

RUNNING HEAD: Television, knowledge, and nuclear power

**TELEVISION, KNOWLEDGE, AND NUCLEAR POWER: EXAMINING THE
CULTIVATION EFFECT OF GENRE-SPECIFIC TELEVISION VIEWING ON RISK
PERCEPTION OF NUCLEAR POWER**

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Paper presented at the 2012 MAPOR Annual Conference

November 16-17, 2012

Chicago, IL

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This material is based upon work supported by grants from the National Science Foundation to the UW-Madison Nanoscale Science and Engineering Center in Templated Synthesis and Assembly at the Nanoscale (Grant No. SES-DMR-0832760), and by the Department of Energy (NEUP contract 120341). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation and the Department of Energy.

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7,556 words (not including abstract)

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Abstract

Using national survey data, this study examines how attention to five forms of genre-specific television programming influences people's risk perception of nuclear power. We find that people who pay closer attention to science-themed crime drama and science documentaries are more likely to perceive nuclear power as potentially polluting and harmful to human health. Overall perceived risk associated with nuclear power is not directly related to factual knowledge about this issue. However, the relationships between serious TV programs uses and risk perception of nuclear power vary for viewers with different levels of knowledge.

Keywords: television, cultivation, risk perception, nuclear power

Abstract: 100 words

Introduction

The U.S. nuclear industry has been revived as the government provides extensive incentives for civilian use of nuclear power. According to the Energy Policy Act of 2005, the government promises to provide incentives for building new power plants through loan guarantees and tax credits. It also establishes the Next Generation Nuclear Plant project to develop, construct and operate more advanced plant reactors that would satisfy the needs of industrial processes. On the one hand, these government's promotional efforts are closely linked to public concerns on mitigating climate change and reducing dependence on imported oil ((De Groot and Steg 2010). On the other hand, fears over possible nuclear accidents and nuclear radiation are still lingering among the lay citizens (Pew Research Center 2011a).

As the public increasingly engages in decision-making about nuclear energy, there are emerging debates on the accuracy and validity of mass media's representation of nuclear power safety, especially among the nuclear scientists and engineers' community (American Nuclear Society 2012). For instance, the American Nuclear Society (2012) has lamented media coverage on Fukushima Daiichi nuclear accident for using dramatic images and incorrect quotes from governmental officials, which might potentially lead to decline in public trust and rampant speculation. However, in part given the absence of systematic analysis of most recent media coverage on nuclear power, it's too hasty to make any firm conclusions regarding the quality of media content, let alone its effects on public perceptions of this issue.

Moreover, news coverage on nuclear accidents should not be the only source that may possibly misinform the lay public about the issue of nuclear power. As the primary storyteller of our era, television still serves as the most importantly information source of science for the U.S.

public, despite the fact that Internet based searching strategies are becoming the norm to find out scientific information (Pew Research Center 2011b). It is shown that attention to a variety of television (TV) programs, including both news programs and entertaining ones, helps shape how people perceive sciences and technologies (Brossard and Dudo 2012; Dudo et al. 2010).

According to cultivation theory, individuals that pay greater attention to television are more likely to accept the representation of reality as presented on TV (Gerbner and Gross 1974). Most commonly, heavy viewers tend to develop a belief in a “mean and scary” world from watching TV and thus maintain distorting understanding of social risks (Gerbner, Gross, Morgan, Signorielli, and Shanahan 2002).

Moreover, some scientists believe that increasing citizens’ technological knowledge would be one of the most effective ways to improve public perception about nuclear energy, but the conflicting empirical evidences on the relationships between knowledge and science-related attitudes may disprove this assertion (Allum, Sturgis, Tabourazi, and Brunton-Smith 2008). In addition, although factual knowledge plays a critical role in explaining the TV effects on support for science in general (Nisbet et al. 2002), we know little about how people with different levels of knowledge perceive nuclear risks as responding to the messages conveyed by television in the U.S. context.

The purpose of this study is two-fold: (1) to examine the degree to which the impacts of TV program viewing on risk perception of nuclear power vary across genres (i.e. political news, science news, science-themed crime shows, science-fiction dramas, and science documentaries); (2) to explore whether levels of preexisting knowledge on nuclear power moderates the relationship between genre-specific TV viewing and risk perception.

