

Design Principles of Animated Pedagogical Agent and Instructional Message for Affective Learning

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The purpose of this study was to develop design principles of both animated pedagogical agents as 'credible' persuasive message source and persuasive fear arousing instructional messages in order to help enhance attitude changes toward a certain issue. Based on the previous pedagogical agent research, this study drew the design principles providing ways to manipulate agent credibility level and fear arousing level of message. Consequently, it specified how to make pedagogical agents perceived less or more credible by learners by manipulating a variety of agent features. For fear arousing message, this study showed how fear arousing messages would be structured into one of three levels: non-threatening, moderately threatening, and strongly threatening. Two different agent conditions and three message conditions were actually developed and experimentally tested with the participants of 40 undergraduate students. The results showed that the agent design principles specified from the previous research worked well enough to make a distinction between the more credible agent and the less credible agent. The overall results of this study may indicate that the design strategies for fear arousing message are retained on the premise of some future refinements.

Keywords : Animated Pedagogical Agent, Life-Like Character, Affective Learning, Message Design, Design-Based Research, Human-Computer Interaction

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Introduction

Animated pedagogical agents (APAs) are life-like characters (Johnson, Rickel, & Lester, 2000) specifically designed to facilitate learning in computer-based environments through various pedagogical strategies emphasizing social interactions. APAs enrich social interactions by employing a variety of human-like features in terms of voice, gestures and facial expressions, and roles. Thus, APAs have been drawing increasing attention as social interface, which is defined as interface that displays social and affective cues and aims at triggering social reactions (Krämer & Bente, 2010; Leung, Virwaney, Lin, Armstrong, & Dubbelboer, 2013; Prendinger & Mitsuru, 2004).

The potential of APAs as social interface implies that APAs can have social influences on learners and thus influence their thought and action in relation to an object (person, place, or issue). Influencing learners' thought and action may be rephrased as influencing their attitude when we consider that attitudes in the category of affective learning are defined as acquired internal states that influence the choice of personal action toward some class of things, persons, or events (Gagné, 1985). Along this line, the concept of social interface provides important implications for this study, which is intended to design and develop APAs that can influence attitudes toward a certain object in the context of affective learning.

As a matter of fact, attitudes have been examined thoroughly in communication-persuasion research. Persuasion is the study of attitudes and how to change them. Perloff (2002) a well-known communication researcher defined attitudes as a learned, global evaluation of an object that influences thought and action. He also defined persuasion as a symbolic process of convincing people to change their attitudes or behaviors in regards to an issue through the transmission of messages.

Persuasion research has indicated that message source and message itself can influence attitudes in isolation and they also interact with each other to make changes to attitudes. The message source refers to the communicator who delivers

messages. In an attempt to influence a person's attitude toward a certain issue it really matters who delivers the messages, more specifically what characteristics the message source have such as authority, social attractiveness, and credibility. In terms of credibility being of interest in this study, persuasion research has shown that a high credibility message source is more effective in attitude changes than a low credibility one (Pornpitakpan, 2004).

The message, which is also an important factor in regards to attitude change, refers to what the message source intends to deliver to elicit attitude changes. Perloff (2002) suggests that there are three main aspects of message that need to be in consideration when we develop messages: message structure (e.g., message sidedness, conclusion drawing, and order of presentation, message content (e.g., evidence, and fear appeal) and language (e.g., speed of speech, and powerful vs. powerless). Among the three main aspects of message, fear appeal is paid attention to as effective persuasive strategy in this study. It attempts to scare people into changing their attitudes by conjuring up negative consequences that will occur if they do not comply with the message recommendations (Perloff, 2002). Persuasion research suggests that fear enhances attitude change, and that high-fear appeals are more effective than low-fear appeals in attitude change (Mongeau, 1998).

