



## Using the elaboration likelihood model to examine online persuasion through website design

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### ABSTRACT

To investigate the dynamics of online persuasion, this research uses the Elaboration Likelihood Model (ELM) to determine the effects of argument quality as a central route to influence attitude change versus design and social elements as peripheral routes to attitude change. Additional to this research is an examination of change in issue involvement as a mediator between central and peripheral routes leading to attitude change. Findings from a study involving 403 participants add to our understanding of ELM concerning the role of website design and how an individual's level of issue involvement is a prerequisite to changing user attitudes.

### 1. Introduction

Persuasion refers to human communication that is devised to *influence* the autonomous actions and judgments of others [1]. In the realm of information technology (IT), persuasive systems may be defined as computerized software or information systems designed to reinforce, alter, or shape attitudes and/or behaviors *without* resorting to coercion or deception [2,3]. Unlike earlier information systems research where the IT artifact was presumed to be “neutral” and existed exclusively to serve the needs of users, persuasive IT artifacts have the explicit aim of modifying users' attitudes and/or behaviors.

According to Te'eni ([4], p. 341): “New communication technologies, not the least social media, are changing the way we process information, learn, make decisions, create and distribute knowledge, manage, and socialize, all of which have been traditional areas of our research in Information Systems.” Despite this, although persuasion has been researched extensively in the fields of marketing, psychology, and sociology, there are comparatively few instances when persuasion has been examined in the context of information technology, especially as an IT artifact [5,6]. Owing to a paucity of studies about persuasive technology, Slattery et al. ([6], p.1) alleged that there is “little consensus on how to persuade effectively within the digital realm.” There is, however, a compelling case for this line of work because digital environments are increasingly structured with the purpose of convincing individuals or groups to undertake a course of action not normally

pursued. For example, in the e-business domain, this might include the creation of a web environment whereby consumers are prompted to purchase sustainable products. In an e-health setting, there are significant social benefits to be gained from persuading parents to immunize their children against infectious diseases. In fact, approximately 90 million American adults have difficulty in understanding and using health information [7], and persuasive websites have the potential to assist this pressing need. Other contexts when online persuasion can be influential are in politics, safety, e-learning, and training, to name a few.

Previous research on IT and persuasion has centered on “persuasive technology” (i.e., [2]) that is outcome driven (e.g., systems designed for content personalization, service customization, or effort reduction on the part of users). Of interest, in 2009, a special section of the *Communications of the Association for Information Systems* (CAIS) was devoted to the topic of Persuasive Technology with calls for future research into how users can be persuaded in an IT context. It was noted that “[D]espite the fact that attitudinal theories from social psychology have been quite extensively applied to the study of user intentions and behavior, these theories have been developed for predicting user acceptance of the information technology rather than for providing systematic analysis and design methods to develop persuasive software solutions” ([3], p. 486). More recently, other researchers (e.g., [8–11]) have introduced multiple constructs that could contribute to a better appreciation of persuasion through design. These include Inspiration in

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E-mail addresses: [cyr@sfu.ca](mailto:cyr@sfu.ca) (D. Cyr), [headm@mcmaster.ca](mailto:headm@mcmaster.ca) (M. Head), [e.t.lim@unsw.edu.au](mailto:e.t.lim@unsw.edu.au) (E. Lim), [agnis@mit.edu](mailto:agnis@mit.edu) (A. Stibe).

that the website evokes a positive purpose; Design Aesthetics; Unobtrusiveness and the system's ability to fit with the user environment; Social Influence, among others. Yet, the applicability of these constructs has generally not been empirically validated. Consequently, to fill this knowledge gap, the current investigation explores how an IT artifact fosters online persuasion.

For this study, we build on the ELM as developed by Petty and Cacioppo [12,13] to support our research model. Although originally applied to consumer behavior before the Internet, the ELM has been employed in online contexts such as user responses to online advertising [14,15]. The basic premise of the ELM is that persuasion may be induced through a central route based on the strength of arguments presented in a message or a peripheral route based on cues such as attractiveness of the message source. The extent to which individuals choose to scrutinize the information provided from each route is based on their state of "elaboration likelihood." In high elaboration likelihood states, individuals are likely to engage in scrutiny or thoughtful processing of an *informational message* – so much so that they are more inclined to be persuaded by argument quality than by peripheral cues. By contrast, those in low elaboration likelihood states (i.e., lacking the ability or motivation to deliberate thoughtfully) tend to be motivated by peripheral cues. In this study, peripheral cues take the form of design elements that appear on a website such as *image appeal*, *navigation design*, *social presence*, or *connectedness* with others on the website. Peripheral cues will thus exert a stronger influence on attitude change or persuasion when individuals are in low elaboration likelihood states than if they are in high elaboration likelihood states. An interesting caveat to the ELM, and pertinent to this study, is that an individual's motivation determines the elaboration likelihood, which is described in the ELM as level of involvement [12]. Those with high motivation and ability (e.g., involved and having prior knowledge of the persuasive issue) adopt the central route to persuasion and rely on the quality of arguments presented about the topic for persuasion. In contrast, those who are unmotivated (e.g., uninvolved and having little or no prior knowledge of the issue) tend to rely on peripheral routes to persuasion.

Although the ELM has distinction and longevity, criticisms have surfaced regarding the descriptive nature of the theory, the simplicity of the dual channels (e.g., central and peripheral routes), and the outcomes of mediating variables as previously investigated [16]. Petty and Cacioppo's [12] method to determine involvement has also been questioned, in which the expectation of receiving a gift for correct recall of a product was meant to indicate subjects were highly involved with the product [12]. Others have suggested the model fails to adequately explain the relationships and conditions of the persuasive process, and how these processes might vary [17]. Further, the nature of the dual paths to persuasion has been questioned since ELM was introduced, based on an early assumption that message recipients were not able to process peripheral cues and arguments simultaneously [18]. While this argument has softened, and a Dual Mediation Model demonstrated that central and peripheral processing routes are not mutually exclusive [19], an in-depth appreciation of how this duality works is still not well understood.

Returning to how the ELM might operate in an online context, SanJose-Cabezudo et al., [15] found that for highly involved users exposed to serious versus amusing online advertising, there is evidence of a combined influence of central and peripheral routes. The presentation of the website (e.g., serious or amusing) is specifically identified as the peripheral cue for the user. As one conclusion of their investigation, the researchers call for additional work to probe "...not only exchanges in the routes but also the possibility of a joint or combined influence such that one route – the peripheral – might enhance the effects of the other – the central." ([15], p. 306) A second conclusion is that in the context of the ELM, researchers should consider the qualitative effect of motivation (which can be involvement) to determine which advertising stimuli are most effective. In this vein, Flavian Blanco et al. [14] did examine the combined effects of an online product image and text

information on users' recall and perception of quality of the product information. They also examined the moderating effects of familiarity of the user with the type of products on the website and found that familiarity moderates the relationship between presentation mode and user recall. But at the same time, the authors acknowledged that some of their findings were unexpected. Specifically, they found that participants who were less familiar with a type of product perceived a higher quality of information when there was no product picture. Although the ELM was not applied in their study, these findings run counter to the model. In sum, Flavian Blanco et al. [14] noted they can extract no firm conclusion from their results and called for further research to explain this phenomenon.

Against this backdrop of controversial findings, the current research aims to explore the ELM in an online context to understand how different antecedents, reflecting different routes to persuasion, influence change in user involvement and attitude change. More specifically we

- (1) Simultaneously examine the impact of argument quality (a central cue) compared with multiple design elements and connectedness (peripheral cues) to determine the relative impact of each cue on a user's change in issue involvement, ultimately leading to attitude change.
- (2) Focus on issue involvement as part of the ELM with a goal to explore whether a *change* in issue involvement matters and is a mediator between central and peripheral cues and attitude change.
- (3) Investigate whether prior knowledge acts not only as a moderator on argument quality but also more uniquely on design elements and connectedness. As a further analysis, we explore if there are any differences for users who are either high or low in knowledge of the persuasion topic.

To understand the phenomena as outlined above, data are collected in two ways. Survey data are used to model the proposed relationships. Additionally, qualitative data are collected in the form of user comments related to their persuasive experience.

## 2. Theoretical background and research model

### 2.1. The Elaboration Likelihood Model (ELM)

The ELM is a dual process theory of attitude formation and change resulting in persuasion outcomes. Attitudes are formed and modified as individuals obtain and process information related to the type of information they receive, and the cognitive energy each decides to expend to process that information [13]. As briefly outlined in the introduction, elaboration likelihood is an important aspect of the ELM whenever individuals scrutinize and pay attention to issue-relevant arguments. Those with interest in a topic will most probably take the time to read and process the informational arguments presented. By contrast, those who are less interested will make judgments based on less elaboration and will seek cues to guide attitude formation. When elaboration is high, an individual gravitates toward the central route of persuasion through arguments. When elaboration is low, a peripheral route is preferred [13].

