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# The Media Equation and team formation: Further evidence for experience as a moderator

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## Abstract

This study extends previous media equation research, which showed that interdependence but not identity leads to team affiliation effects with computers. The current study used an identity manipulation that more closely replicated the manipulation used in traditional team and group formation research than the original media equation research in this area. The study also sought further evidence for the relationship between experience with computers and behaviour reflecting a media equation pattern of results. Sixty students from the University of Queensland voluntarily participated in the study. Participants were assigned to one of three conditions: control, human team (a team made of only humans) or human-computer team (a team made of computers and humans). Questionnaire measures assessing participants' affective experience, attitudes and opinions were taken. Participants of high experience, but not low experience, when assigned to either of the team conditions enjoyed the tasks completed on the computer more than participants who worked on their own. When assigned to a team that involved a computer, participants of high experience, but not low experience, reacted negatively towards the computer (in comparison to high experience participants working on their own or on a team without a computer as a team member) – rating the information provided by the computer lower, rating themselves as less influenced by the computer and changing their own ratings and rankings to be less like those of the computer. These results are interpreted in light of the 'Black Sheep' literature and recognized as a media equation pattern of results.



## Keywords

Media Equation; Team Formation; Groups; Experience; Human Computer Interaction

## 1. Introduction

The media equation is based on the idea that people respond socially to computers. In its simplest form the media equation can be stated as 'media equals real life': more broadly it is the concept that people's interactions with televisions, computers and new media are fundamentally social and natural (Reeves and Nass 1996). In media equation studies, the social dynamics surrounding human-human interactions are shown to exist in human-computer interactions. The studies conducted supporting the media equation all follow a similar research process. The process is as follows: (a) pick a social science finding (usually social psychology or sociology) which concerns behaviour or attitudes towards humans, (b) substitute 'computer' for 'human' in the statement of the theory e.g., 'people like people that flatter them' becomes 'people like computers that flatter them' (Fogg and Nass 1997), (c) replicate the methodology of the social science study but replace one or more humans with computers, (d) determine if the social rule still applies (Nass, Steuer et al. 1994).

A myriad of different media equation effects are described in the literature. The vast majority of this research can be considered to fall into four categories, reflecting the kinds of psychological or sociological effects that are being explored. Human research in the areas of traits, social rules and norms, identity, and communication has been shown to be applicable to human-computer interactions. Media equation research focusing on human traits includes studies on gain-loss theory (Moon and Nass 1996), social facilitation (Rickenberg and Reeves 2000), social presence (Lee and Nass 2003) and principles of attraction (Gong and Lai 2001; Nass and Lee 2001; Lee and Nass 2003). For example, research has shown that people tend to prefer computers that are similar to themselves (Nass and Lee 2000; Nass and Lee 2001) which parallels the tendency to prefer other people who are similar to oneself (the similarity attraction hypothesis; (Duck 1973; Byrne, Clore et al. 1986; Neimeyer and Mitchell 1988). The media equation research concentrating on social rules and norms has explored reciprocity (Fogg and Nass 1997; Takeuchi, Katagiri et al. 1998; Nass and Moon 2000; Takeuchi, Katagiri et al. 2000), flattery (Fogg and Nass 1997; Johnson, Gardner et al. 2004), politeness (Nass, Moon et al. 1999), assignment of roles (Nass, Reeves et al. 1996) and praise and criticism (Nass, Steuer et al. 1994)). For example, there is evidence that people perceive a computer who criticises others to be smarter than a computer that praises others, which is the same process that tends to occur between people (Nass, Steuer et al. 1994). Media equation research focusing on identity incorporates studies on group formation and affiliation (Nass, Fogg et al. 1995; Nass, Fogg et al. 1996), self-serving bias (Moon and Nass 1998), and stereotyping (Nass, Moon et al. 1997). For example, research has shown that people (both male and female) will apply gender-based stereotypes to a computer as a function of whether the computer communicates using a male or female voice (Nass, Moon et al. 1997). The media equation research directed towards issues of communication has included studies exploring party host behaviour (Isbister, Nakanishi et al. 2000), balance theory (Nakanishi, Nakazawa et al. 2003) and emotion theory and active listening (Klein, Moon et al. 1999). The latter researchers, for example, found that for people experiencing negative affect (e.g., frustration), interacting with a computer that provided sincere non-judgmental feedback led to a moderation of the negative feelings experienced (as often happens when people talk to other people who offer sincere non-judgmental feedback).

