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# Designing Caring and Informative Decision Aids

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## ABSTRACT

The focus in decision aid research and practice has largely been on the utilitarian aspects of their design. We propose that these aids should also be designed as effective social partners, especially when their use involves the exchange of sensitive information. In this paper, we investigate the effects of designing caring and informative decision aids on users' evaluations of these aids. Our results show that the use of explanations and expressive speech acts can enhance users' beliefs that the aid is informative and cares about the user. These strengthened beliefs subsequently enhance perceptions of its competence and benevolence, and improve the interaction atmosphere, subsequently increasing satisfaction with the decision aid.

## Keywords

Decision aids, recommendation agents, IS in healthcare, human-computer interaction.

## INTRODUCTION

Online decision aids (also known as recommendation agents) have received extensive attention in both research and practice. These tools typically perform the role of a tutor educating users about decision attributes, and a recommender system offering specific recommendations based on user-defined criteria (Xiao and Benbasat, 2014).

In practice, decision aids have been deployed in domains as varied as accounting and finance, e-commerce, employee interviewing, and healthcare (e.g., Stacey et al., 2014; Xiao and Benbasat, 2014). Depending on the context in which decision aids are employed, the nature and type of information solicited and the recommendations sought could vary greatly. They could range from product-specific requirements to highly sensitive information about one's finances and health. Yet despite their widespread use in contexts that require the solicitation of sensitive information, research on decision aids has largely maintained its focus on the utilitarian nature of their design and use (Xiao and Benbasat, 2014).

In contrast, when deployed in settings that require the provision of sensitive information such as healthcare, decision aids perform some of the functions traditionally performed by humans. Hence, they engage with users in interactions that are often interpersonal and social. It is not surprising therefore that one of the major complaints

users voice about using patient decision aids, for example, is that these interactions are qualitatively different than traditional patient-provider ones, and feel superficial and void of social norms (Stacey et al., 2014).

In this study we bridge this gap by viewing users' interactions with decision aids as social and interpersonal. This proposition is anchored in the Computers are Social Actors (CASA) paradigm (Reeves and Nass, 1996), which was corroborated by a number of studies that have shown that the dynamics of user interactions with decision aids are similar to those in interpersonal settings.

In light of this, we focus on examining how decision aids can be designed to "behave" socially, and respond appropriately to user disclosures, requests, and expressions. Specifically, we investigate how a decision aid can be designed so it is perceived to be caring of the user and his/her needs. Furthermore, given their important role as means for educating users about the domain in which they are employed, and the decision-relevant criteria, we also investigate how decision aids can be designed to be more informative. Hence, we attempt to identify design-relevant antecedents for desired characteristics that can be manifested by an aid. We accomplish this goal by identifying and testing the effects of a parsimonious set of three design elements, which we show can endow decision aids with perceived care and informativeness. We subsequently, investigate the effects of the perceived perceptions of care and informativeness on users' evaluations of these aids, and satisfaction with their use.

## THEORY, RESEARCH MODEL AND HYPOTHESES

An important focus of research on decision aids has been on the requirements elicitation stage, during which users disclose information about their needs and preferences. While research in this stream has been extensive, it has mainly focused on the various methods to elicit requirements, and the amount, and nature of input solicited (Xiao and Benbasat, 2014). This research, however, has largely ignored user perceptions when these aids elicit requirements in the form of questions asked, and has assumed that users are only motivated by the expected benefits of using these aids, and unaffected by how the aids behave during that elicitation stage.

In contrast, and as has been highlighted in prior research (e.g., Al-Natour and Benbasat, 2009), with the advent of new e-commerce artifacts that possess interactive and

human-like characteristics, the utilitarian benefits users expect to achieve through their use are now paralleled by the benefits of engaging in satisfactory social interactions. In addition to being tools that help extend users' cognitive limitations in decision-making, decision aids are endowed with human-like characteristics that induce attributions of social action (Reeves and Nass, 1996).