From an online design perspective, Oinas-Kukkonen and Harjumaa [3] proposed the key to persuasion is to better understand both direct and indirect routes to persuasion. Some researchers have proposed that a website can persuade by inspiring positive motivation (e.g., [3,20,21]), offering visual and aesthetic cues [22], or providing social support [8,9,23]. Despite this, there are relatively few studies that have empirically investigated the role of design (the peripheral route) related to persuasion and attitude change, or in the context of the ELM. One exception, SanJose-Cabezudo et al. [15] tested the content (direct route) and the format (indirect route) of a fictitious travel website to examine user perceptions of advertising effectiveness. Website content referred to information as presented on the website (e.g., concerning

the company's prices, products, and availability). Using the ELM in their investigation, the authors indicated that website content is synonymous with direct arguments for persuasion because its elaboration requires thoughtful processing. Alternately, peripheral cues differ from the message arguments, as they were not issue or product relevant and were instead more related to the affective or emotional states experienced by users in the context of persuasion. Design elements are the substance of these peripheral cues, and users are not required to exert too much effort to process them. Specifically, the research manipulated elements of design such as font type, photographs, and images to impart an impression that the website was either serious or amusing. The authors concluded that in an online context, and contrary to the original ELM, not only one route but both central and peripheral routes "act jointly and significantly to impact attitudes and intentions in individuals' behavior" ([15], p. 306). This is an important finding and leads us to believe that both direct and indirect routes to persuasion should be tested simultaneously as in the present research.

Design elements take many forms. In the current investigation, we draw on Fogg's [2] "triad" of elements that he advocates contribute to online persuasion. This includes tools to increase capability; media that can be symbolic and sensory such as "text, graphics, charts, and icons" ([2], p. 25) and social actors who create relationships with the user and provide social support. These dimensions further resonate with persuasive design elements proposed by Allammad and Gulliver [8,9], which are website usefulness and ease-of-use; the presence of visually appealing stimuli; social support; and the presence of dialog to provide feedback to consumers. Building on the preceding, in this study, we chose design elements that have been previously tested. This includes Navigation to enhance capability through usefulness and ease-of-use [24,25]; Image Appeal to evoke a sensory and aesthetic visual experience for the user [26,27]; Social Presence, which is associated with the warmth and sociability of the website's design [28,29]; and Connectedness, which is likewise aligned to social support [30,31]. It should be noted that in all cases, the design elements and Connectedness are *perceived* by the user rather than objective. For example, for Connectedness, this is based on the perception by the user that he or she feels a benefit from input from the community on the persuasive website, rather than any actual content feature.

As outlined in the introductory section, involvement is a form of motivation in the ELM and serves as a determinant as to whether attitude change occurs through the central or peripheral routes [13]. Further, consistent with Beatty et al. [32] and as an extension to the ELM, we test the mediating role of change in issue involvement between the central and peripheral routes to persuasion and attitude change by the user toward the persuasive issue. We are unaware of any prior empirical investigation in which issue involvement is investigated concurrently with both argument quality (the central route) and website design features and connectedness (peripheral routes). In most studies on attitude change, issue involvement is artificially manipulated and has been "criticized for the difficulty it poses in confirming that the manipulation actually took effect and the respondent takes on the prescribed involvement" ([33], p. 353). Therefore, in this study, we attempt to circumvent this issue by assessing user involvement prior to and following review of a website and to determine change in issue involvement.

Finally, prior expertise or experience constitutes part of the ELM concerning how elaboration likelihood occurs. Those knowledgeable in the issue for persuasion are more likely to thoughtfully consider arguments (in this case on a website) than pay attention to peripheral cues. The opposite applies to non-experts and those who are less knowledgeable. Of interest in this research is whether a user's level of prior knowledge of the persuasion issue will moderate both central and peripheral cues leading to change in issue involvement and ultimately to attitude change. As there is evidence that prior knowledge can affect business relationships and perceptions [34,35], we additionally test the relationship of prior knowledge directly to attitude change.

## 2.2. Toward a research model of online persuasion

Related to the preceding discussion, we construct a research model as depicted in Fig. 1 to assess the relative impact of Argument Quality, Design (Image Appeal, Navigation Design, Social Presence), and Connectedness on Change in Issue Involvement. In addition, we are also interested to investigate whether Change in Issue Involvement will mediate the effect of Argument Quality, Design Elements, and Connectedness on Attitude Change. Prior Knowledge will be tested for its moderating influence on Argument Quality, the Design Elements, as well as on Connectedness. We also test the direct path of Prior Knowledge to Attitude Change.

Attitude Change was chosen as the endogenous variable in our proposed model because attitudes are formed and altered when information is processed – and traditionally attitude change has been associated with persuasion using the ELM [13]. Moreover, aligned to the original ELM [13], and the ELM in a website environment [15,36], issue involvement is part of our model, and more particularly, we examine the role of change in issue involvement. Prior knowledge was chosen as a moderator in our model, building on Flavian Blanco et al. [14], who examined the moderating effect of familiarity by users of products presented online on website effectiveness. As already outlined, the level of knowledge or expertise is also part of the original ELM and contributes to the degree of elaboration likelihood and has been associated with attitude.

Building on the ELM, Argument Quality has already been solidly established as a central route of persuasion as provided by written content and messages and is thus included as an independent variable. As already outlined, design elements chosen are Image Appeal, Navigation, Social Presence, and Connectedness as tested in prior design research and supported by others studying online persuasion (e.g. [2,8,9]). An elaboration of constructs contributing to our model follows in subsequent sections.

## 3. Hypotheses development

### 3.1. Relationship between change in issue involvement and attitude change

As outlined in the introductory section, involvement is a form of motivation in the ELM and persuasive mechanisms (e.g., peripheral or central routes) lead directly to attitude change [13]. Issue involvement influences commitment [32,37]. Persuasion is the modification of a private belief or attitude based on the interpretation of a message [2]. A socio-technical information system such as a website has the potential to change, alter, or reinforce attitudes [7]. In line with the classic ELM [13], and ELM in a website environment [15,36], issue involvement will influence a user's attitude toward the topic of persuasion.

Although to date, research has examined the effect of issue involvement on attitude change, we expect the route to persuasion to be more complicated. A more nuanced perspective may depend on a user's original position, and the changes in issue involvement that occur when information (in our case from both central and peripheral routes) is presented on a website. In part, we base this assumption on work by SanJose-Cabezudo et al. [15] who studied high involvement only in an online context and concluded: "The ELM should consider the effect of the qualitative dimension of motivation toward the medium. Individuals' behavior patterns will impact their responses to advertising; that is, it will determine which advertising stimuli prove more effective." (p. 306). In ELM, motivation is the level of user involvement. For instance, individuals who are unsure about an issue will often seek input from others, and depending on the information provided, this may help to change one's level of involvement with the issue. In our web context, argument quality, design elements, and connectedness may serve to provide such input, and it is of interest to explore how this results in change in issue involvement leading to attitude change. The preceding leads us to propose our first hypothesis:

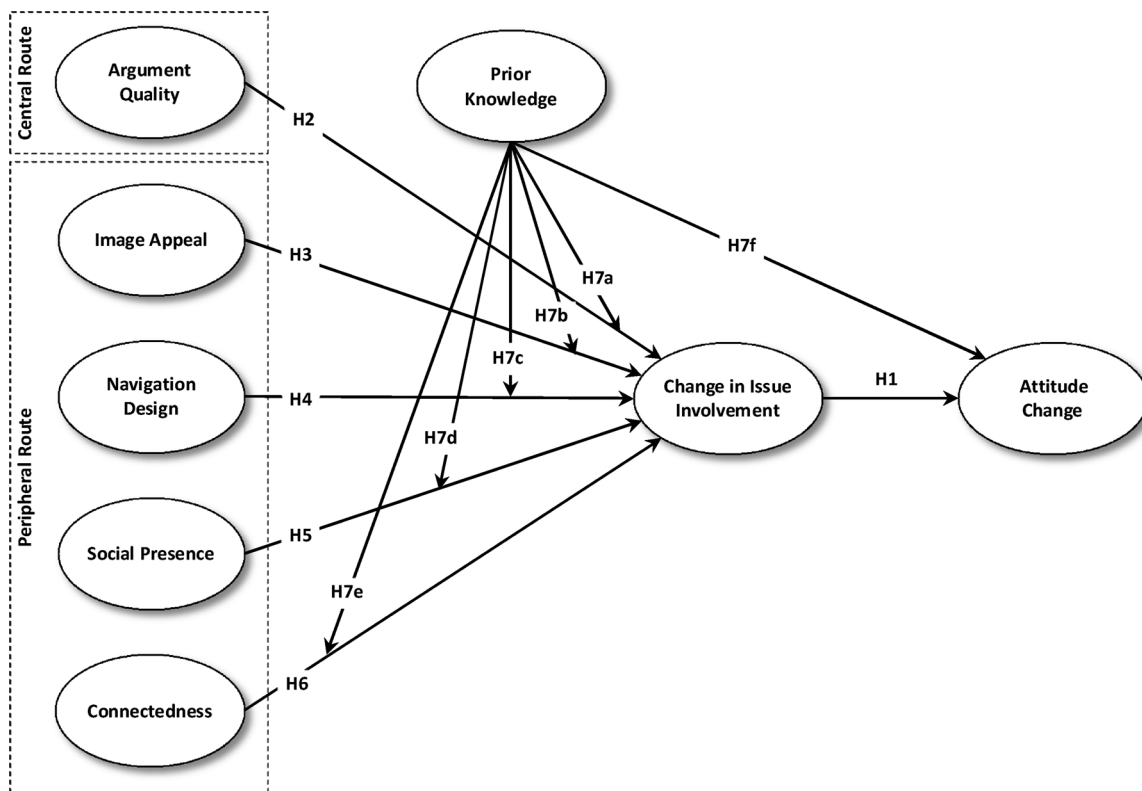


Fig. 1. Research Model of Online Persuasion.