## *1.1 Refining the Media Equation*

The research reviewed above is based on the process whereby social science methodologies are replicated in the context of human-computer interactions. The findings derived from this process do not provide support for the simple form of the media equation, that is, that ‘media equals real life', rather the findings show that peoples' attitudes and behaviours when interacting with computers follow the same pattern as evidenced in social science findings. People's social responses to computers are often dichotomized in media equation research; people are considered to either display a social response to computers or not. It is more useful to think of peoples' social responses to technology in terms of a continuum (Morkes, Kernal et al. 1999). In some situations, people are likely to show a stronger social response to humans than to computers. Obviously, the basic tenet of media equation research, that people respond socially and naturally to computers, is not challenged by this idea. Rather, the implication is that additional important information regarding the degree of social responses can be gained when studies are conducted exploring exactly how people's social reactions to humans and computers may differ.

Because of unavoidable differences between the original social science research and the majority of media equation studies conducted (in terms of subject population, experimental situation and manipulations) the nature of any equivalence between human-human interactions and human-computer interactions cannot be assessed. To examine the exact extent of similarity between human-human interactions and human-computer interactions, studies must be conducted in which the situation, the procedures, and the measures are identical for both a group of subjects who believe they are interacting with another person (computer-mediated communication: CMC) and a group of subjects who believe they are interacting with a computer (human-computer interaction: HCI). To ensure experimental control across conditions subjects in both groups should believe they are interacting with either the person or computer via their own computer (that is, subjects in the first group should believe they are using a computer to communicate with another computer, whereas subjects in the second group should believe they are using a computer to communicate with a person) (Morkes, Kernal et al. 1999). Recently, studies have begun to use this methodology to assess the degree of similarity in social reactions to computers and humans.

The majority of research conducted using this methodology has found a difference in the degree of the social reaction shown by participants, but no difference in the kind of reaction. Lee and Nass (1998, cited in Nass, Isbister et al. 2000) found that while participants in both a CMC and HCI condition showed intergroup attitudes and behaviours, participants in the CMC condition showed stronger intergroup reactions. Morkes, Kernal and Nass (1998) showed that participants who believed they were interacting with a computer (CMC) and subjects who believed they were interacting with a person (HCI) rated the interactant as equally humorous, likeable, and cooperative and made equal numbers of jokes to the interactant. However, subjects in the CMC condition (who believed they were interacting with a person), compared to the HCI condition, showed greater mirth during the interaction, made more sociable comments and spent more time performing the task. Shechtman and Horowitz (2003)found that while all participants (both CMC and HCI) emphasized relationship goals to a certain degree, when participants believed they were interacting with another person (CMC) they showed significantly more of the kinds of behaviours associated with emphasizing relationship goals than when they believed they were interacting with the computer (HCI).

The aforementioned studies all show a difference in the degree of a particular social reaction depending on whether interaction partners are considered to be human or computer. These differences are largely quantitative, in that, the same general pattern of response is present in both the CMC and HCI condition, but more of the behaviour is exhibited in the CMC condition. Recently, research has been conducted in which participants showed a qualitative behaviour difference across conditions. That is, the reaction of participants in the HCI group, while social, was of a different nature to that of participants in the CMC group. Jettmar and Nass (2002) found important initial evidence that in response to the monitoring and presence inherent in adaptive software, participants in a CMC condition showed a social facilitation response (high task confidence participants perform better when they are being monitored than when they are not, low task confidence participants perform less well when they are being monitored than when they are not) and participants in a HCI condition showed a ‘choking’ response (high task confidence participants perform less well when they are being monitored than when they are not, low task confidence participants perform better when they are being monitored than when they are not). Participants still responded as though the computer was a social actor in the HCI condition (by choking), but the nature of their reaction differed to that of participants who believed they were interacting with another human being. Future research is necessary in order to confirm that social responses to humans and computers differ within the framework of behavioural adaption and presence effects. It would also be interesting to assess whether the difference is a function of the perceived expertise of the interaction partner.