Media technology plays an important role in enhancing persuasion by improving how the messages are delivered (Ijsselstein, de Kort, Midden, Eggen, & van den Hoven, 2006). Ijsselstein et al. (2006) believed that technology becomes an especially powerful tool when it allows the persuasive techniques to be interactive, adjusting the pattern of interaction based on the characteristics or actions of the persuaded people. On this background, persuasive technology has been suggested, which is defined as a class of technologies that are intentionally designed to change a person's attitude or behavior (Fogg, 2003).

APAs can be categorized as kind of persuasive technology when they are employed as message source who delivers persuasive messages to influence learners' attitudes. APA research is well aligned with the persuasion research in that it has

also placed its focus on two factors, including APAs as message source and instructional content as message. However there is still lack of research on the effects of APA-delivered persuasive messages on attitude as affective learning outcome, though there have been a few early explorations regarding the use of APAs for delivering persuasive messages (Baylor & Plant, 2005; Creed, 2006, Eyck et al., 2006). It also adds to the motive of this study that APAs may be more suitable for affective learning outcome to work as a kind of persuader.

Along this line, this study was to develop and experimentally test design principles of both APAs as persuasive message source and persuasive messages to enhance attitude changes toward a certain issue, placing its main interest in credibility as message source factor and fear appeal as message factor in the context of APA-based learning environments. Indeed, portraying agent credibility has been an important issue in the APA research (Burgoon et al., 2000; Cowell & Stanney, 2005), because APAs can be perceived as more or less credible by learners by evoking different emotional responses from the learners. When it comes to fear appeal, it is applicable to APA-based learning environments that fear appeal functions as regulator for attitude change.

Thus, the purpose of this study was two-folds from the perspectives of design-based research. The first was to draw the design principles with which APAs' credibility level and message's fear appealing level can be controlled and manipulated, based on the review of previous research in this context. The second was to test the design principles with an experimental approach. That is, APAs and messages differing in credibility level and fear arousing level respectively were actually developed according to the design principles and tested to identify if they all were perceived as intended.

Literature Review

Animated pedagogical Agents (APAs) as social interface

Human and computer interaction is fundamentally social. Reeves and Nass (1996) performed a number of classical tests of human social interaction, substituting computers into a role usually occupied by human and concluded that humans are strongly biased in interpreting synthetic entities as social actors even if they do not display anthropomorphic features and individuals' interactions with computers are inherently natural and social. Social interface is an interface that displays social and affective cues to users and aims at triggering social reactions in users (Prendinger & Mitsuru, 2004). Social interface has particular relevance for character-based interfaces, where the user engages the interface in an explicitly social manner (Strommen & Alexander, 1999).

Life-like characters can be a key in social human-computer interaction in that they can embody the interface between human and computers (Wang & Braman, 2009), and thus enhance otherwise poor communicative capabilities of computational devices. APAs are life-like characters (Johnson, Rickel, & Lester, 2000), are specifically designed to facilitate learning through various pedagogical strategies in social context exhibiting various types of like-like behaviors such as speech, emotions, gestures, etc.

Research on APAs has indicated that positive effects on learners' attitude toward learning and performance and showed that learners in pedagogical agent-based environments has showed deeper learning, motivation, and self-efficacy (Baylor & Kim, 2003; Moreno, Mayer, Spires, & Lester, 2001; Van der Meij, 2013). Recognizing the potential of APAs as social interface in computer-based learning environments (Krämer, 2010), researchers have tried to design and develop a variety of APAs, which differ in terms of voice (Atkinson, Mayer, & Merrill, 2005; Mayer, Sobko, & Mautone, 2003), gestures and facial expressions (Lester, et al.,

2000), and roles (Baylor & Kim, 2004).

Attitude as Affective Learning Outcome

It has been widely accepted that there are three major domains in learning outcomes: cognitive, affective, and psychomotor. Gagné (1985) divided the cognitive domain into three distinct categories including verbal information, intellectual skills, and cognitive strategies and thus suggested five categories: verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills. Here there is no doubt that attitude is considered a kind of affective learning.

Gagné defined attitudes as acquired internal states that influence the choice of personal action toward some class of things, persons, or events. What they have in common is that both assume: (1) attitudes can be learned, (2) attitudes are emotional evaluations, (3) attitudes influence thought and actions, and (4) attitude is functional (Perloff, 2002).