**H1.** Change in Issue Involvement positively influences Attitude Change.

### 3.2. Relationship between argument quality and change in issue involvement

In a website context, the quality of information is important to users and has an impact on user attitudes, involvement, and behavior. In e-commerce, “[C]ustomers dissatisfied with web site information contents will leave the site without making a purchase.” ([38], p. 308) The appropriateness and completeness of information are precursors to perceptions by the user of website usefulness [39], trust [24,40,41], satisfaction [41,42], and level of involvement [37].

Related to the ELM, Argument Quality is a central route based on the strength of the arguments and it is related to the users’ involvement with the topic of persuasion. Depending on the users’ perceived quality of the arguments on the website, users may be swayed to change their level of issue involvement. This in turn can result in a change in attitude toward the persuasion topic [36]. Angst and Agarwal [33] applied the ELM to examine individual persuasion in the adoption of electronic health records. These researchers were particularly interested to determine how argument framing and issue involvement interact to influence individual persuasion when privacy concerns prevail. They discovered that a person’s concern for information privacy is a function of argument framing and issue involvement, which in turn affects attitudes toward the use of electronic health records. Although not the identical construct, we are interested in examining if Argument Quality will similarly affect a user’s level of issue involvement, eventually leading to attitude change.

In the current study, after browsing a website about the controversial Keystone XL pipeline, users are asked if they find the topic interesting, involving, and personally relevant. On the continuum of elaboration likelihood, user involvement with the persuasive topic will occur in varying degrees. Further, if users are involved initially, but after browsing the website they find the arguments about the pipeline uninteresting or inadequate, then we propose this may result in a

change in issue involvement. The user may become less engaged with the topic, or even disillusioned. In turn, this will affect attitudes about whether construction of the pipeline is desirable. Alternately, if users have more limited involvement with the issues on the Keystone XL pipeline but perceive the arguments on the website as interesting or convincing, then they may also have a change in issue involvement to be more supportive of the pipeline. Based on the preceding, we propose:

**H2.** Argument Quality positively influences Change in Issue Involvement.

### 3.3. Relationship of design elements (ELM peripheral route) on change in issue involvement

As already outlined, design elements have the potential to persuade users in an online setting. In the ELM, peripheral cues will be particularly influential on attitude change when elaboration likelihood is low and users have a lesser state of involvement with the persuasion topic. However, as with argument quality, issue involvement based on peripheral design cues will be relative and can be changed by user perceptions of a design element. In turn, if users find the design element useful (i.e., navigation), attractive (i.e., image appeal), and exuding warmth (i.e., social presence), then this may result in a change in issue involvement, ultimately leading to attitude change. Each of the design elements will be discussed in greater detail in the sections below.

#### 3.3.1. Image appeal

The visual design of a website is important because it improves website aesthetics and emotional appeal [43–45], which in turn may culminate in positive attitudes [20,46] or trust [26,27]. Visual design encompasses elements such as images, photographs, colors, shapes, or font types [43]. A combination of product pictures and information on a website improves user recall better than text alone [47].

Lehto et al. [22] found that design aesthetics significantly impacted website credibility resulting in perceived persuasion. According to

Borchers [48], images are used to persuade. For example, political advertising often provides a picture of a candidate's supporters as a mix of sexes, races, religions, and ages – suggesting through images that these various groups are likely to support the candidate. Images function to “attract our attention and make emotional appeals...and serve as proof for a persuader's message.” ([48], p. 157) In the current research, we choose to focus on Image Appeal as one aspect of visual design of websites. More specifically, we adopt a construct from Cyr et al. [27] for Image Appeal in which images on the website are perceived to be appropriate, satisfying, and appealing. In the case of the Keystone pipeline, a picture of a rally shows people with placards supporting the project. Additional information using images appears as a map depicting where the pipeline will go, or images of a refinery. We expect that if a user finds the images on the website useful and convincing, then he or she may experience a change involvement in terms of support of the project, which will further affect whether one is persuaded to favor the pipeline or not. Based on the preceding:

**H3.** Image Appeal positively influences Change in Issue Involvement.

### 3.3.2. Navigation design

Navigation design refers to the navigational scheme employed to help users as they access different sections of a website [43,49]. This could include whether text is horizontal or vertical, and the number of drop-down menus or submenus. Without a clear and facilitated path to information, users become lost within the Web structure [50]. Well-designed navigation schemes save time for online consumers leading to trust [25,51] and satisfaction [24,52]. In the current study, Navigation Design refers to ease of use and navigation of the website.

In the case of the Keystone XL pipeline website, navigation is a peripheral cue which facilitates user access to information and other features. To understand how Navigation influences Issue Involvement, we examined the ease of access to website features. On the Keystone XL website, navigation appears straightforward with easy access to information using pull-down menus. As users access information or other data on the website, this is expected to affect involvement in the pipeline issue with potential to change the level of issue involvement. Hence, our next hypothesis:

**H4.** Navigation Design positively influences Change in Issue Involvement.

### 3.3.3. Social presence

Social Presence is defined as “the extent to which a medium allows users to experience others as being psychologically present” ([53]p. 11). Based on prior research (e.g. [28,53]), in the current investigation Social Presence refers to a website for which users perceive it to have a sense of human contact, personalness, sociability, as well as human warmth and sensitivity. In the context of hedonic consumer interactions, perceived social presence has received considerable attention as an antecedent to online consumer enjoyment and trust (e.g. [28,29]), website involvement [54], and utilitarian outcomes such as perceived usefulness or effectiveness [29].

Website design features that facilitate social presence include socially rich text content, personalized greetings [53], human audio [55], or human video [56]. Gefen and Straub [53] suggested that pictures and text can convey personal presence in a manner same as that of personal photographs or letters. Hassanein and Head [29] demonstrated that emotive text and pictures of humans result in higher levels of perceived social presence for websites. On the Keystone XL website, social presence is represented using photos of people and personalized comments about the pipeline as if others are present.

According to Fogg [2], “simply having physical characteristics is enough for a technology to convey social presence” (p. 92), and he suggests “that a more attractive technology (interface or hardware) will have greater persuasive power” [2] and social influence. As such, users

can be persuaded by the perceived level of social presence on the Keystone XL pipeline, which in turn can impact user involvement with the topic. This leads to the following hypothesis:

**H5.** Social Presence positively influences Change in Issue Involvement.

### 3.4. Connectedness (ELM peripheral route) on change in issue involvement

With the rapid expansion of social media, online users increasingly expect to engage and connect with others on a website or other digital medium. The presence of social elements on websites plays a role in how users experience connectedness in online environments [11]. In a consumer-driven context, researchers have suggested that online interactivity including connectedness aids vendors in cultivating good customer relationship [57] and converts website visitors into loyal customers [30]. In online social networks perceptions of user “closeness” resulted in trust [58]. Aligned to Cyr et al. [30] and Lee [31], in the current study, Connectedness refers to the extent to which website visitors perceive to share views, acquire benefits from the community of visitors, and share a common bond.

Connectedness can help to involve or persuade the user. Fogg [2] outlined that connectedness can “provide better information, can leverage social influence strategies, and can tap into group-level intrinsic motivators.” (p. 195) In the case of the Keystone XL pipeline, connectedness can assist users to be influenced by others' comments on the website, and through a perception of connectedness with those others. On the Keystone XL website, this is achieved by a blog, Twitter feeds, and a Question and Answer section. As users learn about the pipeline through these various sources, it is expected that their level of involvement with the pipeline project may change. Thus, we propose:

**H6.** Connectedness will positively influence Change in Issue Involvement.

### 3.5. Moderating effects of prior knowledge on argument quality and the design elements

As part of the ELM, expertise or prior knowledge influences the likelihood of elaboration with the topic of persuasion [12]. In research that examined the role of user expertise, it was discovered that expertise moderates the effect of argument quality on perceived usefulness, which is an attitudinal construct [59]. In the current investigation, we are interested to explore the degree to which prior knowledge moderates the relationship of argument quality (the central route), design elements (e.g., Image Appeal, Navigation, and Social Presence), and Connectedness with our dependent variable of Change in Issue Involvement. In line with Alba and Cooke [35], we expect that depending on a user's prior knowledge this will affect perceptions of the stimulus on the website (in this case regarding the Keystone XL pipeline), which can potentially affect changes in user involvement with the persuasive topic. This expectation is represented in the following hypotheses:

**H7a–e.** Prior Knowledge will attenuate the relationships of Argument Quality (H7a), Image Appeal (H7b), Navigation Design (H7c), Social Presence (H7d), and Connectedness (H7e) with Change in Issue Involvement.

Familiarity or prior knowledge can influence online business-to-consumer relationships [34] and decision-making [60]. Familiarity can also affect user perceptions of product attributes and the users' sensitivity to the stimulus context [35]. As an intrinsic attribute of the user before exposure to our treatment, we are also interested to determine if prior knowledge influences receptivity of the user to changing opinions or attitudes. We explore this relationship in our final hypothesis:

**H7f.** Prior Knowledge will positively influence Attitude Change.

## 4. Methodology

### 4.1. Participants

Participants were recruited by a market research firm with access to a broad pool of participants in Canada and the United States. This was a balanced stratified sample with the following profile: all respondents were over the age of 18 years and consisted of 52.3% males (or 47.7% females), with 77.7% having a college education or higher. There were 403 completed survey responses.