## *1.2 Applications of the Media Equation*

Recently, the media equation has been applied to the design and implementation of software programs, interfaces and electronic devices. Both the general theory, that people tend to treat computers as though they are real people and places, and specific media equation findings have proven useful to designers. Cooper (1999) applied the media equation theory (particularly findings regarding politeness; see (Nass, Moon et al. 1999) when creating a series of principles for programmers to use when designing software. Diederiks (2003) analyzed ‘L-icons’ (virtual personal friends that make viewing recommendations for a television system) and ‘Bello’ (a virtual pet dog that facilitates voice control for a television set) and found evidence that animated characters deploying social behaviour and social rules make it easier to interact with consumer electronic products. Friedman, Kahn and Hagman (2003) found that as a result of the social cues they provide, AIBO robots (small robotic dogs produced by SONY) provide their owners with social companionship and emotional satisfaction. Based on the media equation literature, Johnson (2003) designed and implemented guidebots (or virtual tutors) based on the behaviour of actual human teachers. The results of this work are being used to create a social intelligence model that will be incorporated into a guidebot-enhanced interface that will be able to assess when pedagogical interventions are appropriate. These examples represent a sample taken from the population of published applications of the media equation, and as such are very unlikely to represent the full scope of applications drawing on media equation research that are currently in existence.

## *1.3 Explanations for the Media Equation*

A variety of explanations for media equation findings have been proposed. The three major arguments put forward centre around anthropomorphism, the idea of the computer as a proxy, and mindlessness. Anthropomorphism refers to people acting on a belief that computers are essentially human, thus their behaviour when responding socially to computers reflects ignorance, psychological dysfunction, or social dysfunction. The ‘computer as a proxy’ argument is based on the notion that when an individual responds socially to a computer they are, in fact, responding to the machine as a human artifact. That is, the machine is merely a medium that embodies the responses of the producer or programmer (Nass and Steuer 1993; Nass, Steuer et al. 1994; Nass, Steuer et al. 1994; Nass, Fogg et al. 1996; Nass and Moon 2000; Sundar and Nass 2000). Inherent in both the anthropomorphism and computer as proxy explanations is that individuals’ social responses to technology are consistent with their beliefs about the technology: the computer is treated like a person because it either is perceived to be or perceived to represent a human being. By contrast, mindlessness refers to the human tendency to act on ‘autopilot’, that is, to react to certain cues that may lead to responses that are not necessarily the most appropriate. According to the mindlessness explanation, peoples’ social responses to technology are not necessarily consistent with their beliefs about the technology.

The anthropomorphism explanation of social responses is weakened greatly by a number of characteristics of the media equation literature. In particular, the participants in most of the studies were experienced computer users with a tertiary level education. It seems unlikely that a majority of these participants suffered from a social or psychological deficiency that led them to believe that computers are actually human. Moreover, when debriefed, participants in the studies insisted they would not respond socially to a computer and strongly denied that they would ever exhibit the behaviours they had actually shown in the studies (Nass, Steuer et al. 1994; Nass, Fogg et al. 1996; Nass and Moon 2000). Such denials are inconsistent with the idea that the participants actually believe that computers are essentially human[1].

Sundar and Nass (2000) have conducted research specifically aimed at testing the validity of the ‘computer as proxy’ explanation for the media equation. These studies compare the behaviour of people who think they are interacting with a computer with the behaviour of people who think they are interacting with another person (e.g., the programmer) via the computer. The results of this research provide strong evidence against the ‘computer as proxy’ explanation. Specifically, Sundar and Nass found that people behave differently as a function of whether they

[1] In discussing the anthropomorphism explanation of media equation findings, Nass and Moon (2000) draw a useful distinction between (a) anthropomorphism, which is defined as a sincere belief the computer warrants human treatment; and (b) reactions to ‘cherished objects’, in which people orient to an object and focus on its ability to engender certain feelings or attitudes e.g., naming one’s car and talking to it. Like anthropomorphism, the idea of people reacting to cherished objects does not explain media equation findings. Participants in media equation studies had no history with the computers with which they worked in the study upon which to base an emotional attachment.

think they are interacting with a computer or think they are interacting with another person via the computer. If the 'computer as proxy' explanation were correct, people's behaviour would not differ across these conditions. Beyond these specific results, the general findings in media equation studies also argue against a computer as proxy explanation. Firstly, the vast majority of participants in media equation studies indicate (both spontaneously and when questioned) that they did not have a human, such as a programmer, in mind during the interaction. Secondly, participants in studies involving multiple computers indicated that they thought the same person wrote the programs on the different computers. Given that participants held this belief, if they were treating the computer as a proxy for the programmer then one could expect them to behave in the same way towards each computer. However, participants in studies involving multiple computers show different behaviours and attitudes towards the different computers across conditions (Nass and Moon 2000).

