>Demographics</i>		
Married	.830**	.912
Still Studying	.718**	.555*
Edu. 0-14	1.227	1.093
Edu. 15-18	.908	.846
Edu. 19-21	.951	.994
Edu. 22+ (reference)		
Occ. Manual	1.170	1.193*
Occ. Unemployed	.947	.978
Occ. Non-manual (reference)		
Difficulty Paying Bills	1.106	1.290*
N = 5,913 (no children)		
N = 4,281 (children)		
Nagelkerke R Square	.045	.038

## 6. Discussion and Conclusion

The existing explanations for the gender difference in attitudes toward nuclear power emphasize both gender differences in values (Stern et al., 1993; Whitfield et al., 2009), and gender differences in the responsibility for caring for children (Nelkin, 1981; Hamilton, 1985a, 1985b; Freudenburg & Davidson, 2007). Women are socialized to value nature and the environment more than men are, which is hypothesized to make them more likely to oppose nuclear power. Women also have disproportionate responsibility for bearing and caring for children, which is also hypothesized to explain their opposition to nuclear power. This study has examined how gender roles and values work independently, and together, to shape women's attitudes toward nuclear power.

Based on the "feminine values" explanation, H1 predicted a statistically significant and positive correlation between traditional gender values and opposition to nuclear power for women. This prediction was confirmed, utilizing a latent variable capturing attitudes toward the appropriateness of women working outside the home as a measure of traditional gender values. Because traditional gender values are supposed to predispose women toward opposition to nuclear power and not men, H2 predicted that a traditional gender values would not be correlated with opposition to nuclear power for men. This prediction was also confirmed. Table 2 provides support for the gender values explanation: traditional gender values (in relation to domesticity, in this case) were found to make women more likely to oppose nuclear power, but had no effect on men's attitudes.

The explanation emphasizing women's role as mothers was also supported. H3 predicted a statistically significant and positive correlation between living with dependent children and opposition to nuclear power for women. The data from the Eurobarometer 72.2 supported this hypothesis: the odds of opposing nuclear power were about 22% greater for women living with children compared to women without dependent children, before controlling for any other variables (and about 16% greater when controlling for all other variables).

But because caring for children is traditionally the woman's responsibility, caring for children should not affect opposition to nuclear power for men. Therefore H4 predicted that there would not be a significant correlation between living with dependent children and opposition to nuclear power for men. The data in Table 2 showed this to be the case.

However, Hypotheses 1-4 do not address the question of whether or not roles and values have independent effects. That is, traditional gender values are likely to be correlated with motherhood status, and so to what extent do values affect opposition to nuclear power when parenthood status is held constant? If the values and roles explanations are both correct, then, for women, each should be significantly correlated with opposition to nuclear power while the other is held constant. Consequently, H5a predicted that, for women, the effect of traditional gender values on opposition to nuclear power would be positive and significant when parenthood status is held constant, and H5b predicted that the effect of caring for dependent children on opposition to nuclear power would be positive and significant when gender values are held constant. H5a and H5b were each confirmed, suggesting that *both* gender values *and* gender roles matter when considering women's attitudes toward nuclear power. Neither values nor roles can be explained away as an extension of the other. While previous literature has suggested that gender differences in support for nuclear power could be explained by gender differences in values and roles, this is the first study to confirm that they are indeed empirically distinctive and shape opposition to nuclear power independently of each other.

A further question is the extent to which the effect of gender values may vary by parenthood status. H6a predicted a positive and significant interaction effect, hypothesizing that the effect of gender values may be amplified when women are responsible for caring for children. H6b predicted that, alternatively, the effect of gender values would be suppressed for women caring for children. This hypothesis was formulated based on the rationale that, for women without children, variations in traditional gender values would significantly affect the likelihood of opposition as predicted by the "feminine values" explanation, but might not further affect the likelihood of opposition for women who are responsible for children. That is, this "value-suppression hypothesis" predicted a negative values-roles interaction, and further, that values would be an important predictor of opposition for women without children, but not for women with children. Model 4 in Table 2 displayed evidence of a negative values-roles interaction, supporting H6b and contradicting H6a. Table 3 then gave further support to H6b, demonstrating that, for women without children, those with more traditional values were more likely to oppose nuclear power, but for women with children, variation in values does not affect the likelihood of opposing nuclear power.

The primary contribution this study makes to the literature on gender and nuclear power is to empirically clarify the independent effects of gender roles and gender values on opposition to nuclear power. The existing literature on gender and nuclear power often did not distinguish between values and roles. Frequently categorized under the single heading of "gender socialization" (e.g., Mobley & Kilbourne, 2012; Zelazny et al., 2000; Davidson & Freudenburg, 1996), researchers have often pointed to women as being more concerned with nature and the intrinsic value of life than men, and also to their responsibilities as the caretakers of children. There is little doubt that socialization plays a part in both value construction and role adoption, though it is important to recognize that they are theoretically and empirically distinct. Values refer to *psychological orderings* of socially relevant phenomena, while roles refer to the *responsibilities* inherent in the structure of social relationships. Suggesting that gender socialization plays a key role in shaping attitudes toward nuclear power is an important first step in understanding the gender gap in attitudes; however, a more refined analysis would distinguish between multiple dimensions of socialization: women are not only socialized to *do* particular things (like care for children), they are also socialized to think and feel in particular ways, to have unique *subject positions* that differ from those of men. This is the theoretical distinction between roles and values.

The empirical distinction concerns the extent to which roles and values operate independently of each other. If feminine values were only activated when women are placed in traditionally feminine roles, then in practice they could be treated as a single package. There would be no need to treat gender roles and values separately if, empirically, they always occurred together. It would be enough to observe whether or not a woman is occupying a traditionally feminine role and the corresponding values could be assumed. If such were the case, even if we assumed that both values and roles affect women's opposition to nuclear power it would be unnecessary to measure them separately in empirical investigations.

This study has shown that it is necessary to consider values and roles separately when investigating the relationship between gender and nuclear power. It is well known that feminine values are acquired long before women become mothers (Thorne, 1993; Fagot, 2000), and that there is variation in feminine values even among women who reject traditional female roles (Zwerman, 1992). In the case of attitudes toward nuclear power, roles and values work together and separately in complex ways to affect the likelihood of women's opposition. When women are not responsible for dependent children, their gender values are important predictors of their opposition, with more traditional values rendering women more likely to oppose nuclear power. However, when women occupy the traditionally feminine role of mother, variations in their gender values do not affect the likelihood of their opposition to nuclear power. The results presented here suggest that the "feminine values" hypothesis is most appropriate in instances in which women are not in the mothering role. However, in instances in which women are in the mothering role, the importance of values is suppressed, apparently trumped by concern for the immediate safety of children (the "safety hazards" hypothesis: Hamilton, 1985a, 1985b; Freudenburg & Davidson, 2007). The implication of these findings is that, in order to understand the gender gap in opposition to nuclear power, both values and roles must be taken into account, and that their separate effects cannot be understood without reference to each other.

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