Nuclear power and the U.S. public

Nuclear power is characterized by both benefits and risks (Costa-Font, Rudisill, and Mossialos 2008). When applied to energy generation, nuclear power could lower fuel costs, create less pollution, and mitigate dependence on foreign fossil fuels (Kasperson, Berk, Pijawka, Sharaf, and Wood 1980). At the same time, risks related to release of radioactivity, potential nuclear accidents, waste disposal, and thermal water pollution is also a salient concern (Kasperson et al., 1980). Other considerations include the vulnerability of nuclear facilities and potential terrorist attacks on nuclear power plants (Costa-Font et al. 2008).

The long-term trend analysis of survey findings indicates that the perceived benefits of nuclear energy have consistently outweighed the perceived risks for roughly 75% of the respondents over the past decade (Jenkins-Smith 2011). However, more recent opinion polls have aggregately suggested that the U.S. public holds ambiguous attitudes toward development of civilian use of nuclear power. According to the findings of a national online survey conducted in March 2012, 42% of the respondents have “strongly” or “somewhat” supported building more nuclear power plants (Center for Climate Change Communication 2012). Nevertheless, only 34% of the respondents would support the construction of a new nuclear reactor within 50 miles of their homes (Civil Society Institute Poll 2012a).

In addition, when asked about financing nuclear energy, 76% of the respondents reported to support shifting federal loan-guarantee away from nuclear reactors, and towards other forms of clean energy, such as wind or solar (Civil Society Institute Poll 2012b). In general, most Americans believe the benefits of nuclear power exceed the risks and favor continued or increased reliance on nuclear energy. But significant fractions of the public appear to decrease

support as the prospective nuclear plant site is close to their neighborhood. Also, the lay public tends to perceive nuclear energy as less competitive compared to alternative forms of clean and renewable energy.

Risk perception and television

General television use can exert both short- and long-term effects on perceived nuclear risk. In retrospect, public opposition to nuclear risk ebbed and flowed closely corresponding with the volume of television coverage of the Three Mile Island accident (Gerbner, Gross, Morgan, and Signorielli 1981). In terms of longitudinal effects, we should caution against expecting a direct relationship between TV attention and perceived nuclear risk. Gerbner and his colleagues (1981) have suggested that entertaining television programs cultivate less favorable attitudes toward science because of recurrent negative portrayal of scientists on television. However, recent studies find no direct negative relationship between TV use and support for science, which could be partially explained by a “better” depiction of scientists (Dudo et al. 2010). It remains to be empirically tested, of course, if such a depiction of scientist has an effect on perception of risks related to nuclear power.

Furthermore, television use narrows the gaps in science-related attitudes among heavy viewers (Gerbner 1987). Studies confirm that the negative relationships between entertainment television viewing and support for science are strongest for those who would have been otherwise expected to be the most favorable toward sciences (Dudo et al. 2010). This so-called “mainstreaming” phenomenon was also observed for nuclear-related attitudes: Watching pro-science dramas or documentaries might cultivate positive attitudes toward nuclear power, yet the misperception developed from general TV viewing actually counterbalanced this positive

tendency (Gardner et al. 1982). Gerbner et al. (2002) suggest that “mainstreaming” phenomenon demonstrates the fact that the actual power of television resides in its consistent messages as an integrative package.

Nonetheless, some scholars argue that the extent of television effects hinges on the specific nature of TV programs (Dahlstrom and Scheufele 2010; Dhingra 2003). For instance, overall television viewing is sporadically related to public perception of a variety of hazards to human wellbeing, such as manmade accidents or illness, but viewing news and documentaries does not relate to such perceptions (Gunter and Wober 1983). In addition, uses of TV news and nature documentaries, but not that of entertainment programs, are linked to environmental concern (Holbert, Kwak, and Shah 2003). Interestingly, support for biotechnology is positively related to attention to entertaining programs, whereas negatively related to that to TV news. And although TV news and fictional dramas cultivate young students with beliefs in uncertain and unknown sciences, exposure to documentaries and TV magazines leads them to become certain about sciences (Dhingra 2003).

The distinct patterns of TV effects on perception of science and technology could be explained by the heuristic processing model (Chaiken 1980). Despite providing stable and pervasive value beliefs to its viewers, television programs contain heuristic cues that can be used as interpretive lens to form cognitions of reality (Shrum 2002; Good 2009). Television manipulates the accessibility of constructs as different programs focus on different aspects of the same fact. At the same time, heavy viewers make evaluations of reality based on the ease of accessing to relevant TV images in memory (Shrum 2002; Shrum, Burroughs, and Rindfleisch 2004; Holbrook and Hill 2006). Even for the topics not frequently appearing on TV (e.g. the nuclear power issue, except around specific events, such as Chernobyl or Fukushima accidents),

the effects of various television programs should not be neglected. We hence elicit our hypotheses and research questions in the following section based on summarizing the most common heuristic cues featured on different types of TV programs, including TV news, documentaries and entertaining programs.