Attitude has been studied more thoroughly in the context of persuasion. Persuasion is the study of attitudes and how to change them and is defined as a symbolic process in which communicators try to convince other people to change their attitudes or behaviors regarding an issue (Perloff, 2002). Communication research has indicated that message source and message itself can influence attitudes in isolation and they also interact with each other to have an impact on attitude change. The message source refers to the communicator who delivers the message. In an attempt to influence a person's attitude toward a specific social issue it really matters who communicates the message intended to elicit attitude change.

Message Source Credibility and Fear Appeal, and Relevance to Agent Research

Credibility as message source factor

Regarding the persuasive message source such attributes of communicators as

authority, social attractiveness, and credibility influence audiences through different processes (Perloff, 2002). When it comes to credibility, credible communicators influence people through internalization. People accept the message recommendations suggested by credible communicators because they are congruent with our values and attitudes. Human communication research has shown that a high credibility communicator is more effective in producing attitude change than a low credibility communicator (Pornpitakpan, 2004).

APA researchers maintain that if on-screen characters are part of a computing product, they are likely the most immediate psychological target for credibility evaluation (Lester et al., 1997; Reeves & Nass, 1996). Agent credibility has been examined in the agent research than the other two factors of message source (Brave, Nass, & Hutchinson, 2005; Cowell & Stanney, 2005; Dehn & van Mulken, 2000; Kim, Baylor, & Reed, 2003; Mayer, Sobko, & Mautone, 2003). For example, Cowell and Stanney (2005) discussed a set of empirical studies that attempted to replicate human-human non-verbal behavior for increasing agents' perceived credibility and presented the design suggestions for portraying agent credibility. Kim, Baylor, and Reed (2003) examined the effects of agent voice on students' perceptions of agent credibility. They employed three different voices: strong human-voice, calm human-voice, and computer-generated voice.

Communication researchers found that credibility has more than one dimension, more than a single layer (Buller & Burgoon, 1996). Credible communicators are perceived as having expertise, trustworthiness, goodwill, dynamism, extroversion, sociability, and composure (e.g., McCroskey & Young, 1981). By far the most important characteristics – the ones that have emerged in study after study or generated the greatest theoretical interest – are (a) expertise, (b) trustworthiness, and (c) goodwill or caring.

Agent expertise, trustworthiness, and caring (or goodwill) can be perceived through a number of non verbal behaviors. For example, expertise is often perceived from the way the pedagogical agent wear (e.g., suit or casual) (e.g., Baylor

& Kim, 2005) and what it is called (e.g., professor or peer-like name) (e.g., Fogg & Tseng, 1999). Trustworthiness and caring tend to go in pairs. Empathic facial expressions make the pedagogical agent to be perceived more trustworthy and caring than neutral facial expressions (e.g., Brave, Nass, & Hutchinson, 2005; Cowell & Stanney, 2005). Eye contact can also affect agent trustworthiness and caring. For a pedagogical agent to be perceived credible - in terms of trustworthiness and caring - it should maintain eye contact with the learner, employ direct eye contact, which is not challenging, and avoid looking down (e.g., Cowell & Stanney, 2005).

Fear appeal as message factor

The message itself is also an important factor that can influence audience. There are three major types of message factors (Perloff, 2002): message structure (e.g., message sidedness, conclusion drawing, and order of presentation), message content (e.g., evidence, fear appeal, and framing), and language (e.g., speed of speech, powerful vs. powerless speech, and language intensity).

Among the message factors, a fear arousing message is a persuasive communication that attempts to “scare” people into changing their attitudes by conjuring up “negative consequences” that will occur if they do not comply with the message recommendations (Perloff, 2002). Human communication research suggests that fear enhances attitude change and that high-fear appeals are more effective than low-fear appeals (e.g., Boster & Mongeau, 1984). People are emotional as well as cognitive creatures, and they do not always do what is best for them. Thus, fear appeals are a necessary persuasive strategy.