### 4.2. Experimental task and design

The purpose of this investigation is to better understand how website design features and social elements may persuade individuals to alter their involvement and attitudes toward an issue. We selected the Keystone XL oil pipeline as our experimental topic. At the time of data collection in 2015, the Keystone XL oil pipeline was a contemporary topic that had received substantial coverage in the news in both Canada and the United States. It was relevant to citizens of both countries and included a certain degree of controversy without extreme polarization (e.g., which may be the case with issues of abortion, drug legalization, or cloning). Consequently, it was considered a suitable topic with relevance and some level of awareness among our target population, as well as being susceptible to issue involvement change and attitude change. More specifically, the <http://www.keystone-xl.com> website<sup>1</sup> was chosen as our experimental website due to incorporation of elements of argument quality, design features, and social elements as identified for investigation.

Qualifying participants (over the age of 18 years and living in Canada or the United States) were first asked to read and agree to an ethics consent form before proceeding further. Next, participants were asked about their knowledge, attitudes, and involvement with the Keystone XL oil pipeline issue.<sup>2</sup> Refer to [Appendix A](#) for items in these three categories, as well as the other constructs tested in this study. Except for Attitude Change, all items in the survey were constructed as agree–disagree statements on a seven-point Likert scale. Following the pre-test items for knowledge, attitudes, and involvement, participants were directed to the Keystone-XL.com website where they were asked to take their time to thoroughly browse the website. Only those participants who spent a minimum of 15 min completing the study (browsing the website and answering the survey questions) were included in our data analysis. Once participants completed their browsing of the Keystone XL website, they were asked three content-specific questions as a manipulation check to ensure attention was paid to the website. Only those participants who correctly answered all three questions were permitted to proceed to the survey questions.

In the online survey, participants responded to previously validated items for Argument Quality, Image Appeal, Navigation Design, Social Presence, and Connectedness. Participants were again asked about their involvement and attitudes related to the Keystone XL pipeline to determine their potential change in these constructs after viewing the website. Further, at the end of the survey open-ended questions were used to gather additional information from participants about their experience of the website. Refer to [Appendix B](#) for these questions. Change in Issue Involvement and Attitude Change was derived from

<sup>1</sup> Note that this was a live website, and data were collected in 2015. As such, the website may have changed since that time. However, of interest is the user's perception of the website rather than absolute characteristics.

<sup>2</sup> Angst and Agarwal [33] outlined that in most studies of attitude change, issue involvement is artificially manipulated by providing respondents with a description as to how much or little they will be impacted by a decision in the future. As indicated before, this approach has been criticized. In our study, we aim to circumvent this issue by determining a respondent's issue involvement prior to exploring a website on the topic of persuasion, and again after they have reviewed the website.

taking the difference between pre- and post-individual scores. Finally, participants were asked questions pertaining to their demographics. The average completion time for the experiment (website browsing and survey questions) was approximately 29 min.

## 5. Test of measurement model

### 5.1. Common method bias

Common method bias may occur when both the independent and dependent variables are collected at the same time and from the same source [61]. To assess common method bias, the Harman's one-factor test [61] was conducted. An exploratory factor analysis was run on the items in our measurement model. The results yielded 7 factors with eigenvalues greater than 1.0, which accounted for 78.6% of the total variance. The first factor captured 40.3% of the variance in the data (below the 50% threshold as recommended [62]).

We also applied the marker variable technique to further test for CMB [63]. A marker variable (Design Aesthetic) was implemented in the study that was theoretically unrelated to at least one other variable in the study (Navigation Design). CMB can be assessed based on the correlation between the marker variable and the theoretically unrelated variable [64]. This value (0.009) was assumed as the method variance was parceled out from the other correlations, and the analysis was rerun. The results indicate no significant difference between the original correlation estimates and the adjusted ones. Given the results of the Harman's one-factor test and the marker variable test, we conclude that common method bias is not substantial in our data and, therefore, is not likely contaminating the results.

### 5.2. Content and construct validity

Content validity reflects how representative and comprehensive the measurement items are in the latent constructs, when constructs should draw representative items (questions) from a universal pool [65,66]. In this study, survey items ([Appendix A](#)) were adapted from previously validated work on issue involvement [67], attitude change [33], prior knowledge [59], argument quality [59], image appeal [27], navigation design [24,68], social presence [28,53], and connectedness [30,31]. Therefore, content validity for these constructs was ascertained through prior research [69].

A PLS approach to confirmatory factor analysis (CFA) was utilized to assess the psychometric properties of the multi-item constructs as outlined by Gefen and Straub [68]. This approach is well suited for studies when constructs have been validated in prior work. The complete cross-loading matrix is provided in [Table 1](#). When utilizing the PLS CFA approach to assess discriminant validity, Gefen and Straub [70] recommend that the factorial loadings of measurement items on their respective latent constructs should exhibit an order of magnitude larger than their loadings on other constructs. As shown in the cross-loading matrix, this recommendation for discriminant validity is satisfied.

Further assessment of discriminant validity examines interconstruct correlations whereby Fornell and Larcker [71] recommended that the correlation between any two constructs should be lower than the square root of the average variance shared by items within a construct. As shown in [Table 2](#), this criterion is also satisfied.

Construct validity assesses the extent to which a construct measures the variable of interest and whether “the measures chosen ‘fit’ together in such a way as to capture the essence of the construct” ([72], p. 388). [Table 2](#) summarizes the construct validity criteria for our reflective constructs. Cronbach's alpha values ranged from 0.699 for Attitude Change to 0.949 for Social Presence and are within acceptable ranges in accordance with Rivard and Huff [73], who advocated that this measure for reliability should be higher than 0.5, and ideally, higher than 0.7. Similarly, the composite reliability of each construct exceeds the

**Table 1**  
Factorial Loading and Cross-Loading Matrix.

	Argument Quality (AQ)	Change in Attitude (ATT <sup>†</sup> )	Connectedness (CO)	Image Appeal (IA)	Change in Issue Involvement (II <sup>†</sup> )	Navigation Design (ND)	Prior Knowledge (PK)	Social Presence (SP)
AQ-1	<b>0.935</b>	0.227	0.396	0.641	0.386	0.558	-0.134	0.504
AQ-2	<b>0.963</b>	0.266	0.456	0.657	0.421	0.578	-0.115	0.538
AQ-3	<b>0.933</b>	0.264	0.479	0.649	0.382	0.499	-0.132	0.548
ATT-1	0.251	<b>0.825</b>	0.126	0.133	0.263	0.076	-0.195	0.081
ATT-2	0.173	<b>0.783</b>	0.080	0.097	0.141	0.069	-0.132	0.076
ATT-3	0.188	<b>0.747</b>	0.083	0.189	0.240	0.092	-0.183	0.165
CO-1	0.314	0.084	<b>0.831</b>	0.473	0.290	0.371	0.003	0.433
CO-2	0.479	0.140	<b>0.922</b>	0.563	0.348	0.383	-0.030	0.447
CO-3	0.437	0.108	<b>0.889</b>	0.556	0.330	0.379	0.004	0.482
IA-1	0.651	0.190	0.438	<b>0.817</b>	0.331	0.475	-0.036	0.604
IA-2	0.626	0.166	0.514	<b>0.880</b>	0.357	0.505	-0.018	0.676
IA-3	0.526	0.167	0.595	<b>0.838</b>	0.317	0.420	0.019	0.661
IA-4	0.601	0.161	0.505	<b>0.894</b>	0.346	0.492	-0.024	0.655
IA-5	0.556	0.137	0.476	<b>0.840</b>	0.314	0.563	-0.056	0.686
IA-6	0.514	0.113	0.538	<b>0.791</b>	0.305	0.390	0.025	0.641
II-1	0.369	0.279	0.283	0.352	<b>0.862</b>	0.231	-0.367	0.295
II-2	0.358	0.241	0.332	0.323	<b>0.869</b>	0.277	-0.276	0.244
II-3	0.320	0.195	0.307	0.294	<b>0.760</b>	0.295	-0.267	0.247
ND-1	0.494	0.055	0.381	0.483	0.277	<b>0.943</b>	0.049	0.427
ND-2	0.529	0.097	0.414	0.524	0.316	<b>0.961</b>	0.039	0.489
ND-3	0.602	0.132	0.407	0.573	0.301	<b>0.910</b>	0.005	0.525
PK-1	-0.104	-0.203	-0.017	-0.014	-0.332	0.041	<b>0.906</b>	-0.033
PK-2	-0.122	-0.196	-0.004	-0.027	-0.349	0.044	<b>0.918</b>	-0.027
PK-3	-0.145	-0.222	-0.005	-0.008	-0.334	0.005	<b>0.937</b>	-0.040
SP-1	0.514	0.099	0.446	0.663	0.264	0.521	-0.013	<b>0.882</b>
SP-2	0.513	0.098	0.416	0.695	0.240	0.462	-0.014	<b>0.893</b>
SP-3	0.502	0.157	0.453	0.693	0.277	0.458	-0.024	<b>0.927</b>
SP-4	0.512	0.142	0.489	0.728	0.311	0.469	-0.049	<b>0.934</b>
SP-5	0.520	0.141	0.523	0.740	0.331	0.441	-0.055	<b>0.919</b>

<sup>†</sup>Changes in Attitude and Issue Involvement were computed as the difference between pre- and post-manipulation assessments.