Television coverage of nuclear power

The amount of news coverage on nuclear power has fluctuated over decades, with peaks triggered by few occurrences of disastrous nuclear accidents (Friedman 2011). Throughout the period from 1945 to 1970s, elite media had been dominated by a “progress” theme, which linked nuclear power to tremendous economic growth (Gamson and Modigliani 1989). Later on, this established narrative came under attack from anti-nuclear activists, who condemned nuclear power for its catastrophic nature (Gamson and Modigliani 1989). Moreover, nuclear power was depicted as a bad investment because it was not cost effective compared to alternative energy sources (Pollock, Lilie, and Vittes 1993). Recently, elite media started redefining nuclear power as one way to enhance national security given its potential in mitigating overdependence on imported oil (Nisbet 2010). Nuclear power has also been portrayed into a possible “green” solution to global climate change due to its low carbon emission (Doyle 2011).

These narratives could be easily replicated by television news. In fact, the repetitive uses of vivid images and inflammable languages on TV may dramatize the risks associated with nuclear power (Friedman 2011). Specifically, TV coverage of nuclear accidents occurring at Three Mile Island and Chernobyl has been criticized as inaccurate and overly exaggerating (Friedman 2011). In contrast, some tentative analysis has shown that the *New York Times* coverage on Fukushima accident includes extensive background information that allows readers

to make better sense of the technical aspects of nuclear power (Friedman 2011). Overall, television news coverage on nuclear power is no longer purely optimistic as it used to be, but integrates various environmental and political issues to form a context that allows viewers to interpret it from different perspectives (Gamson & Modigliani, 1989; Nisbet, 2010). Given the mixed tone of TV news coverage on nuclear power, research questions (RQ) would be more prudent than formal hypotheses regarding the direct relationship between TV news viewing and risk perception. Moreover, we are interested in examining whether attention to politics in television news differ from that to scientific issues in terms of its relationships with perceived nuclear risk:

RQ1a: Does attention to political news have a significant relationship with risk perception of nuclear power?

RQ1b: Does attention to scientific news have a significant relationship with risk perception of nuclear power?

Additionally, fictional television programs could serve as sources of scientific knowledge regarding nuclear energy for a majority of audience members (Marsh, Meade, and Roegdiger 2003). Moreover, beneath the surface of fabricated characters and scenarios often rests some fairly elaborate social and political value beliefs (Feldman and Sigelman 1985). Historically, a few fictional TV programs dealing with the nuclear issue had received wide attention. For instance, when *The Day After* first aired on ABC network, more than 100 million Americans sat in front of their TV sets and learned about “what their lives would be like after a nuclear war” (Feldman and Sigelman, 1985, p. 556). In *Cosmo*, one of the most popular science documentaries aired in the 1980s, the concept of “nuclear winter,” along with the looming threat

of nuclear warfare, was vividly represented on the TV screen (Metz 2008). Overall, these shows include a lot of unprecedentedly graphic terms regarding nuclear devastation that may still resonate thereafter.

To the extent of our knowledge, systematic analysis of entertaining TV regarding nuclear power is absent. A general understanding of popular television discourse, therefore, offers best guidance on what impression to expect about nuclear power that viewers could derive from watching entertaining television. Unlike nuclear-specific programs, conventional science fiction programs tend to depict technologies as promising and hence imply less risk associated with them. The *Star Trek* series frames technologies as allowing beneficial social changes that help maintain a secure future (Banks and Tankel 1990). The latent message indicates that industrial societies could progress only with the aid of advancing technology. Moreover, fictional TV shows often portray a world as being guided by a principle of justice (Appel 2008). Good and bad characters can be easily identified, which prompt viewers to believe in a “safe and just” world (Appel 2008). Therefore, our hypothesis (H) on the relationship between science fiction programs use and perceived nuclear power risks becomes:

H1: Attention to science fiction dramas has a negative relationship with risk perception of nuclear power.

In addition, science documentaries usually feature pro-science discourses and educational contents, which turn to exert positive influence on viewers' perception of scientific issues (Nisbet and Goidel 2007). However, the need for drama leads science documentaries to adhere to fear-driven narratives when covering controversial technologies (Metz 2008). Many documentaries

portray environmental contamination, which are shown to raise viewers' concerns over technological impact on environment (Holbert, Kwak, and Shah 2003).