In this study, we adopt the Computers are Social Actors (CASA) paradigm (Reeves and Nass, 1996), and propose that users of decision aids view their interactions with these artifacts as social and interpersonal. Consequently, we conceptualize these interactions as a form of social exchange (Altman and Taylor, 1973), where users provide personal information in exchange for personalized recommendations. As with any type of social exchange, utilitarian factors (e.g., expected benefits and costs) are important. Yet, social exchanges are also influenced by social cues and signals exchanged between those involved (Altman and Taylor, 1973), such as expressions of concern when disclosing negative experiences.

This study investigates the effects of two beliefs (namely, perceived caring and informativeness), which users form during their interaction with the decision aid, on their subsequent evaluations of the decision aid and the interaction with it. These evaluations extend beyond utilitarian ones (i.e., perceived competence), to those that are relational and social in nature (i.e., perceived benevolence and perceived interaction atmosphere).

Understandably, users can form a multitude of beliefs during their interaction with decision aids. We chose to focus on perceived care and informativeness due to a number of reasons. First, given their role as a tools to educate users, perceived informativeness captures the extent to which the aid is successful in this role. We define perceived informativeness as a utilitarian belief that concerns the extent to which the decision aid is perceived to be knowledgeable about the decision context, and communicates this knowledge to the user. Hence, this belief captures a utilitarian characteristic of the aid. Second, in light of our discussion of the importance of viewing interaction with decision aids as social and interpersonal, we focus on perceived care as it is an important factor that determines the success of social exchanges (Altman and Taylor, 1973), especially those involving the exchange of sensitive information. We define perceived caring as the extent to which the aid is perceived to care about the user and his/her needs.

To cue perceived care and informativeness on the part of the decision aid, three design elements are used. For the sake of brevity, specific hypotheses concerning the effects of these design elements are not developed, yet their anticipated effects are briefly discussed. Specifically, why-explanations, which are used to provide justification for why the aid asks a question, are proposed to enhance perceptions of both care and informativeness. Similarly, because how-explanations describe how the information solicited will be used by the aid, they offer pertinent

information as well as convey the aid's desire to arrive at a personalized recommendation that addresses the user's needs and concerns. Hence, they enhance perceptions of both beliefs. Finally, we propose that expressive speech acts, which are used to express a certain psychological state by the speaker, can manifest concern and care.

### The Effects of Perceived Caring

In terms of conceptualization, research has differentiated between trusting beliefs (trustworthiness) and trusting intentions. Trust as a belief addresses the trustor's perception that the trustee has attributes that are beneficial to the trustor (McKnight, Choudhury, and Kacmar, 2002). Specifically, it refers to the extent to which the trustor believes that the trustee has competence (the ability, skills, and expertise to perform effectively), benevolence (cares about the trustor and acts in the trustor's interest), and integrity (adheres to a set of principles that the trustor finds acceptable (e.g., McKnight et al., 2002).

Research on trust has further distinguished between calculus-based and relational trust (McKnight et al., 2002). While the first uses second-hand information in a process of impression formation, the second is based on information obtained from interactions with the trust object. In the most general sense, perceptions of caring is a belief that captures information about the decision aid as an interaction partner. In so being, this belief represents the user's level of familiarity with some pertinent aspects of the decision aid, such as how well it understands the user's needs and concerns, and how it feels towards the user, his/her concerns and needs. This familiarity then serves as an appropriate context to interpret the decision aid's other behaviors (Luhmann, 1979). At minimum, it lessens confusion about the aid's intentions, and reduces the possibility that the user will sense that she is being taken advantage of (Gefen, Karahanna, and Straub, 2003).

Specific to the study's context, perceived care on the part of the decision aid acts as trust-relevant knowledge that is accumulated throughout the interaction (Wang and Benbasat, 2016). Specifically, when the decision aid communicates an accurate understanding of the user's needs and concerns, it strengthens the user's belief that the aid has the competence to understand these needs, and subsequently, use them as inputs for the decision process. In addition, a caring aid would be perceived as one that is more invested and committed to helping the user. This could further enhance perceptions of its competence in recommending a personalized rather than a generic one.