Fear appeals do not always produce attitude change. Not only can fear appeals fail because they arouse too little fear, they can also backfire if they scare individuals too much. According to Witte (1994), fear appeals arouse fear by depicting a personally relevant and significant threat, and then following this description of the threat by outlining recommendations presented as feasible options for avoiding the

threat.

Even though there have been a few studies involving a message factor in relation to using pedagogical agents as a persuasive message source, for example, message sidedness (Nguyen, Masthoff, & Edwards, 2007), there have been no empirical studies involving fear appeals as a message factor in a pedagogical agent-based learning environment. Thus, it would be worth investigating the effects of fear appeals in the pedagogical agent research.

Portraying Agent Credibility

With regard to agent credibility there is an issue of how to operationalize credible agents as opposed to less credible agents. Indeed, it is not simple to operationalize agent credibility mainly because so many factors will influence agent credibility. As described above, the concept of credibility consists of three major dimensions including expertise, trustworthiness, and caring. Thus, various factors that can influence agent credibility need to be taken into consideration when portraying agent credibility. Those factors include, but not limited to: agent demographics like age, gender, and ethnicity; agent voice; agent non-verbal behaviors (e.g., facial expressions, gestures, eye movement, and the like).

Cowell & Stanney (2005) suggest a set of general design guidelines for portraying agent credibility resulting from a comprehensive review on human-human communication research. In relation to agent credibility they propose three main categories of agent characteristics. The three categories include: agent demographic variable; agent physical appearance variable; and agent non-verbal behavioral variable. They maintain that credible agents should appear attractive, both facially and in body, to take advantage of attributes perceived to be associated with good look, and dress according to function, to take advantage of stereotypical attributions of expertise. There is also considerable evidence that agent gender

and ethnicity can influence learners' perception of agent in terms of such affective aspects as facilitation of learning, self-regulation, motivation, and affability, as well as learning (Baylor & Kim, 2003; Lee & Nass, 1998).

For agent non-verbal behavioral variables Cowell & Stanney (2005) identified five non-verbal behavioral mechanisms that are associated with credibility: facial expression, eye contact, gestures, paralanguage, and posture. Regarding facial expressions associated with agent credibility, Cowell & Stanney (2005) suggest that to convey credibility an agent should use smiles in appropriate situations (e.g., welcoming, saying goodbye, offering information) and avoid negative emotional expressions (e.g., anger disgust), and an agent's facial model should be animated, avoiding the use of a single neutral facial expression to support a trusting environment.

Brave, et al. (2005) investigated the psychological effects of emotion in agents upon users. They employed and compared an empathic agent with a non-empathic agent with regard to their effects on the users' perceptions of agent credibility assessed based on such dimensions as trustworthiness, perceived caring, and felt support. The empathic agent had the appropriate facial expressions for the situation the users encountered. In empathic conditions, for example, the agent responded with either happiness or sadness to the user depending on the situation the user encountered while the non-empathic agent simply unemotionally responded to the user regardless of the situation the user encountered.

Along this line, it is believed that empathic agents with appropriate facial expressions would be considered more credible than non-empathic agents with neutral facial expressions, especially in terms of two dimensions of credibility: trustworthiness and caring. Eye contact is seen as a direct and powerful form of non-verbal communication (Leathers, 1997) and as influencing agent credibility. Based on the literature, Cowell and Stanney (2005) some general design guidelines: (1) an agent should maintain eye contact while interacting with users; (2) eye contact should be direct but not continuous to avoid challenging the user; and (3)

an agent should avoid looking down. It appears that appropriate eye contact is associated with trustworthiness and caring as two dimensions of credibility.

When it comes to agent voice, it has been found that pedagogical agents with human voices are perceived as significantly more credible than those with computer-generated voices (e.g., Kim, Baylor, & Reed, 2003). Especially, it appears that human voices are perceived as more trustworthy than computer-generated voices. Thus, in this study, human voices were used for more credible agent whereas computer-generated voices for less credible agents.