**Table 2**  
Inter-Construct Correlation Matrix [Sample N = 403].

	Average Variance Extracted (AVE)	Composite Reliability	Cronbach's Alpha	AQ	ATT <sup>†</sup>	II <sup>†</sup>	CO	IA	ND	PK	SP
Argument Quality (AQ)	<b>0.891</b>	<b>0.961</b>	<b>0.939</b>	<b>0.944</b>							
Change in Attitude (ATT <sup>†</sup> )	<b>0.617</b>	<b>0.828</b>	<b>0.699</b>	0.268	<b>0.786</b>						
Change in Issue Involvement (II <sup>†</sup> )	<b>0.692</b>	<b>0.870</b>	<b>0.776</b>	0.420	0.289	<b>0.832</b>					
Connectedness (CO)	<b>0.777</b>	<b>0.913</b>	<b>0.856</b>	0.470	0.127	0.367	<b>0.881</b>				
Image Appeal (IA)	<b>0.713</b>	<b>0.937</b>	<b>0.919</b>	0.688	0.185	0.390	0.604	<b>0.844</b>			
Navigation Design (ND)	<b>0.880</b>	<b>0.957</b>	<b>0.932</b>	0.578	0.102	0.318	0.428	0.562	<b>0.938</b>		
Prior Knowledge (PK)	<b>0.847</b>	<b>0.943</b>	<b>0.909</b>	-0.134	-0.225	-0.368	-0.010	-0.018	0.032	<b>0.920</b>	
Social Presence (SP)	<b>0.830</b>	<b>0.961</b>	<b>0.949</b>	0.562	0.141	0.316	0.515	0.774	0.514	-0.036	<b>0.911</b>

Note: Square roots of Average Variance Extracted (AVE) are displayed diagonally and should exceed the interconstruct correlations below and across them for adequate discriminant validity. <sup>†</sup> Changes in Attitude and Issue Involvement were computed as the difference between pre- and post-manipulation assessments.

recommended threshold of 0.7 [72], and the average variance extracted (AVE) of each construct exceeds the recommended 0.5 threshold [71]. Given the above assessment, we conclude that our instrument is of satisfactory construct validity.

**6. Test of structural model**

Structural Equation Modeling (SEM) was conducted using PLS, which is a component-based approach. PLS is appropriate for testing models/theories in the early stage of development [70,74,75]. In the absence of a lack of research concerning the role change in issue involvement, as well as how website design elements and connectedness influence persuasion, we deem PLS to be an appropriate technique. Table 3 provides a summary of the hypotheses and the results.

**6.1. Full sample results**

Fig. 2 depicts the analytical results of our model (n = 403), while

Table 4 details our findings. The R<sup>2</sup> value for Change in Issue Involvement is 0.357, while the R<sup>2</sup> value for Change in Attitude is relatively small at 0.099. However, this does not threaten the model's validity. This is very close to the recommended 10% benchmark [76,77], noting that Cohen ([78], p. 532–535) suggests that the amount of actual association between constructs is often greater than the proportion of variance accounted for by measuring R<sup>2</sup>. We appreciate that there may be other factors that can cause individuals to change their attitudes (beyond change in issue involvement and prior knowledge), but this falls outside the scope of our investigation. As such, this somewhat lower R<sup>2</sup> for our endogenous variable is neither surprising nor concerning.

Based on the results in Fig. 2, Hypotheses H1, H2, H4, and H6 are supported, H3 is marginally supported at the 0.10 level, and H5 is not supported. There is a highly significant relationship between Change in Issue Involvement and Attitude Change (p < .001). In addition, Argument Quality, Image Appeal, Navigation Design, and Connectedness positively influence Change in Issue Involvement. Social Presence was

**Table 3**  
Hypotheses Results.

Hypothesis	Results
H1: Change in Issue Involvement positively influences Attitude Change.	Supported (p < .001)
H2: Argument Quality positively influences Change in Issue Involvement	Supported (p < .05)
H3: Image Appeal positively influences Change in Issue Involvement.	Marginally supported (p < .1)
H4: Navigation Design positively influences Change in Issue Involvement.	Supported (p < .05)
H5: Social Presence positively influences Change in Issue Involvement.	Not supported
H6: Connectedness will positively influence Change in Issue Involvement.	Supported (p < .001)
H7a–e: Prior Knowledge will attenuate the relationships of Argument Quality (H7a), Image Appeal (H7b), Navigation Design (H7c), Social Presence (H7d), and Connectedness (H7e) with Change in Issue Involvement.	Supported for H7b (p < .05) and H7d (p < .05). Marginally supported for H7e (p < .1). Not supported for H7a and H7c.
H7f: Prior Knowledge will positively influence Attitude Change.	Supported (p < .05)

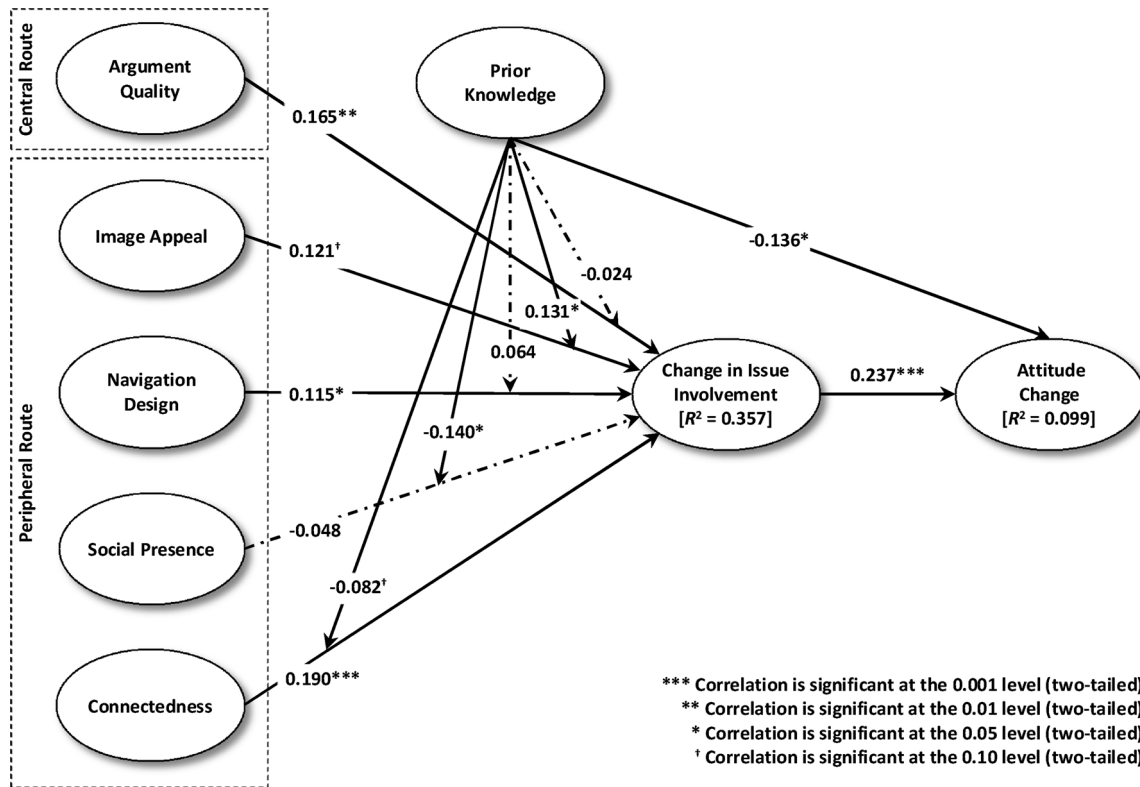


Fig. 2. Results from Structural Model Analysis [Sample n = 403].

the only design element for which the results were not significant.

As a further analysis, we examined the mediation effects. Change in Issue Involvement was proposed to mediate the effects between the central route (Argument Quality) and Change in Attitude, and between the peripheral route (Image Appeal, Navigation Design, Social Presence and Connectedness) and Change in Attitude. Table 5 shows the results of our Sobel tests of mediation. The Change in Issue Involvement mediation between Social Presence and Change in Attitude was not tested, as this was a nonsignificant relationship in our model. The relationship between the central route of Argument Quality and Change in Attitude is shown to be partially mediated through Change in Issue Involvement. The relationships between the peripheral routes (Image Appeal, Navigation Design, and Connectedness) and Change in Attitude are shown to be fully mediated through Change in Issue Involvement.

Hypothesis 7 tested the moderating effect of Prior Knowledge on Argument Quality, the design elements, and Connectedness. As documented in Table 4, Prior Knowledge does moderate Image Appeal (H7b), Social Presence (H7d), and Connectedness (H7e) to Change in Issue Involvement while Argument Quality (H7a) and Navigation Design (H7c) do not. The additional direct path of Prior Knowledge to

Attitude Change (H7f) is significant.

### 6.2. Post hoc analysis of low versus high prior knowledge groups

To gain a deeper understanding of the impact of prior knowledge, we divided our entire sample into two sub-samples: Low Prior Knowledge versus High Prior Knowledge respondents. Prior Knowledge is a three-item construct measured on a 7-point Likert scale, where 4 is the medium/average mid-point. To determine our low and high Prior Knowledge groups, we averaged the three construct items, used a median split approach (as per [14,15]), and removed all participants whose responses fell on the median.

Table 6 shows the results of our multiple linear regression analysis for the Low Prior Knowledge group (n = 249; F = 10.932) and High Prior Knowledge group (n = 126; F = 11.116), where the dependent variable is Change in Issue Involvement. For both Low and High Prior Knowledge groups, Argument Quality is important leading to Change in Issue Involvement, with this relationship stronger for the Low Prior Knowledge Group. In the Low Prior Knowledge group, Connectedness appeared important to users leading to Change in Issue Involvement,



**Table 4**  
Summary of Structural Model Analysis w/Prior Knowledge as Moderator [Sample n = 403].

Relational Path	Direct Path		Moderation of Prior Knowledge	
	B Coefficient	t-Statistic (Sig)	B Coefficient	t-Statistic (Sig)
Argument Quality → Δ Issue Involvement	0.165	2.565 (*)	-0.024	0.453 (n.s.)
Image Appeal → Δ Issue Involvement	0.121	1.651 (†)	0.131	1.967 (*)
Navigation Design → Δ Issue Involvement	0.115	2.064 (*)	0.064	1.123 (n.s.)
Social Presence → Δ Issue Involvement	-0.048	1.015	-0.140	2.087 (*)
Connectedness → Δ Issue Involvement	0.190	4.059 (***)	-0.082	1.673 (†)
Δ Prior Knowledge → Δ Attitude	-0.136	2.534 (*)		
Δ Issue Involvement → Δ Attitude	0.237	4.392 (***)	-	-

while for the High Prior Knowledge group, two design elements (Navigation Design and Social Presence) are significant predictors of Change in Issue Involvement.