Also, public perception of technological risks is fueled in part by heavy exposure to science-themed crime dramas on prime time TV (Holbrook and Hill 2006). Most commonly, these dramas tend to show how technologies can be applied to committing crime or solving criminal cases (Ley, Jankowski, and Brewer 2010). While crime dramas do not depict nuclear power directly, they could convey sense of chaos caused by fatal technologies, which might indirectly influence people's perceived risks associated with things nuclear (Heath and Petraitis 1987). Hence, we assume that heavier attention to these two types of programs will make people perceive more risks associated with nuclear power:

H2: Attention to science documentaries has a positive relationship with risk perception of nuclear power.

H3: Attention to science-themed crime dramas has a positive relationship with risk perception of nuclear power.

Role of knowledge

The construct of "knowledge of scientific facts" has been identified as one factor linking media use and fearful perceptions of science (Brossard and Shanahan 2003). Knowledge of science is positively related to trust in scientists and other democratic institutions that manage technological risks (Slovic 1999). Hence, knowledge may mitigate risk perception through increasing levels of trust. Not surprisingly, experts in the field of nuclear power tend to perceive lower risks associated with radioactivity compared to power plant workers who are less knowledgeable about nuclear radiation (Sjöberg and Drottz-Sjöberg 1991; Fischhoff, Slovic,

Lichtenstein, Read, and Combs 1978). These findings agree with the commonly held assumption that greater science knowledge leads to more appropriate risk judgment.

However, as rigorously debated in previous literature, the power of knowledge in explaining the lay public's perception of scientific risks is relatively marginal compared to other factors, including emotional reactions and trust in authorities (Priest 2001). In fact, people who lack scientific knowledge might use social trust as a standing decision rule in order to reduce the complexity of decision-making processes related to science (Brossard et al. 2008). As discussed earlier, citizens tend to rely on the affective cues and mental shortcuts offered by mass media when rendering the judgment of scientific risks. Overall, the direct relationship between knowledge and risk perception related to technology is tentative at best.

Some scholars have noticed the mediating role of knowledge in explaining media effects on scientific attitudes and risk perceptions. For instance, the more educational content people obtain from the media, the more likely they are to become supportive towards science as mediated by an increased level of knowledge (Hwang and Southwell 2009). Nonetheless, Nisbet et al. (2002) find that television viewing was negatively related to science knowledge. In this study, the authors suggest that heavier television viewing lowers knowledge about science and that lower levels of knowledge in turn heighten reservations about science.

However, there are two major drawbacks involved in this model. First, by suggesting the mediating influence of knowledge on the relationship between media use and science-related attitudes, Nisbet et al. (2002) in fact have assumed a direct link between knowledge and science attitudes, which lacks consistent empirical support as discussed earlier. Second, even though treating knowledge as mediating variable provides some explanatory power in understanding the

mechanism for TV effects, we know little about how people with different levels of knowledge react to specific forms of TV programs in terms of perceiving risks.

In fact, there is possibility that preexisting factual knowledge might moderate the effects of television viewing on perceived risks associated with nuclear power. For instance, Feldman and Sigelman (1985) suggested that the potential impact of *The Day After* was limited by the knowledge of its viewers. It is argued that the well-informed people perceived fewer risks because they are less likely to be affected by the new information represented on TV compared to their ill-formed counterparts. Although lacking empirical evidences, this tentative assumption can be transferred into a research question that is worth testing: After watching TV programs, are those who are initially well informed about nuclear more likely to perceive it as risky compared to those who know little about this issue? Very few studies have addressed the role of factual knowledge in moderating the relationship between genre-specific TV viewing and risk perception. Our second research question hence becomes:

RQ2: Do the links between attention to different television programs and risk perception of nuclear power vary for respondents with different levels of factual knowledge?

In addition, there is a range of factors influencing people's perception of and attitudes toward nuclear power. Females were found to express more worries regarding nuclear power than males (Drottz-Sjöberg and Sjöberg 1990). More recent studies indicate that people's attitudes toward this technology are related to political values (Costa-Font, Rudisill, and Mossialos 2008). Similarly, religiosity is also closely related to support for science in general (Dudo et al. 2010). People also intend to interpret scientific evidences through the lens of religious beliefs (Brossard et al. 2008). In addition, individuals' perception of science is related

to their “deference to scientific authority” and “participatory attitudes toward science,” which represents stable and long-term value predispositions regarding science (Brossard and Nisbet 2007; Brossard and Shanahan 2003). Specifically, these values could predict science-related attitudes and perceptions as mediated by people’s trust in scientists and governmental agencies as sources of information (Anderson, Scheufele, Brossard, & Corley, 2011). These factors will be included as control variables in our model in order to factor out confounding influences.