The paralinguage for enhancing agent credibility involves using a moderately fast rate of speaking and appropriate variation in pitch, rate, and volume (Cowell & Stanney, 2005). Computer-generated voices are usually monotonous regarding variations in pitch, rate, and volume, compared to natural human voices with appropriate variations in these dimensions of paralinguage. Thus, differences between a more credible and a less credible message source in variations in pitch, rate, and volume can be made by using computer-generated and human voice for a less credible and a more credible agent, respectively. In addition, it appears that voice tone (strong or calm) can improve agent credibility in terms of the caring dimension of credibility (Kim, Baylor, & Reed, 2003).

It has been shown that agent expertise can be enhanced by the attire the agent is wearing (Baylor & Kim, 2005). Baylor and Kim attempted to operationalize and design three different agent roles: pedagogical agents as expert, mentor, or motivator. In their agent design, the expert agent wore a suit that looked more formal while both the motivator and the mentor agents did a casual that looked more informal. It appears that the way the pedagogical agents wear has a great influence on agent expertise. It is also suggested that labels of expertise give people more credibility (Baylor & Kim, 2003; Fogg & Tseng, 1999). That is, titles that denote expertise (e.g., Dr., Professor, etc.) make people seem more credible.

Table 1 suggests the design principles that have been drawn from the relevant previous research. It implies that agent credibility can be portrayed and manipulated

in terms of facial expressions, eye contact, voice, speech rate, attire, and label of expertise.

Table 1. Design Principles of Agent Credibility

	More Credible	Less Credible	Credibility Dimension
Facial Expression	Empathic	Neutral	Trustworthiness Caring
Eye Contact	Maintain eye contact; Direct and not challenging eye contact; Avoid looking down	Some deliberate violations of the guidelines	Trustworthiness Caring
Voice	Calm Human Voice (Male)	Computer-generated Strong Voice (Male)	Trustworthiness Caring
Speech Rate	Moderate Rate	Faster Rate	Overall Credibility
Attire (Clothing)	Suit	Casual	Expertise
Label of Expertise	Professor	Peer-like name	Expertise

Structuring Fear Arousing Message

Fear appeals do not always produce attitude change. Not only can fear appeals fail because they arouse too little fear, they can also backfire if they scare individuals too much (Morris & Swann, 1996). According to Witte & Allen (2000), fear appeals arouse fear by depicting a personally relevant and significant threat, and then following this description of the threat by outlining recommendations presented as feasible options for avoiding the threat. As this definition implies, the two key constructs in fear appeal research are perceived threat and perceived efficacy. Perceived threat results from two components in the persuasive message: severity information (information about the seriousness and magnitude of the threat and susceptibility information (information about the likelihood that the threatening outcomes will occur). The severity information refers to a message element that

makes individuals feel they will be harmed if the threat is realized. The susceptibility information refers to a message element that makes them feel they are likely to experience the threat.

After threatening or scaring the person, the fear-appealing message must provide ways the individuals can avert the threat (Boster & Mongeau, 1984). Perceived efficacy, which helps avert the threat, can result from efficacy information in the persuasive message. Efficacy information is composed of two components: response efficacy information and self-efficacy information. Response efficacy information refers to whether or not an individual believes the recommended behavior or response will prevent the threat while self-efficacy information refers to whether or not an individual believes they can perform the recommended response. In short, a fear-arousing persuasive appeal describes a threat. Second, the fear appeal indicates that message recipients are likely to experience that threat. Third, fear appeals indicate that one way of avoiding that threat is to perform the change in attitudes recommended by the message source. Accordingly, Table 2 suggests fear arousing message structures, with which the level of fear arousing can be controlled and manipulated.