Portraying care and concern on the part of the aid, also strengthens the user's belief in the aid's benevolence. Benevolence is behaviorally marked by caring about the trustor and acting in the trustor's interest (McKnight et al., 2002). By communicating care for the user when disclosing sensitive information, the aid is invariably communicating general concern for the user's welfare.

H1: Caring positively influences competence.

H2: Caring positively influences benevolence.

Manifesting care on the part of the decision aid can further improve perceptions of the interaction. Specifically, we propose that increased perceived care improves the perceived interaction atmosphere, which we define as the extent to which the interaction is perceived as friendly, cooperative and conflict-free. Essentially, perceived care lowers perceptions of conflict and the user's anxiety, and acts as a comforting factor. All of these can enhance the perceived interaction atmosphere by making it seem more cooperative and friendly.

H3: Caring positively influences perceived interaction atmosphere.

### The Effects of Perceived Informativeness

An informative decision aid communicates pertinent information to the user, and educates them about the decision context. This reduces the information asymmetry between the user and the decision aid, and as a result, reduces the knowledge-gap, and subsequently, increases users' trust in the aid (Wang and Benbasat, 2016). More specifically, communicating what the advisor does and how it is done can be used to demonstrate its expertise, subsequently increasing perceptions of its competence (Wang and Benbasat, 2007). Providing justifications as to why the advisor is doing something, alternatively, can help bridge the "intentions gap" that may arise as a result of users' unawareness of why certain information is being solicited. Bridging this gap will convey goodwill toward users, which will enhance their perceptions of the benevolence (Wang and Benbasat, 2007).

H4: Informativeness positively influences competence.

H5: Informativeness positively influences benevolence.

Finally, providing descriptions of what's being done, how, and why, as well as other pertinent information about skin care, can enhance user involvement in the interaction. In essence, by communicating information to the user, and attempting to educate him/her about the decision context, the aid creates the impression that user involvement is important and encouraged. This enhances feelings of mutuality and cooperation.

H6: Informativeness positively influences interaction atmosphere.

### The Effects on Satisfaction

The model further proposes that the three evaluative beliefs of competence, benevolence and interaction atmosphere enhance users' satisfaction with their overall interaction with the decision aid. Research on trust in online contexts has extensively confirmed the positive effects of trust and individual trusting beliefs on reuse intentions, satisfaction, and positive evaluations of IT artifacts (e.g., Gefen et al., 2003; McKnight et al., 2002), including decision aids (e.g., Wang and Benbasat, 2007). Hence, hypotheses 7 and 8 constitute a replicated attempt

to examine these established effects in contexts that require the solicitation of sensitive information.

H7: Competence positively influences satisfaction.

H8: Benevolence positively influences satisfaction.

As discussed earlier, users' interactions with decision aids constitute a form of social exchange. The success of this social exchange depends on part on perceptions that both exchange partners are interdependent and cooperative (Blau, 1964). Hence, perceptions that the interaction is friendly, cooperative and conflict-free should enhance overall satisfaction with that interaction. Similarly, research on the intimacy process has shown that interactions that are harmonious and conflict-free, or those characterized by the personal connection one feels towards another, are markers of relationship growth and well-penetrated interactions (Altman and Taylor, 1973).

H9: Interaction atmosphere positively influences satisfaction.

## RESEARCH METHOD

A between-subjects fully-factorial experiment was used to test the hypotheses. Participants were randomly assigned to interact with one of eight decision aids that differed in whether they used why explanations, how explanations, and expressive speech acts. The decision aids were designed to assist users in finding personalized skin care solutions. They were deployed on a fictional website, and they were represented by an avatar and communicated through text. During the task, the aids asked subjects thirty multiple-choice questions used to determine a user's skin care needs. The questions were developed based on an analysis of a number of websites that offer skin care help, and varied in their sensitivity ranging from demographics to health conditions.

All constructs used in this study were measured using 7-point Likert scales. Competence and benevolence were measured using the scale from McKnight et al. (2002). Satisfaction was measured using the scale adapted by Cenfetelli et al. (2008). Three new scales were developed to measure the three remaining constructs.