Methods

Data

This study was based on an online experiment using KnowledgePanel run by Knowledge Networks. KnowledgePanel is a probability-based web panel designed to be representative of the U.S. population. The survey was fielded from July 9 to 23, 2010. It took approximately 28 minutes to complete the questionnaire. Knowledge Networks’ initial online sample was obtained through probability sampling techniques and hence was a reliable source of data (see American Association of Public Opinion Research on Online Panels, March 2010, for information on online panels). Knowledge Network initially selected households for their panel using random digit dialing (RDD) sampling and address-based sampling (ABS) methodology. Households that did not already have Internet access were provided a laptop computer and Internet access. The sample for this study was drawn at random from the active panel members. Descriptive statistics and results reported in this paper were those using a stratification weight. Those contacted who did not consent to participate were terminated from the survey. The completion rate was 54.2%. In order to enhance survey completion, Knowledge Networks sent reminders via e-mail to those

who did not respond on two different dates during the field period. In total, 2,338 people completed the survey.

Measures

Risk perception ($M = 6.10$, $SD = 2.30$) was measured with four items asking respondents' agreement with each of the following statements regarding nuclear power on a consistent 10-point scale (1 = do not agree at all, 10 = agree very much): (1) "Nuclear power may lead to human health problems," (2) "Nuclear power may lead to more pollution and environmental contamination," (3) "Nuclear power may lead to contamination of water supplies," (4) "Nuclear power may increase the risk of a nuclear accident in the United States". The measurement items demonstrated high reliability (Cronbach's $\alpha = .89$). The average value of these items was used as an index for this dependent variable.

Television use was measured with items tapping people's attention paid to different types of genre-specific programs. Respondents were asked to report how much attention they would pay to TV programs on a 5-point scale (1 = none attention, 5 = a lot of attention), either on a traditional television or on online sources, including both popular video website such as Hulu.com and the official websites of television networks. In particular, *attention to political news* ($M = 2.88$, $SD = 1.10$; $r = .84$, $p < .001$) was measured with the mean value of two items measuring respondents' attention paid to "international affairs" and "national government and politics" on TV. Similarly, *attention to scientific news* ($M = 2.60$, $SD = 1.00$) was measured with the mean value of three items measuring people's attention to stories related to "science and technology," "scientific studies in new areas of research," and "social or ethical implications of emerging technologies." The composite measure was highly reliable (Cronbach's $\alpha = .93$).

Attention to science-fiction drama ($M = 2.12$, $SD = 1.22$) was measured with a single item asking people how much attention they paid to science-fiction dramas, such as “*Lost*” or “*Heroes*”. People were also asked how much attention they paid to *science-themed crime dramas*, such as “*CSI (Crime Scene Investigation)*” or “*Bones*” ($M = 2.87$, $SD = 1.33$). In addition, respondents reported the extent of attention paid to *science documentaries* on stations such as PBS, the Learning Channel, or Discovery Channel ($M = 2.91$, $SD = 1.22$).

Factual knowledge about nuclear power ($KR-20 = .53$) was an additive index of five true-false items asking respondents whether (1) “Less than 10% of the U.S.’s electricity comes from nuclear power plants,” (2) “There are over 90 operating nuclear reactors in the U.S.,” (3) “Nuclear energy creates heat,” (4) “Nuclear power emits significant amounts of carbon dioxide,” and (5) “Nuclear power plants produce energy through fusion.” The additive index had a range from 0 to 5 ($M = 1.90$, $SD = 1.30$).

In order to factor out the effects of exogenous variables on risk perception, we included demographics, value predispositions and other types of media use as control variables in our model. *Age* was measured as a continuous variable ($M = 46.45$, $SD = 17.00$). In terms of *gender*, 48.3% of respondents were male (male =1, female =2). *Household income* ($M = 10.36$, $SD = 4.47$) was measured by asking respondents “total 2009 household income before taxes” (1 = less than \$5,000, 19 = “\$175,000 or more”; $Mdn = 10$, “\$35,000 to \$39,999”). *Educational attainment* ($M = 2.70$; $SD = 1.02$) was measured by asking the highest education respondents had completed (1 = no formal education, 4 = completed a professional or doctorate degree).