Table 2. Fear Arousing Message Structures

Level of Fear Arousing	Message Structure	
Moderately Threatening	Threat Statement	- Severity Information - Susceptibility information
	Efficacy Statement	- Response Efficacy - Self-Efficacy
Strongly Threatening	Threat Statement only	- Severity Information - Susceptibility information
Non-Threatening	Neither threat nor efficacy statements	- Neutral information only

Methods

Research design

This study employed one-way between-groups ANOVA design and one-way between-groups MANOVA design. The independent variable for ANOVA was fear arousing message with three levels: non-threatening, moderately threatening, and strongly threatening. The participants were randomly assigned to one of the three experimental conditions differing in the degree of fear arousing, asked to read carefully the message given, and given the perceived fear measure, which was the dependent variable. On the other hand, the independent variable for MANOVA design was agent credibility with two levels: more credible agent and less credible agent. The participants were asked to take a short lesson presented by either more credible or less credible agent, and then they were given the agent credibility measure as dependent variable. The agent credibility measure consisted of three different dimensions: expertise, trustworthiness, and caring. Table 3 summarizes the research design for this study.

Table 3. Research Design with Two Independent Variables

IV	Agent Credibility		Fear Appeal		
	Less Credible (LC)	More Credible (MC)	Non-Threatening (NT)	Moderately Threatening (MT)	Strongly Threatening (ST)
DV	Agent Credibility Measure		Perceived Fear Measure		
	Expertise	Trustworthiness	caring		

Note. * IV: Independent Variable, DV: Dependent Variable

Participants

A total of 40 undergraduates participated in the study and they were recruited from a total of 84 students enrolled in computer literacy courses at a state university

in the southern Florida in the United States. Any students who wanted to obtain an extra credit for their computer literacy course were allowed to participate in the study. The voluntary participants signed up for participation. Once they came to a computer lab at a designated time they were randomly assigned to one of two different agent groups in terms of agent credibility and one of three fear arousing instructional message conditions in terms of fear appeal, respectively, as this study treated the two independent variables (agent credibility and fear arousing message) separately. The average age of the participants was 19.76 (SD=2.76). There were 67.6% of female students and 32.4% of male students.

Independent variables

Two independent variables – agent credibility and fear appeal - were employed in this study. agent credibility consisted of two levels (less and more credible) and fear appeal three levels (non-threatening, moderately threatening, and strongly threatening) Based on the design principles, two different agent conditions were developed differing in the level of credibility and three different fear arousing conditions differing in the degree of fear arousing.

Agent credibility



For agent credibility two pedagogical agents were employed that differed in the level of credibility. The less credible agent showed neutral facial expressions with no eye blinking throughout the presentation of information, and sometimes looked up and down to avoid eye contact with the participants on purpose. A computer-generated male voice was employed, which was strong and had a faster speech rate than the human voice. The less credible agent wore a casual and was called a peer-like name “Chris.”

In contrast, the more credible agent showed empathic facial expressions with eye blinking that changed according to the content of the message, and maintained eye contact with the participants, and maintained eye contact throughout the

presentation of the message. A human voice was employed that was calm and had moderate speech rate compared to the computer-generated voice with a faster speech rate. The more credible agent wore a suit and was called “Professor Keller,” which sounded like more professional. Table 4 shows the screenshots of each pedagogical agent model and how each of them was portrayed differently in terms of those properties.

Both pedagogical agents narrated the same instructional message. The instructional message covered the basic information of what copyright is and current practice of illegal file downloading and sharing.

Table 4. Agent Credibility Conditions

	Less Credible Agent	More Credible Agent	Credibility Dimensions
Screenshot			
Facial Expression	Neutral (throughout the instruction)	Empathic (changes according to message)	Trustworthiness Caring
Eye Contact	Sometimes looking up and down; no eye blinking; head turning	Maintain eye contact; some eye blinking; head turning	Trustworthiness Caring
Voice	Computer-generated Strong Voice	Calm Human Voice	Trustworthiness Caring
Speech Rate	Faster 188 words/75 seconds	Moderate 188 words/90 seconds	Overall Credibility
Attire (Clothing)	Casual	Suit	Expertise
Label of Expertise	Chris	Professor Keller	Expertise

Fear appeal

For the independent variable of fear arousing message three instructional messages were generated that were designed to be different from each other in terms of the level of fear arousing. The non-threatening message (NT) was intended to deliver only the facts surrounding the issue of illegal music downloading and sharing and it did not contain any fear arousing components. The moderately threatening message (MT) contained all of the four components of fear arousing: severity information, susceptibility information, response efficacy, and self-efficacy information. The strongly threatening message (ST) contained the first two components – severity information and susceptibility information - of fear arousing message to arouse fear from the participants. Table 5 shows a sample statement for each message element for fear arousing. The fear arousing level differs depending on which elements are included in the message condition, as shown in Table 2.