A number of pilot studies were conducted to inform the design, script and the measurement instrument used in the final data collection. A separate study was conducted where we asked thirteen females to rate all the questions that have been developed in terms of their social sensitivity, and relevance to skin care. The results were used to select the final list of questions used by the aid.

The study was conducted on-line using 195 female participants recruited from an e-commerce panel.

### Treatment Conditions

The eight decision aids differed in their use of: 1) Why-explanations, which justify why a certain question is being asked (Wang and Benbasat, 2007); 2) How-

explanations, which describe how the information elicited is used (Wang and Benbasat, 2007); and 3) Expressive speech acts, which are used to express a certain psychological state, such as apologizing or expressing concern (Al-Natour et al., 2009).

Specifically, in conditions where a why-explanation is used, the aid offers a detailed description of why a certain question is asked, as well as information concerning the issue addressed. In so doing, the aid offers pertinent information regarding the relevance of the information solicited, and how the issue being addressed can impact skin care. Given that why-explanations describe how the issues addressed impact skin care, they educate users about the topic, and hence enhance the perceived informativeness of the aid. Similarly, why-explanations manifest the willingness to be transparent and diligent in serving users, and hence enhance perceptions of caring.

When offering how-explanation, the aid describes how the information provided by the user (i.e., the answer to a specific question) will be used in the decision-making process. Hence, unlike static how-explanations used in prior research (e.g., Wang and Benbasat, 2007), which generally describe how information provided by the user is incorporated into the decision-making, the how-explanations used in this study address how each specific answer provided by the user is factored into the decision-making, and how it affects consequent recommendations.

In essence, how-explanations offer additional information regarding the relevance of specific answers to skin care, and how the user characteristics, behaviors or experiences affect his/her skin care. In so doing, they manifest the aid's desire to educate the user about skin care, and hence enhance its perceived informativeness. Similarly, how-explanations communicate the willingness, motivation and commitment to help the user and find solutions that fit the user's specific condition. This communicates care, and therefore enhances these perceptions.

Expressive speech acts are used by the decision aid to communicate concern for the user and express appropriate emotions. For instance, when disclosing that he/she suffers from a certain condition, the aid would communicate an appreciate emotions and help comfort and validate the user (e.g., "Sorry to hear that you are experiencing this condition. There is nothing to worry about as this is very common"). Such speech acts manifest involvement and understanding on the part of the aid, and hence increase perceptions that it cares about the user. In other words, because expressive speech acts address the concerns of the user, they act to increase perceptions that they care about the well-being of the user and empathetic to his/her needs and situation.

## RESULTS

An assessment of the measurement model and an analysis of the structural model were performed using SmartPLS 2.0 (Ringle, Wende, and Will, 2005).

## Measurement and Structural Model Results

The loadings for all items on their intended constructs exceeded the recommended tolerance of 0.70 (Fornell and Larcker, 1981). To test for discriminant validity, we compared the square root of the average variance extracted (AVE) for each construct, to ensure that it is larger than its correlations with other construct. This criterion was also met. Finally, composite reliability and Cronbach's alpha were all above the suggested minimum of 0.70 (Fornell and Larcker, 1981).

Consistent with hypotheses 1-6, the results of the model indicate that perceived caring of the aid enhances its perceived competence and benevolence ( $\beta = 0.40$ ,  $p < 0.01$ ;  $\beta = 0.40$ ,  $p < 0.01$ , respectively), and perceptions of an improved and friendly interaction atmosphere ( $\beta = 0.58$ ,  $p < 0.01$ ). Similarly, the perceived informativeness of the aid enhances its perceived competence and benevolence ( $\beta = 0.25$ ,  $p < 0.01$ ;  $\beta = 0.31$ ,  $p < 0.01$ , respectively), and improves perceptions of the interaction atmosphere ( $\beta = 0.16$ ,  $p < 0.01$ ).