Political ideology ($M = 3.62$, $SD = 1.24$; $r = .75$, $p < .001$) was measured with two items asking respondents how they thought they were liberal or conservative in terms of (1) economic

and (2) social issues on a six-point scale (1 = very liberal, 6 = very conservative). *Religiosity* ($M = 5.90$, $SD = 3.20$) was measured by asking respondents on a 10-point scale how much guidance religion played in their everyday lives (1 = no guidance, 10 = a lot of guidance). *Participatory attitudes toward science* ($M = 4.72$, $SD = 2.04$; $r = .51$, $p < .001$) was measured with the mean value of two items on a ten-point scale asking respondents' agreement with (1) "Public opinion is more important than the scientists' opinions when making decisions about scientific research," and (2) "Scientists should pay attention to the wishes of the public, even if they think citizens are mistaken or do not understand their risks." Similarly, *deference to scientific authority* ($M = 4.43$, $SD = 1.98$; $r = .50$, $p < .001$) was measured by asking respondents if they agreed with (1) "Scientists know best what is good for public," and (2) "Scientists should do what they think is best, even if they have to persuade people that is right."

Frequency of reading newspaper ($M = 3.97$, $SD = 2.67$) was measured by asking respondents "how many days a week do you read a newspaper, either in print or online?" (1 = none, 8 = seven days.). *Frequency of reading blogs* ($M = 2.36$, $SD = 1.97$; $r = .76$, $p < .001$) was measured with a two-item index asking respondents "how often they read blogs about (1) politics or current events and (2) scientific issues or emerging technologies" on a 5-point scale (1 = never, 5 = very often).

Analytical framework

We used hierarchical ordinary least-squares (OLS) regression to test models predicting risk perception of nuclear power. Each block of variables was entered into the equation according to their assumed causal order. In our analysis, the blocks were: (1) Demographics; (2) Value predispositions; (3) Other types of media use; (4) Five forms of television use; (5) Factual

knowledge of nuclear power. The block-by-block approach allowed us to evaluate the variance explained by each set of variables as they were entered as predictors. The before-entry standardized betas allow us to evaluate the main effects of each variable controlling for those already entered into the equation (Cohen and Cohen 1983). These numbers are especially useful for evaluating the independent effects of variables that may be highly correlated with one another (in this case, for example, the effects of five different genre-specific TV programs).

Because our second research question focused on the interactive effects of factual knowledge and TV programs, we tested two-way interaction terms. Statistical interactions represent the notion that the relationship between two variables (e.g., the link between TV viewing and risk perception of nuclear power) differs across different social groups (e.g., respondents with higher or lower levels of factual knowledge). These multiplicative terms were calculated after standardizing the original variables. This was done to prevent possible multicollinearity problems caused by simultaneously including interaction terms and its components (Eveland 1997). Each interaction term was entered separately in the final block of the regression equation.

Results

Prior to reporting the results of our research questions, we first provide an overview of the main effects of several control variables. All main-effect regression estimates are reported in Table 1.

[Insert Table 1 about here]

According to the results shown in the final equation, females tended to perceive more risk associated with nuclear power than male ($\beta = .066$, $p < .01$). In general, people who were

conservative about social and economic issues perceived less nuclear power risk than liberal people ($\beta = -.212, p < .001$). Religious people tended to hold less favorable attitudes toward nuclear power ($\beta = .105, p < .001$). Participatory attitudes toward science was significantly positively related to risk perception ($\beta = .166, p < .001$), meaning that people who believed scientists should listen to the public when making technical decisions were likely to worry about nuclear power. Overall, value predispositions explained most variances in the dependent variable compared to demographics and oriented attitudes toward science.

Frequency of reading science blogs was significantly negatively related to risk perception ($\beta = -.073, p < .001$). Noticeably, the relationship became more significant after controlling for the TV use variables, which suggested a unique salient impact of online discourse on respondents' perception of nuclear power.

Attention to science-themed crime drama ($\beta = .075, p < .001$) and that to science documentaries ($\beta = .073, p < .001$) were the only two variables that had a significantly positive relationship with risk perception. H2 and H3 were therefore supported. In contrast, attention to science-fiction dramas had a positive relationship but insignificant relationship with risk perception. H1 was hence rejected. However, the relationships between risk perception and attention to political and scientific news on television were not significant.

Finally, factual knowledge of nuclear power had no significant relationship with the dependent variable. Notably, the relationships between risk perception and the two types of television use remained significant even after knowledge was entered in the model. Statistically, this result partly resisted the mediating role of factual knowledge in explaining the television effects (Baron and Kenny 1986).