There is generally a lack of support for anthropomorphism and 'computer as proxy' explanations for media equation findings. A much more compelling explanation for people's tendency to treat computers in a social manner is mindlessness. Mindlessness results from attention to a subset of contextual cues (Langer 1992). The cues trigger scripts and expectations that focus attention towards certain information and away from other (potentially relevant) information[2]. Modern computers offer a variety of cues that suggest 'humanness'; they use words for output, they offer interactivity (responses based on multiple prior inputs), and they fill roles traditionally filled by humans (Nass, Steuer et al. 1994; Nass and Moon 2000). From the perspective of mindlessness, these cues are sufficient to trigger unconscious categorisation of computers as social actors. This categorisation, in turn, often leads to a state of ethopoeia.[3]

[2] Readers interested in more detailed information regarding mindlessness are directed to Langer (1992). For details on similar subconscious processes and an exploration of how they may have developed see Reber (1993).
[3] Ethopoeia can be defined as the assignment of human attitudes, attentions or motives to non-human objects (see Nass et al., 1994) in which people respond to computers in a social and natural way.

### *1.4 Possible Moderating Variables for the Media Equation Effect*

Recent research conducted by Johnson, Gardner and Wiles (2004) found evidence suggesting a link between degree of experience with computers and propensity to show a media equation response to computers. An informal survey of computer users of varying levels of experience revealed that most people expect that users with high levels of experience with computers are <u>less</u> likely to exhibit the tendency to treat computers as though they were real people. This belief is based on the argument that more experienced users, having spent more time using computers, are more likely to view the computer as a tool. They are more likely to be aware of the computer's true status -- that of a machine. This argument shares the assumption inherent in both the computer as proxy and anthropomorphism explanations of the media equation effect: individuals' social responses to technology are consistent with their beliefs about the technology. However, the research conducted did not support this argument, that is, Johnson et al. found that more experienced participants were <u>more</u> likely to exhibit a media equation response.

Specifically, participants of high experience, but not low experience, displayed a media equation pattern of results, reacting to flattery from a computer in a manner congruent with peoples' reactions to flattery from other humans. High experience participants tended to believe that the computer spoke the truth, experienced more positive affect as a result of flattery, and judged the computer's performance more favorably. These findings, considered in light of the mindlessness explanation of the media equation, highlight the possibility that more experienced users are more likely to treat computers as though they were human because they are more likely to be in a mindless state when working at the computer. Research on mindlessness has shown that practice or experience can lead to 'overlearning' which increases the chances of mindlessness occurring (Langer and Imber 1979). Essentially, performing a certain task a number of times can result in the task requiring less conscious attention. A person applying less conscious attention to a task is more likely to act on ‘autopilot’ and mindlessly respond based on potentially misleading or inappropriate cues inherent in the task. Thus, it can be argued that people with more experience using computers are more likely to mindlessly apply ‘human’ schemas and expectations to computers as a result of the fact that computers often exhibit cues that suggest ‘humanness’. However, it should be noted that very little evidence for a link between experience and the media equation effect has been reported and research exploring the exact nature of the relationship between experience, mindlessness and the media equation is warranted.

## *1.5 Group Identity and the Media Equation*

Nass, Fogg and Moon (1995; 1996) explored the possibility that people would form team relationships with computers. Research on human groups has shown that manipulations of identity (simply labeling someone as part of a team) and interdependence (linking individual’s outcomes to the outcome of the entire team) can lead to team formation[4] (Vaughan and Hogg 1995). Nass, Fogg and Moon manipulated levels of identity and interdependence and measured the degree of affiliation participants felt towards the computer. Identity was manipulated by telling ‘identity’ participants that they were part of the ‘blue team’ and that they would interact with a teammate called the ‘blue computer’, and ‘non-identity’ participants that they would be working as an individual, a ‘blue individual’ who would be working with a ‘green computer’. Interdependence was manipulated by telling ‘interdependent’ participants that they would receive the same evaluation as the computer they were working with, and ‘non-interdependent’ participants that they would be evaluated on the basis of their work alone. Nass and colleagues found that interdependence with the computer, but not identity, led to a sense of team affiliation with the

[4] For a review of the research see Nass, Fogg, and Moon, 1996

computer and also to the effects of being on a team observed in the social psychology literature (specifically, participants in the ‘interdependence’ condition perceived the computer to be more similar to themselves, saw themselves as more cooperative, were more open to influence from the computer, thought the information from the computer was of higher quality, found the information from the computer friendlier, and conformed more to the computer’s information).