6.3. Qualitative analysis

Several open-ended questions were asked at the end of the survey as outlined in Appendix B. The first question asked respondents to “elaborate why you changed or did not change your feelings about the Keystone XL oil pipeline.” Subsequent questions delved into the design and social elements of the website. These questions were asked to yield richer insights into participant views regarding the experimental website. The first broad question, in which respondents were asked why their attitudes may or may not have changed, was systematically analyzed using a grounded theory approach [79]. This is an inductive form of analysis, whereby the main objective is to formulate theory through the systematic gathering and analysis of qualitative data. The data are analyzed through a three-stage iterative process. In the first stage, respondent answers to the open-ended questions were reviewed, and open coding was used to identify shared characteristics and generate initial descriptive categories. The second stage consisted of scrutinizing the initially identified categories and integrating them into more centralized categories. One coder performed the first two stages to create a codebook that consisted of 10 centralized categories. This codebook was then utilized to code all open-ended comments by two independent coders. Our preliminary classification of the entire sample of 241 open-ended responses for the low prior knowledge group by the two coders was highly credible with an inter-rater reliability score of 0.90. Similarly, for the high prior knowledge group, our preliminary classification of the entire sample of 142 open ended responses was highly credible with an inter-rater reliability score of 0.88. Table 7 shows the 10 general categories that were identified as well as their frequency for low and high prior knowledge groups (example comments pertaining to these categories are provided in Appendix C). Only the cases where the two coders agreed on the classification are displayed and utilized in further analysis (n = 204 comments from the low prior knowledge group; n = 126 comments from the high prior knowledge group).

In the final stage, the employment of selective coding allowed the synthesis of the above categories into overriding themes [80]. The two coders had 100% consensus on the grouping of the 10 centralized categories into the 4 overriding themes below. These themes relate to our structural model in terms of both an emphasis on the ELM central route

for information, as well as for peripheral cues such as imagery and social cues such as connectedness.

- 1. Helpful new information:** Grouped categories 1 (provided new information), 5 (alleviated prior concerns), and 6 (stimulated interest to investigate further). This theme focused on the value of the information on the website that the participants were not aware of prior to the experiment. Generally, this new information changed their attitudes about the pipeline. Within this overriding theme, there was a subtle but clear distinction in the effect the new information had on participants. Some indicated the new information provided further understanding and helped answer questions. Representative quotes from this group include: “I was already knowledgeable about Keystone so the web site filled in some blanks”; “answered my questions on the route of the pipeline”; and “I am more aware of the environmental impact and the work that is being done by Keystone to minimize it.” However, another group of respondents focused on how new information spurred engagement and involvement with the pipeline issue and indicated their intention to further investigate this project. Representative quotes from this group that demonstrated increased issue involvement include: “I still having doubts on the oil leakage and jobs after – I intend on looking into this more to feel comfortable”; and “I found the website and information on the subject interesting and informative... I intend on looking into this more.” This latter group of participants who demonstrated increased issue involvement came predominately from the low prior knowledge group (26 respondents versus 5 respondents from the high prior knowledge group).
- 2. Information did not change pre-existing view:** Grouped categories 2 (reinforced prior knowledge), 8 (did not alleviate prior concerns), and 10 (no interest in topic). This theme focused on the website information not altering participants prior attitudes about the pipeline. The website information may have confirmed their prior knowledge and/or did not impact their prior perspectives. Sample quotes from this theme include: “The information on the website confirmed my previously held knowledge and opinions”; “I didn’t read anything that alleviated my concerns regarding a potential spill”; and “I still don’t care, sorry.”
- 3. Influence of website imagery and human focus:** Grouped categories 4 (people-focused stories), 7 (expert evidence), and 9 (website visuals). This theme centered on the influence of website imagery and human connection. The human connection was

**Table 5**  
Mediation Effects.

IV	Mediator	DV	Direct path (no mediation)	Direct path (with mediation)	Sobel Stat.	Prob.	Mediation
AQ	Δ II	Δ ATT	0.266	0.179	3.39	< 0.001	Partial
IA	Δ II	Δ ATT	0.194	0.088	4.02	< 0.001	Full
ND	Δ II	Δ ATT	0.112	0.012	4.03	< 0.001	Full
CO	Δ II	Δ ATT	0.129	0.025	4.32	< 0.001	Full

**Table 6**  
Summary of Multiple Linear Regression Analysis for Low and High Prior Knowledge Groups.

Independent Variable <sup>a</sup>	Low Prior Knowledge [n = 249]			High Prior Knowledge [n = 126]		
	Beta	t-value	Sig. <sup>b</sup>	Beta	t-value	Sig. <sup>b</sup>
Argument Quality	0.211	2.623	<b>0.009 (**)</b>	0.276	2.292	<b>0.024 (*)</b>
Image Appeal	0.112	1.060	0.290 (ns)	0.194	1.267	0.208 (ns)
Navigation Design	0.001	0.017	0.986 (ns)	0.252	2.308	<b>0.023 (*)</b>
Social Presence	-0.030	-0.330	0.742	-0.240	-1.908	<b>0.059 (†)</b>
Connectedness	0.209	2.854	<b>0.005 (**)</b>	0.128	1.300	0.196 (ns)

<sup>a</sup> Dependent variable is Change in Issue Involvement.

<sup>b</sup> \*\*\* significant at the 0.001 level; \*\* significant at the 0.01 level; \* significant at the 0.05 level; † significant at the 0.10 level; ns not significant.

represented on the website by individuals sharing their personal stories or experts on the topic articulating their perspectives through images, quotes, and videos. Representative quotes from this theme include: “I tend to believe the people who are interested in saving and protecting our environment...I’m behind them 100%”; “independent experts, agencies and climate scientists have all confirmed keystone XL will have minimal impacts on the environment”; “heavily relies on an appeal to emotion” and “I found the website design to benefit the project. Seeing the beautiful pictures of the fields and water I cannot help but wonder why we have to jeopardize it.”

**4. Influence of incomplete/biased information:** This theme stemmed from category 3 (biased viewpoint) where participants focused on the website contents and imagery as being biased toward a positive point of view. Representative quotes from this theme include: “Flashy propaganda”; “The website is biased and I need to hear the views of the opposing perspective before I truly decide how I feel about it”; and “The website, while admirably containing links to opposing viewpoints, etc., is so obviously slanted in favor of the project.”

To further examine the 4 overriding themes as outlined above, in Table 8, the count and percentage breakdown for low and high prior knowledge groups are presented, as well as significant differences between these groups for each theme. For the low prior knowledge group, 44% of the comments focused on new information they learned from the website, which in turn helped alter their attitudes toward the Keystone XL pipeline project. This was significantly larger than the high prior knowledge group (p < 0.000), who stressed that information on the website supported or reinforced their previous perspectives (representing 47% of the comments). This is a reasonable observation given that the two groups differ significantly with respect to their prior familiarity/knowledge of the topic. Interestingly, 13% of the comments for the low prior knowledge group focused on elements that pertain to the peripheral route in our study (in particular connectedness), as compared to only 6% of the high prior knowledge group comments (p < 0.05).

Following our main open-ended question of why attitudes may or

may not have changed, subsequent open-ended questions probed further into participants’ views of the Keystone XL’s website design (look and feel, organization, community). Exemplary comments provided by the low prior knowledge group that relate to these website design elements included: “website is inviting”; “there was a lot of positive imagery”; “images regarding pipelines and farmland were positive”; “it wasn’t boring pictures of miles of pipeline being laid but had a nice real people touch”; “I was impressed by the comments from landowners regarding their treatment and that changed my feeling a great deal”; “it looks like a community coming together for the same cause”; and “seeing how involved the community is in the project makes one want to be a part of it as well”. By contrast, comments from the high prior knowledge group tend to be more sceptical when it came to website design elements. For example: “we see images of happy people and renewable energy, but we see absolutely nothing about the actual tar sands, the destruction of our earth and other real issues” and “presentations within the website portray an entity that is completely involved with the people that it will come in contact with. That being said, the pictures and presentations are very carefully crafted, almost appearing staged. This project will massively impact and change people’s lives. These people need to be fairly represented and portrayed.” Such comments align with the observation that 32% of the comments made by the high prior knowledge group accentuated the biased nature of the site. This was significantly more than similar comments found among the low prior knowledge group (p < 0.01).