Our second set of research questions focused on the moderating influence of one's factual knowledge regarding nuclear power on the effects of genre-specific programs. Generally speaking, the interaction tests supported strong moderating influence of knowledge on the effects of serious TV programs, including politics news ($\beta = -.069$, $p < .001$), science news ($\beta = -.075$, $p < .001$), and science documentaries ($\beta = -.055$, $p < .01$). However, the moderating influence of knowledge on the effects of entertaining programs was marginally significant for that of science fiction drama, and insignificant for science-themed crime drama (see Table 2).

[Insert Table 2 about Here]

In order to interpret the significant interaction for factual knowledge, we divided the sample into subgroups according to the responses and plotted the observed means on the dependent variable for each type of TV programs. As shown in Figure 1, for those who had limited knowledge about nuclear power, the more attention they paid to political and scientific news, the more likely they were to report nuclear power as risky. In comparison, for those who were knowledgeable about nuclear power, the more attention they paid to hard news, the less risk they perceived. In addition, risk perception was positively related to documentaries use for both groups of people, yet the relationship was much stronger for those with lower levels of knowledge.

[Insert Figure 1 about Here]

Moreover, the insignificant interacting influence of knowledge on the effects of science-themed crime drama suggested that respondents perceived more risks associated with nuclear power as they watched more crime dramas regardless their knowledge level.

Discussion

As the ongoing nuclear renaissance reignites public discussions on nuclear power, it is increasingly important for nuclear scientists, regulatory officials, and other stakeholders to develop a better understanding of how citizens make sense of nuclear risks. Moreover, given the furious debate on the potential role of television in misrepresenting nuclear risks, communication scholars should explore the specific sources of potential misperception if there were any. This study used national survey data to explore how levels of value predispositions, attention to genre-specific TV programs, and levels of factual knowledge help explain risk perception of nuclear power. Most importantly, we found direct and positive relationships between perceived nuclear risks and attention to TV programs, including science-themed crime dramas and science documentaries. Our findings also confirmed that value predispositions, such as ideological beliefs, religiosity and participatory attitudes toward scientists, all played significant roles in shaping risk perception of nuclear power.

It is conventionally assumed that TV news programs and documentaries have positive effects on public perception of science. According to our findings, however, the positive influence of TV news and documentaries only occurred with those with higher levels of knowledge. For people with limited knowledge, watching TV news and science documentaries were likely to make them develop negative perceptions (i.e. higher risk perceptions). In addition, science-themed crime dramas viewing prevented audience members from perceiving nuclear risks in line with experts' assessments regardless their levels of prior knowledge. In other words, the so-called "mainstreaming" effect of television was observed only for crime TV dramas, but not for news programs or documentaries.

Before elaborating on the conclusions, it is important to address some of the limitations of our study, and consequently, directions for future studies. First, there is a lack of systematic

research about the nature of recent television coverage on nuclear power. Of course, a television content analysis would enable those interested in the subject to know if television is indeed providing viewers with mental shortcuts that can be applied to magnifying nuclear risk. The inquiry of interest, however, should move beyond merely focusing on the nature of TV news coverage on nuclear accidents to the more common discourse of influential TV programs and online contents. For instance, the positive relationship between blogs use and perceived nuclear risks could be a sign for the potentially negative tone of online information regarding nuclear power. Studies on the qualitative nature of television discourse would help interpret the findings of this study.

Second, the data for this study was collected prior to the nuclear accident at the Fukushima Daichii power plant in Japan in March 2011. Any interpretations of these findings need to bear in mind our obvious lack of capability in capturing the historical effect of this event after the accident. To be sure, the relationships between TV news use and risk perception would most likely differ from what we had observed if tested right after the accident, although the long-term effects of a negative coverage are still under debate. Ultimately, how the Fukushima accident and its media coverage shaped public understanding of civilian use of nuclear power in the U.S. context remains an empirical question. Our results could be used as a benchmark for future comparative studies on the trend of media coverage and public opinion.

In addition, it is worth pointing out that our measures only allowed us to tap the levels but not how much risk perceptions were in line with experts' measures of risk probability. In particular, we were not able to determine whether the judgments of light viewers were more in line with those of experts than heavy viewers by using comparative measures. We thus need to caution against judging the merits and demerits of television programs based on their

relationships with perceived risks. However, given the fact that heavy viewers tend to have a distorted understanding of actual statistics related to social risks (Romer, Jamieson, and Aday 2003), we judge it acceptable to be conservative about the negativity of crime dramas.

Consistent with previous studies on television cultivation, this study identified relatively small but significant relationships between genre-specific television uses and individuals' perceived reality regarding nuclear energy. According to our findings, people's risk perception was only related to attention to science-themed crime dramas and science documentaries. Although current cable networks provide casual opportunities for lay citizens to see more knowledge-based information about emerging technologies, the positive effect of these programs are limited on public assessment of nuclear risks. In fact, people may overestimate the risks related to potentially damaging technologies, such as nuclear power, by recalling the environmental pollution and suffering constantly appearing in these programs.