The lack of effect for identity in Nass and colleagues study is striking given the breadth of research showing a link between manipulations of identity and team formation (Vaughan and Hogg 1995). Nass, Fogg and Moon (1995; 1996) drew upon a range of findings in the social identity and group formation literature to develop their identity manipulation. Their manipulation successfully captured the key feature of human-human team formation research in that participants were categorised as group members in the identity condition and were not categorised in the non-identity condition. Nass and colleagues’ findings can be interpreted as evidence that the social psychology research on identity and group formation does not extend to human-computer interactions. However, the robustness of the link between categorisation and team formation and the increasingly wide range of studies showing a media equation effect suggest the possibility that a different manipulation of identity might be more likely to lead to team affiliation in human-computer interactions. On this basis, an extensive review of the group formation and team affiliation literature was conducted.

One of the strongest findings in intergroup behaviour research is the minimal group effect (Vaughan and Hogg 1995). The minimal group paradigm is an experimental methodology developed by Tajfel and colleagues in order to explore the minimal conditions required for intergroup behaviour (including team formation) (Tajfel, Billig et al. 1971). In Tajfel and colleague’s original study participants were invited to take part in a study on decision making and assigned to one of two groups on the basis of their reported preference for paintings by either the artist Klandinski or Klee. Participants were then given the opportunity to allocate money to pairs of fellow participants identified only by group membership. The results indicated that participants tended to strongly favor their own group (Tajfel, Billig et al. 1971). The striking feature of this initial (and subsequent) minimal group paradigm (MGP) studies is that team affiliation effects resulted even though the categorisation was on the basis of a largely arbitrary criterion, the groups created had no history or future, and self-interest was not a motivating factor for participants (Vaughan and Hogg 1995).

More recently, MGP studies have shown categorisation and associated affiliation effects on the basis of coin toss allocations to groups K or W (Gagnon and Bourhis 1996), painting preferences (Gaertner and Insko 2000; 2001), line length estimation (overestimators and underestimators) (Dobbs and Crano 2001), random categorisation to groups X and Y (Grieve and Hogg 1999), figural versus grounded perceptual style (Otten and Moskowitz 2000), shape dependency and independency (Hertel and Kerr 2001), and concave and convex attention styles (Otten and Wentura 2001). The identity manipulations in all these studies share many characteristics with the identity manipulation employed by Nass and colleagues in their study (1995; 1996) however, the identity manipulations employed by Nass and colleagues differs from those in the social psychology literature in one key aspect. All MGP studies incorporate the presence of two groups (or at least the perception, on the part of participants, that two groups are involved). The study conducted by Nass and colleagues implied to participants in the identity condition that they were part of a team, but did not suggest that any other teams might be involved in the study. It is likely (and seems to be an assumption inherent in the MGP) that an awareness of the presence of another group is a key factor in creating a salient identity manipulation. Thus, the current study was designed to extend the work of Nass and colleagues (1995; 1996) by including the presence of another group.

### *1.6 The Current Study*

The current study was designed to extend the research conducted by (Nass, Fogg et al. 1995; 1996) by testing whether a sense of identity (evidenced by increased group affiliation) could be created as a result of categorising participants into two arbitrary teams. This manipulation of identity required that participants be tested in the presence of others (i.e., participants on the other team and participants on the same team). Therefore, it was necessary to separate the effects of being on a team with other humans from being on a team with a computer[5]. The study was also designed to extend prior research by testing whether the propensity to affiliate with the computer was moderated by level of experience with computers. In the current study it was hypothesized that participants would show group affiliation effects as a result of being placed on a team with a computer (H1). Moreover, it was hypothesized that this effect would be stronger for participants with a greater degree of experience with computers (H2).

[5] If only one team condition were employed in the study it would not be possible to tell which effects were attributable to having a computer as a member of one's team and which effects were simply a result of being on a team with other people (irrespective of the computers membership or non-membership in the team).