Table 5. Sample Statements of Each Message Element for Fear Arousing

Sample Statements	
Severity Information	<ul style="list-style-type: none"> - If people get caught, no matter how, for illegal music downloading and sharing they can face a lawsuit by the recording industry group. - In fact, people who do not take the offer face lawsuits and minimum damages of \$750 for each copyrighted recording shared if they lose.
Susceptibility Information	<ul style="list-style-type: none"> - If you have ever downloaded or shared music illegally and have not gotten caught yet, consider yourself lucky. - Any student on any campus in the country who is illegally downloading music may receive one of these letters. You could be one of them.
Response Efficacy Information	<ul style="list-style-type: none"> - The easiest way to avert such an unfortunate consequence is to quit illegal music downloading and sharing. - These websites are compilations of free and legal MP3 music files. - No more worries about being caught and no costs at all!
Self-Efficacy Information	<ul style="list-style-type: none"> - But I believe that you can overcome this temptation on your own will. - Moreover, you have good Internet search skills to find websites that allow you to download and share music files legally.

Dependent Variables

The dependent variables included perceived agent credibility and perceived fear of message. The perceived agent credibility measure (Brave, Nass, & Hutchinson, 2005) was intended to assess how learners perceive the agents in terms of credibility. The agent credibility scale consisted of three sub-measures: trustworthiness, expertise, and goodwill (caring). Trustworthiness items included four 10-point semantic differentials: trustworthy-untrustworthy, honest-dishonest, reliable-unreliable, and sincere-insincere. Caring items were comprised of five 10-point semantic differentials: compassionate-not compassionate, unselfish-selfish, friendly-unfriendly, cooperative-competitive, and the single 10-point Likert-scale item, warm. For expertise, three 10-point semantic differentials were used: intelligent-unintelligent, smart-dumb, and capable-incapable. The perceived agent credibility measure was implemented to all the experimental conditions. All of the instruments are reliable: trustworthiness $\alpha=.77$, caring $\alpha=.88$, and expertise $\alpha=.77$ (Brave, Nass, & Hutchinson, 2005).

The learners' perceived fear of message was measured with the instrument Witte (1994) developed to assess fear arousal. The instrument measures perceived fear by having participants rate the following mood adjectives ("not at all" to "very much"): frightened, tense, nervous, anxious, uncomfortable, and nauseated. The instrument is reliable ($\alpha=.88$). It was implemented to all the experimental conditions to compare the learners' perceived fear of the message delivered by the agents.

Procedures

This study was conducted as an extra credit activity for a computer literacy class in a computer lab. The participants signed up online to schedule when they would come to the lab to complete the study. A brief orientation on the study was given at the beginning of the study, including the introduction of the study purpose and

explanation of overall procedure for the study. Then, the participants were randomly assigned to one of the two agent credibility conditions and one of the three fear arousing message conditions, respectively. For agent credibility condition, they were first asked to take the short lesson presented by either the more credible agent or the less credible agent, and then they were given the agent credibility measure. After completing the agent credibility condition they were asked to read carefully the instructional message given according to the fear arousing message condition they were assigned to, and then they were given the perceived fear measure.