## 7. Theoretical and practical contributions

### 7.1. Theoretical implications

The primary goal of this research was to build and test a more comprehensive and nuanced model for online persuasion. All proposed goals as set out in the introduction section were achieved, including (1) simultaneous testing of multiple peripheral design and social cues compared with the central cue of Argument Quality to find that both are significant to the persuasion process; (2) extension of ELM with a focus on issue involvement confirming that both central and peripheral

**Table 7**  
Generalized categories for the open-ended question of why attitudes may or may not have changed.

Category		Low Prior Knowledge [N = 204 comments]	High Prior Knowledge [N = 126 comments]
		Count (Percentage)	Count (Percentage)
1	Provided new information	63 (31%)	16 (13%)
2	Reinforced prior knowledge	24 (12%)	50 (40%)
3	Biased viewpoint	31 (15%)	40 (32%)
4	People-focused stories	17 (8%)	6 (5%)
5	Alleviated prior concerns	17 (8%)	4 (3%)
6	Stimulated interest to investigate further	9 (4%)	0 (0%)
7	Expert evidence	5 (2%)	1 (1%)
8	Did not alleviate prior concerns	27 (13%)	9 (7%)
9	Website visuals	4 (2%)	0 (0%)
10	No interest in topic	7 (3%)	0 (0%)

**Table 8**  
Overriding themes for the open-ended question of why attitudes may or may not have changed.

Theme	Low Prior Knowledge [Sample N = 204]	High Prior Knowledge [Sample N = 126]	Significant Difference
Helpful new information	89 (43%)	20 (16%)	<b>0.000***</b>
Information reinforced pre-existing view	58 (28%)	59 (47%)	<b>0.006**</b>
Influence of website imagery & human focus	26 (12%)	7 (6%)	<b>0.045*</b>
Influence of incomplete/biased info	31 (15%)	40 (32%)	<b>0.002**</b>

Notes: Significant differences determined using two-tailed chi-square ( $\chi^2$ ) tests; \*\*\* denotes significance at the 0.001 level; \*\* denotes significance at the 0.01 level; \* denotes significance at the 0.05 level.

cues are positively related to Change in Issue Involvement and that Change in Issue Involvement is strongly related to the final endogenous variable of Attitude Change; and (3) clarification that Prior Knowledge does play a role in this model and moderates 3 of 4 peripheral cues, as well as having a direct relationship to Attitude Change. These extensions to ELM are important to our understanding of how digital environments can persuade the user. Although various researchers have criticized the existing ELM [16,17], few investigations have previously focused on how to augment the model – especially from a design perspective.

Although there have been calls to better understand online persuasion based on the design of IT artifacts on websites (e.g. [3,8,9]), little research to date has addressed this topic. This investigation serves to confirm the usefulness of design in persuasion and uncovers the relationship of Navigation Design leading to Change in Issue Involvement and Attitude Change. As Fogg [2] suggested, navigation increases user capability and it appears that the straightforward design of the Keystone XL website contributed to a sense of involvement. Image Appeal also contributed to Change in Issue Involvement and ultimately Attitude Change. This outcome reinforces the earlier finding by Borchers [48] that images serve to persuade. On the Keystone XL website, there was some use of images, but this could have been greater and perhaps contributed to the relationship to Change in Issue Involvement, but at a marginally significant level.

Of interest, Social Presence is not a significant predictor in the model. This is surprising because in prior research Social Presence has been related to website involvement [54] and website trust [28,29]. Although there is evidence of pictures of people – which is one element to enhance social presence – on the Keystone XL website, there was little in the qualitative comments to indicate the Keystone XL website was perceived as having warmth and sociability. This might be explained by the fact that although there are images of people on the website, this may not be sufficient to induce feelings of warm and sociability. Other website features that may have induced social presence and that did not appear on the Keystone website are personalized greetings [53], human audio [55], and more emotive text [29]. Therefore, designers of websites aimed to persuade might wish to consider a rich portfolio of features that induce social presence rather than only one or two elements. Further, it should be considered that for a different type of website, such as in a health care setting, user perceptions of social presence would be even more important.

Alternately, Connectedness is highly significant to Change in Issue Involvement leading to Attitude Change. This is a novel finding with application in a range of settings including social media, when users expect to engage and connect with others on a digital platform or website with a goal to persuade. This finding builds on earlier work in which online interactivity resulted in positive online relations [57], and user control, responsiveness, and connectedness led to trust, loyalty, and user enjoyment [30,31] – now applied to online persuasion. Based on our results that both a social element of Connectedness and two design elements of Image Appeal and Navigation Design are predictors of Change in Issue Involvement, this suggests two new but separate peripheral routes to persuasion.

Building on other work related to how argument framing and issue involvement can persuade users [15,33], a key finding is not only how

issue involvement, but *change* in issue involvement, is inherent in the persuasion model. In line with Bhattacharjee and Sanford [59], we find that issue involvement (in our case change in issue involvement) is a mediator to attitude change. As would be expected in ELM, argument quality impacts user involvement leading to attitude change, but new to this investigation is the role of design and social features. This is a theoretical addition to the existing ELM model and confirms a need for a Dual Mediation Model which includes both central and peripheral processing routes as first suggested by Coulter and Punj in 2004 [19]. An additional theoretical contribution emanating from the current investigation is the moderating role of Prior Knowledge in our persuasion model. The original ELM includes expertise or prior knowledge impacting the likelihood of elaboration of a topic of persuasion [12]. In the current study, we further explore these relationships with an eye to determine whether Prior Knowledge moderates both central and peripheral cues. Although it appears that Prior Knowledge does not moderate between Argument Quality and Change in Issue Involvement, it is a moderator for Image Appeal, Social Presence, and Connectedness. Therefore, when persuasion is induced through peripheral routes, level of prior knowledge of the user concerning the topic of persuasion is a more salient feature than when persuasion occurs through the central route based on the strengths of arguments as presented.

To further explore the role of Prior Knowledge, in a post hoc analysis, we divided our sample into Low Prior Knowledge and High Prior Knowledge sub-groups and found differences. While Argument Quality is important for both groups, it was most important for those with Low Prior Knowledge. In terms of peripheral cues, in the High Prior Knowledge group, Navigation Design and Social Presence are significant leading to Change in Issue Involvement, while Connectedness is most important for the Low Prior Knowledge group. This may be explained in the following way. When users with low prior knowledge are given the option of *both* direct and peripheral cues they will draw on various cues, and the search for information and subsequently involvement may be enhanced by design features and Connectedness on the website. For the high knowledge users, Navigation Design assists to gain access to arguments as presented on the website. It is interesting that Social Presence is also important for this group and supports the earlier premise that, although Social Presence was not significant in this study leading to Changes in Issue Involvement, it does have a role in the persuasion process. Finally, it should be noted that these observations are counter to the original ELM in that more knowledgeable users will use the central route to persuasion, and less knowledgeable users will be persuaded by peripheral cues. As such, this finding merits further investigation and is in line with Flaviano Blanco et al. [14], who also found unexpected results related to the moderating effect of familiarity.

In addition to our survey findings, qualitative comments yield additional insights into the persuasion process that make intuitive sense. Visitors to the Keystone XL website with little or no prior knowledge have the most to learn, while those with existing knowledge indicate that pre-existing views of the pipeline were reinforced. For the qualitative theme of website imagery and human focus, 12% of respondents in the low prior knowledge group felt website elements contributed to their attitude change, compared to 6% in the high prior knowledge group (a significant difference at  $p < .045$ ). While the low prior knowledge group found the website design elements to be positive and

inviting, the high prior knowledge group described these design elements as distracting or even deceiving. In concert with the original ELM, users with low prior knowledge appreciated the peripheral design cues. This further supports the role of design elements in accelerating the attitudinal change process as suggested by others [3,8,9,37].

## 7.2. Practical implications

From a practical standpoint, this research is relevant in a variety of online settings (e.g., e-government, e-health, e-learning, and e-commerce), when the goal is to alter user attitudes and/or behaviors. For example, in another ongoing investigation by one of the authors, a website is experimentally manipulated and tested to determine the impact of Social Presence and Design Aesthetics on whether users will be persuaded to be tested for sexually transmitted diseases. In the realm of e-commerce, the impact of design can be evaluated in terms of whether the color green or images of pristine forests on a website (related to Image Appeal) will have any bearing on whether users select products that are environmentally safe.

Designers of online solutions, who aim to promote sustainable and healthy routines [81,82], can enhance web-based systems by a fuller understanding of how Image Appeal and Connectedness help to increase Issue Involvement, thus engaging more people to join and use the system. For example, in the case of sustainability initiatives, pictures of healthy people cycling could lead to higher involvement of users in urban bicycling as a viable commuting mode in cities. Moreover, the system might allow users to contribute images of themselves by enabling a direct upload feature, thus fostering connectedness among that community of cyclers. Related to this research, design may be especially important for new urban riders (a Low Prior Knowledge group), as there are various attitudinal barriers to overcome such as safety and comfort. Once system developers have introduced the design features that foster Connectedness, novice riders would be able to see similar others using the system, thus creating an atmosphere of sharing a common bond and sense of community.

Practitioners working on new ways to design an online platform that integrates social media in public spaces [23] can gain benefits of our research by applying knowledge of how Social Presence can encourage involvement of existing and potential users, especially those who are more knowledgeable (High Prior Knowledge group). The results of our study revealed that pictures of people on the website are important for more knowledgeable users to become more involved in an issue and therefore more likely to change their attitudes. For example, if a designed social facilitation feature [23] currently presents only the names of engaged users, then complementing user names with the actual pictures of those users from their social media accounts should increase user involvement for other knowledgeable participants. In other words, representation of user pictures would lead more knowledgeable users to realize there are other real people using the platform, thus increasing a sense of human contact and sociability. Such enhancements can also be instrumental for designing other popular socially influencing (or gamified) features in websites, for example, related to competition or social comparison [83].