Our findings also allow us to re-scrutinize the mechanism of television effects on public perception of controversial sciences. Notably, the empirical evidence supporting the mediating influence of factual knowledge was absent from our study. What we detected was the fact that television news and documentaries uses widened the gaps in perceived risks among people with low versus high levels of knowledge. These findings, together with the direct relationships between TV uses and risk perception, support Shrum's (2002) assertion that television has an effect because it leads its viewers to make use of heuristic processing and unrepresentative exemplars. Our results also showed that this tendency could be even heightened if people were ignorant about the issue of interest.

For decades, some scientists and science advocates have criticized mass media for its misrepresentation of scientific facts and risks. The American Nuclear Society (2012) has advocated improving strategies in communicating risks of nuclear power to the general public by implementing education programs for mass media professionals, school kids and lay citizens. Though spurring laudable goals, this practice may lack effectiveness by neglecting the complexity of contemporary communication environment and the limited influence of literacy. Indeed, the popular TV programs, which seems irrelevant to nuclear power superficially, may exert long-term and subtle effects on public perception of this issue. Moreover, considering the differing effects of genre-specific programs on people with different levels of knowledge, we should tailor the campaign messages based on audiences' knowledge levels, value predispositions, and information behaviors.

Our study have indicated that television's cultivation of technology-related risks will play out in more complex ways due to the diversity of TV programs and the evolving online information environment. With television remaining a medium of choice for a vast proportion of Americans of all ages, scholarly efforts should continue to be invested to disentangle the effects of television programs on various technological topics.

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Table 1. Hierarchical OLS Predicting Risk Perception of Nuclear Power

	Before- entry	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Block 1 Demographics							
Age	-.023	-.033	-.025	-.017	-.025	-.033	-.034
Gender (female)	.084***	.076***	.059**	.066**	.062**	.065**	.066**
Education	-.036	-.007	-.027	-.017	-.018	-.021	-.022
Household Income	-.086***	-.077***	-.048*	-.043	-.041	-.035	-.035
<i>Incremental R² (%)</i>		1.4***					
Block 2 Predispositions							
Ideology (conservative)	-.177***		-.217***	-.214***	-.214***	-.212***	-.212***
Religious guidance	.083***		.142***	.109***	.112***	.104***	.105***
<i>Incremental R² (%)</i>			4.6***				
Block 3 Oriented attitudes towards science							
Deference to scientific authority	.042			.026	.034	.023	.022
Participatory attitudes toward science	.171***			.164***	.167***	.165***	.166***
<i>Incremental R² (%)</i>				2.5***			
Block 4 Other media use							
Frequency of reading newspaper	-.013				.011	.008	.007
Frequency of reading news blogs	-.032				-.053*	-.072***	-.073***
<i>Incremental R² (%)</i>					.2*		
Block 5 TV programs use							
Politics news	.009					-.027	-.027
Science news	.044*					.043	.042
Science-fiction drama	.044*					-.022	-.023
Science-themed crime drama	.110***					.075***	.075***
Science documentaries	.090***					.074***	.073***
<i>Incremental R² (%)</i>						1.4***	
Block 6 Knowledge							
Factual knowledge of nuclear power	-.021						.010
<i>Incremental R² (%)</i>							0
Total R² (%)							10.1

NOTE: $N = 2,238$. The original survey included eight stimuli treatments for an experiment. All the coefficients are obtained after the experiment treatments were controlled. Cell entries for the first column are before-entry betas. The remaining cell entries are standardized-regression coefficients. * $p < .05$. ** $p < .01$. $p < .001$ ***.

Table 2 Results of Two-way Interactions Testing Moderation Effect of Factual Knowledge on Effects of Five Forms of Genre-specific Television Viewing

Block 7: Two-Way Interactions	Perceived Risks
Political news × Factual knowledge	-.069***
Science news × Factual knowledge	-.075***
Science fiction drama × Factual knowledge	-.040*
Science-themed crime drama × Factual knowledge	-.014
Science documentaries × Factual knowledge	-.055**

NOTE: * $p < .05$. ** $p < .01$. $p < .001$ ***. N = 2,238. Coefficients are before-entry standardized betas.

Figure 1 Two-way Interaction Effect of Factual Knowledge and Attention to Political News, Scientific News, and Science Documentaries on Perceived Risks