Consistent with H7 and H8, competence and benevolence exert effects on satisfaction ( $\beta = 0.26$ ,  $p < 0.01$ ;  $\beta = 0.16$ ,  $p < 0.05$ , respectively). Perceived interaction atmosphere exerts a larger effect on satisfaction ( $\beta = 0.41$ ,  $p < 0.01$ ) in support of hypothesis 9. Jointly, the two exogenous variables explain 35% of the variance in competence, 41% of the variance in benevolence, and 49% of the variance in interaction atmosphere. These latter three variables explain 53% of the variance in satisfaction.

## Treatment Effects

To test for the effects of the design elements on the two exogenous variables, we performed a MANOVA. The results indicate that all three treatment factors affect these variables. Specifically, caring and informativeness are influenced by the provision of why-explanations ( $F = 15.58$ ,  $p < 0.01$ ), how-explanations ( $F = 4.93$ ,  $p < 0.01$ ), and expressive speech acts ( $F = 18.08$ ,  $p < 0.01$ ).

The tests of the between-subjects effects indicate that the use of why-explanations has an effect on enhancing perceptions of caring ( $F = 4.41$ ,  $p < 0.05$ ) and informativeness ( $F = 28.42$ ,  $p < 0.01$ ). Similarly, how-explanations has a large effect on perceptions of caring ( $F = 9.90$ ,  $p < 0.01$ ) and a more modest effect on informativeness ( $F = 3.82$ ,  $p < 0.05$ ). Expressive speech acts have a large effect on perceived caring ( $F = 26.38$ ,  $p < 0.01$ ), but not on informativeness ( $F = 0.73$ ,  $p > 0.1$ ).

Furthermore, the tests of the between-subjects effects indicate the presence of a significant two-way interaction between how-explanations and expressive speech acts when predicting perceived caring ( $F = 5.13$ ,  $p < 0.05$ ). This is a nominal interaction where the effects of the expressive speech acts is most significant in the absence of how-explanations. Hence, how-explanations can partially substitute for expressive speech acts. The results also highlight the significance of another interaction

between why and how-explanations when predicting received informativeness ( $F = 4.29$ ,  $p < 0.05$ ). This interaction also suggests that the effects of one of the design elements, namely how-explanations, is strongest in the absence of the other design element, namely why-explanations. It also indicates that the effects of both design elements are amplified when they are both used.

## DISCUSSION AND CONCLUDING REMARKS

The results from this experimental study provide support for the importance of designing interactions with decision aids that are characterized by care and informativeness. The relatively large effects of perceived care on the part of the decision aid on evaluations of its competence and benevolence strongly support that interactions with these aids are viewed as social and interpersonal. While most of the studies examining the determinants of trust in decision aids have focused on utilitarian factors (Wang and Benbasat, 2016), our results highlight the importance, and probably the dominance, of social and relational aspects of the interaction as predictors of the different trusting beliefs. Hence, these aids need to be designed so they manifest social characteristics that are appropriate within the context of their use, in order to enhance users' trust in them. Nonetheless, the results also highlight that endowing a decision aid with explanation facilities that enhance its perceived informativeness could subsequently enhance its perceived trustworthiness via enhancing perceptions of its competence and benevolence.

The large effects of perceived care on interaction atmosphere, and the large effects of the latter on satisfaction, lend further support that user-aid interactions are akin to interpersonal social exchanges. This is consistent with the Al-Natour and Benbasat (2009), who advocate that users' experiences when interacting with IT artifacts shape their evaluations. Future research should attempt to examine other aspects of this social interaction, and identify other variables that affect users' evaluations.

The results concerning the effects of the three design elements on the exogenous variables indicate that a small subset of design elements can be used to cue desired social and utilitarian beliefs. Interestingly, the design elements exhibited synergetic effects that demonstrate their complex relationship. As indicated by the two significant two-way interactions, the effects of the design elements can be both supplementary as well as complementary. Future research should identify other types of design elements, and examine the effects of these in cueing other desired characteristics.

The large variance explained in all constructs indicate the saliency of these constructs, and their sufficiency to understand the antecedents of users' satisfaction.

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