As such, this work offers insights for designers and emphasizes a need to be cognizant of how to use specific design elements (such as those employed in this study) if they wish to potentially persuade users. While three design elements and a social element of Connectedness were investigated in this study, there is much scope for designers to determine which elements are most appropriate for the goal of persuasion. Based on the current results, increasing user knowledge through design leads to a corresponding increase in issue involvement which then culminates in attitudinal change. The qualitative comments by users act as a guide on how to design websites for those with differing levels of knowledge with respect to a focus on either information or other cues.

## 8. Limitations and future directions

There are several strengths of this research investigation. The sample is relatively large (403), located in both the United States and Canada, representing diversity in age and education. Further, we carefully pre-tested and post-tested respondents for knowledge, attitudes, and involvement toward the Keystone XL pipeline. This served to address the concern by Angst and Agarwal [33] that issue involvement is artificially manipulated rather than actually measured. Finally, in addition to survey data, qualitative remarks by users add value to more deeply understand how information, design, and social elements interact and contribute to online persuasion.

Alternately, this work is not without limitations. A single website about an oil pipeline was used for the experimental study. While the Keystone XL website was carefully selected, it may be that other websites would yield differing results depending on the level of user knowledge and involvement with the topic. For this reason, it is recommended that future studies expand to different types of websites. For example, the persuasiveness of websites that promote health care for children or specific diseases might be investigated. This could be done with attention to the relative merits of argument quality, design, and social elements with a goal to persuade users. Although the role of social presence was not significant leading to Change in Issue Involvement and ultimately Attitude Change in the current investigation, it may be of greater significance in a health care website, for example, that aims to persuade mothers to vaccinate their children.

Based on the scope of this investigation, it was possible to test only a limited number of design or social elements. However, there are others that could be evaluated in future research. As a sample, these could include “inspiration” or the ability of a website to inspire positive motivation [3,20], or task support and social support [8,9]. In addition, design or social elements could be investigated across cultures. Although prior research confirms differences in use preferences for design elements across cultures (e.g. [27,66,84,85]), we are unaware of any study that investigates specific persuasive design features in diverse cultural environments.

Referring to an earlier section, it was explained that contrary to the original ELM, the central route of argument quality was most important for the low prior knowledge groups, and in the high prior knowledge group, the peripheral route design elements (for Navigation and Social Presence) were significant leading to Change in Issue Involvement. As both our results and those of Flavian Blanco et al. [14] do not match expected outcomes, there appears to be an opportunity for further research in this area. It is our expectation that these routes to persuasion are not as dichotomous as expected in earlier work, and that Change in Issue Involvement in this model requires additional exploration.

It appears that the routes to online persuasion are more tangled and complex than first expected. As has been the case for trust and other complicated research variables, it is recommended that additional methods may be helpful to determine how online persuasion occurs. In addition to surveys, interviews and other forms of qualitative data, neurophysiological techniques such as fMRI have been used to test user reactions [86,87]. The use of multiple methodologies such as an eye-tracking device coupled with surveys and interviews (e.g. [27,88]) have been useful to examine design elements related to trust, satisfaction, loyalty, or cross-cultural differences.

To conclude, the topic of online persuasion is of immense contemporary merit and deserves additional investigation. Within the scope of the present research, we have fulfilled our research goals and validated a model that extends ELM to include a comparison of different routes to online persuasion, including design and social elements which to date, have received little attention. We have also probed the little-known roles of Prior Knowledge and Change in Issue Involvement to Attitude Change. While we have derived insights from this work, additional work is necessary to more fully appreciate how users change their opinions and beliefs in digital environments.

## Appendix A. Survey Items

### Attitude Change

Source: [33] – Semantic Differential Scale – Assessment of Attitude (Pre- and Post-Manipulation).

With what you now\* know about the Keystone XL oil pipeline, please answer the following question. What are your feelings about the implementation of the Keystone XL oil pipeline? (1 to 7 scale).

- Bad to Good.
- Foolish to Wise.
- Unimportant to Important.

\*Note: The word “now” was only used in the post-manipulation attitude assessment.

### Issue Involvement

Source: [67].

- II-1: I find the topic of the Keystone XL oil pipeline interesting.
- II-2: I find the topic of the Keystone XL oil pipeline involving.
- II-3: I find the topic of the Keystone XL oil pipeline personally relevant.

### Prior Knowledge

Source: Modified from [59].

- PK-1: How knowledgeable are you regarding the Keystone XL oil pipeline? novice....expert.
- PK-2: Have you previously viewed television coverage regarding the Keystone XL oil pipeline? never....often (new item).
- PK-3: Have you previously read news coverage regarding the Keystone XL oil pipeline? never....often (new item).

### Argument Quality

Source: [59].

- AQ-1: The information provided on the website was informative.
- AQ-2: The information provided on the website was helpful.
- AQ-3: The information provided on the website was valuable.
- AQ-4: The information provided on the website was persuasive.

### Image Appeal

Source: [27].

- IA-1: The images used in the website are appropriate.
- IA-2: The images used in the website are satisfying.
- IA-3: The images used in the website are exciting.
- IA-4: The images used in the website are interesting.
- IA-5: The images used in the website make the website content look appealing.
- IA-6: The images used in the website appeal to me emotionally.

### Navigation Design

Sources: [24,89,90].

- ND-1: I can easily navigate this website.
- ND-2: I find this website easy to use.
- ND-3: This site provides good navigation facilities to information content.

### Social Presence

Sources: [28,53].

- SP-1: Pictures of people on the website provide a sense of human contact in the website.
- SP-2: Pictures of people on the website provide a sense of personalness in the website.
- SP-3: Pictures of people on the website provide a sense of sociability in the website.
- SP-4: Pictures of people on the website provide a sense of human warmth in the website.
- SP-5: Pictures of people on the website provide a sense of human sensitivity in the website.

### Connectedness

Sources: [30,31].

- PI-1 Visitors to this website share their views about the Keystone XL oil pipeline with other visitors of this website.
- PI-2 Visitors to this website benefit from the community visiting the website.
- PI-3 Visitors to this website share a common bond with other members of the community visiting the website.

## Appendix B. Open-ended Survey Questions

1. For your responses to the questions above, please elaborate why you changed or did not change your feelings about the Keystone XL oil pipeline. Why did the website change or not change your feelings towards the Keystone XL oil pipeline?

2. Did the information content presented on the website cause you to change your feelings towards the Keystone XL oil pipeline? If so, what was it about the information content as presented on the website that convinces you to feel otherwise? If not, what was it about information presented on the website that fails to convince you to feel otherwise?

3. Did the look-and-feel of the website cause you to change your feelings towards the Keystone XL oil pipeline? If so, what was it about the look-and-feel of the website that convinces you to feel otherwise? If not, what was it about the look-and-feel of the website that fails to convince you to feel otherwise?

4. Did the way in which information was organized on the website cause you to change your feelings towards the Keystone XL oil pipeline? If so, what was it about the way information was organized on the website that convinces you to feel otherwise? If not, what was it about the way information was organized on the website that fails to convince you to feel otherwise?

5. Did the presence of other community members on the website cause you to change your feelings towards the Keystone XL oil pipeline? If so, what was it about the presence of other community members on the website that convinces you to feel otherwise? If not, what was it about the presence of other community members on the website that fails to convince you to feel otherwise?

### Appendix C. Example Qualitative Comments Pertaining to the 10 General Categories

Category	Example Comments
1 Provided new information	<i>"I am more aware of the environmental impact and the work that is being done by Keystone to minimize it"</i> <i>"I think more positive now that I know what exactly it is by gaining more information. I didn't even think of the job prospects."</i>
2 Reinforced prior knowledge	<i>"Didn't change my mind as I was aware of the things I read about the pipeline that are most important to me."</i> <i>"I did not change my opinion of the pipeline, only reinforced my opinion by checking out the website"</i>
3 Biased viewpoint	<i>"The website is skewed toward a positive outcome and thus does not sufficiently reflect both sides of the story"</i> <i>"The website is biased and I need to hear the views of the opposing perspective before I truly decide how I feel about it."</i>
4 People-focused stories	<i>"I tend to believe the people who are interested in saving and protecting our environment....I'm behind them 100%"</i> <i>"the website changed my views because of job creation and commitment to safety of the people involved"</i>
5 Alleviated prior concerns	<i>"It changed my feelings for a little more positive. It helped to have read about a few things that are a concern to me like the environment."</i> <i>"The website did provide information specifically about how it interacts with communities and environmental concerns that helped alleviate some of my previous concerns."</i>
6 Stimulated interest to investigate further	<i>"I still having doubts on the oil leakage and jobs after – I intend on looking into this more to feel comfortable"</i> <i>"I was previously unaware of most of the information I learned today. ... That said, getting information from just one source and calling it a day would be foolish of me. I may look into researching the subject to develop my opinion and fact check."</i>
7 Expert evidence	<i>"Independent experts, agencies, and climate scientists have all confirmed keystone XL will have minimal impacts on the environment"</i> <i>"a lot of information about pipeline, referencing experts"</i>
8 Did not alleviate prior concerns	<i>"I didn't read anything that alleviated my concerns regarding a potential spill."</i> <i>"I still don't think it is something that we need and I don't see why we are putting our land at risk over crude"</i>
9 Website visuals	<i>"I found the website design to benefit the project. Seeing the beautiful pictures of the fields and water I cannot help but wonder why we have to jeopardize it."</i> <i>"The site ... heavily relies on an appeal to emotion"</i>
10 No interest in topic	<i>"Some people believe it to be important, but I do not."</i> <i>"I still don't care, sorry."</i>

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