Results

The learners' perception of agent credibility was analyzed using a one-way MANOVA with an independent variable (agent credibility) and with three dependent variables (perceptions of agent expertise, trustworthiness, and caring). The results indicated that there was a statistically significant difference between the more credible agent condition and the less credible agent condition on the combined dependent variables: $F=4.56$, $p=.017$; Wilks' Lambda=.54; partial eta squared=.46. When the results for the dependent variables were considered separately, there were significant differences between the more credible agent condition and the less credible condition in all of the three dependent variables (Table 6). The mean scores of all of the three dependent variables for the more credible agent condition were significantly higher than the less credible agent condition as shown in Table 7. As a result, it was concluded that the more credible agent condition was perceived more credible overall than the less credible agent condition.

Table 6. Multivariate and Univariate Analysis of Variance F Ratios for Perceived Agent Credibility

Variable	ANOVA			
	MANOVA	Agent Expertise	Agent Trustworthiness	Agent Caring
	<i>F</i>	<i>F</i>	<i>F</i>	<i>F</i>
Agent Credibility	4.56*	13.78*	10.84*	11.75*

Note: * Statistically significant at $\alpha=.05$.

Table 7. Means and Standard Deviations for Perceived Agent Credibility

Perceived Agent Credibility	Condition						Total		
	Less Credible Agent (LC)			More Credible Agent (MC)			M	SD	N
	M	SD	n	M	SD	n			
Expertise	9.18	2.93	20	14.33	3.28	20	11.50	3.99	40
Trustworthiness	12.36	3.41	20	18.78	5.26	20	15.25	5.34	40
Caring	12.73	3.82	20	22.00	7.95	20	16.90	7.53	40

A one-way ANOVA was conducted to analyze learners' perceived fear of message. The results indicated that there was no significant difference in perceived fear of message among the three fear arousing conditions: $F=2.05$, $p=.16$. However, there were meaningful mean differences among the three fear arousing conditions: not-threatening message condition ($M=9.57$, $SD=4.23$), moderately threatening message condition ($M=12.00$, $SD=4.77$), and strongly threatening message condition ($M=15.43$, $SD=6.85$), as presented in Table 8.

Table 8. Means and Standard Deviations for Learners' Perceived Fear of Message

Dependent Variable	Condition						Total	
	Non-Threatening		Moderately Threatening		Strongly Threatening		M (SD)	N
	M (SD)	n	M (SD)	n	M (SD)	n		
Perceived Fear of Message	9.57 (4.23)	14	12.00 (4.77)	12	15.43 (6.85)	14	12.35 (5.73)	40

Discussion

The findings from this study with regards to agent credibility showed that the agent design principles specified from the previous research worked well enough to make a distinction between the more credible agent and the less credible agent. Even though there were no statistically significant differences among the three fear arousing message conditions, the considerable mean differences among the message conditions may indicate that the design strategies for fear arousing message are retained on the premise of some future refinements.

The significant results in terms of perceived agent credibility indicate that the agent credibility design specified in this study is in the right direction. This study looked into many of the verbal and non-verbal agent characteristics collectively in one setting, and attempted to design credible agents and validate the agent credibility design. After all, this study may empirically show that agent credibility can be manipulated by employing a variety of verbal and non-verbal agent behaviors or variables, and provides an implication for pedagogical uses of agent in the context of affective learning domain.

The present study has a couple of limitations. First, the role of the pedagogical agents employed for the study was limited to presenting the instructional module to the learners. There were no meaningful interactions between the students and the agents and/or the instruction module except their clicking on the next buttons to proceed in the instruction. The second limitation of the study may come from the short intervention time, which took approximately 10 minutes across the on the experimental conditions. It was a short period of time considering that this study dealt with learner perception in relation to attitude change. Third, this study involved a small number of participants so there may be an increase in statistical errors, even though the statistically significant results were found.

On the foundation of the results of this study, a couple of future research studies can be suggested. It will be worthwhile to investigate how agent credibility and fear

appeal affect as well as attitudes toward a certain social issue in the affective domain and message learning in the cognitive domain. Moreover, it will be interesting to identify how agent credibility and fear appeal interact with each other to make differences in both attitudes and message learning. Lastly, it will be valuable to examine how message learning affects or is related to attitudes with APA-delivered persuasive messages, from the notion that attitude changes begin with acquiring relevant knowledge and information.

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