# 2. Method

## *2.1 Participants*

Sixty students from the University of Queensland voluntarily participated in the study, 40 females and 20 males. In return for their time students were given a movie pass. Fifteen of the participants were from the Faculty of Arts, 20 were from the Business, Economics and Law faculty and 25 were from the Engineering, Physical Science and Architecture faculty. Participants ranged in age 17 to 35 with an average age of 19.8 years.

## *2.2 Procedure*

As the study was designed to extend the findings of Nass et al. (1995; 1996), the procedure employed in the present study is similar to that used by the original researchers. Upon arrival, participants were thanked for agreeing to participate and told that the study was focused on decision making with computers. Participants were given a subject number and told to take a seat at a computer and follow the instructions on the screen. All participants were asked not to speak to one another during the study.

After entering demographic information into the computer, participants were informed that the computers they were working on had been programmed to make use of neural networks. Specifically, they were informed that the computers had been trained to use neural networks to complete two different tasks: a text rating task (TRT) that involved rating a passage of text on various descriptive dimensions, and the desert survival task (DST) that involved ranking a series of items according to their importance for survival in a desert. Participants were informed that the computers were capable of proficiently completing both tasks but that their performance was not perfect.

For the TRT participants were asked to read a body of text (taken from a fiction novel, The Pigeon by Patrick Suskind) and rate the extent to which six words (descriptive, emotive, intriguing, factual, stimulating, entertaining) accurately described the passage. Definitions for each of the words were provided. Participants rated the applicability of each descriptive word on a scale from 1 (low) to 100 (high). After the participants had completed their ratings the computer presented its own ratings in a table that also displayed the participant's initial ratings. Participants were informed that the computer had not been exposed to that particular passage of text before. Ostensibly, the computer rated the applicability of the words to the passage on the basis of the neural network it employed, in actual fact, the computer changed the six ratings by the same absolute value for all participants (for example, if the participants rating of the passage for the word 'descriptive' was under 50 the computer calculated its own rating as the participant's rating plus 37, if the participant's rating for 'descriptive' was over 50 the computer calculated its rating as the participant's rating less 37). This manipulation resulted in each participant experiencing the same degree of disagreement between their original ratings and the computer's ratings. After viewing the computer's ratings, participants were asked to enter a final rating for each word; that is, they were given the opportunity to alter their original ratings.

For the DST participants were asked to imagine they were stranded in the desert and to rank 12 items according to their importance for survival. When participants had completed their ranking, the computer provided a ranking and listed reasoning for the differences between the participant's ranking and the computers ranking (for example if the computer ranked the torch in a higher position than the participant, the reasoning presented was "A torch is the only reliable means of signaling after dark."). Ostensibly, the computer used a neural network to rank the items; in fact, the computer's ranking was systematically different from the participant's (for example, the item placed in rank 1 by the participant was always moved to rank 3 by the computer). Participants were presented with a table that contained their own initial rankings, the computer's rankings, and the reasoning behind the differences between the participant's and the computer's rankings. Participants made a final ranking and they were informed that the computer-based task component of the study was concluded. Participants then completed the questionnaire component of the study on paper[6], were debriefed and thanked for their time.

### 2.3 Manipulation

The experiment had three conditions: control (participants worked as individuals, N = 25), human team (participants were on a team with other participants, N = 19), and human-computer team (participants were on a team with other participants and computers, N = 17). The three conditions were identical in all ways with the exception of whether participants were led to believe they would be working as part of a team (control versus human team and human-computer team) and whether the team would include computers (human team versus human-computer team).

In all conditions participants were asked to wait outside the room until everyone had arrived, they were then given a subject number and told that the purpose of the study was to explore decision making tasks conducted with a computer. The room contained six computers arranged in two banks of three.

In the control condition, participants were given a subject number on a white piece of cardboard and told they would be working on their own during the experiment. The computers all had white identification cards attached to their monitors and the interface for the two tasks (TRT and DST) had a black border. Participants were told it did not matter which computer they used, and that they could work on any computer in the room. The questionnaires completed by participants were printed on white paper.

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[6] Paper questionnaires were used to avoid any politeness effects resulting from participants answering questions about the computer, at the computer on which they had been working (see Nass, Moon and Carney 1999, for further details on the politeness effect).

In the human team condition, participants were randomly given a subject number printed on either red or blue cardboard and told they would be working as part of the red or blue team, respectively. As, per the control condition, the computers all had white identification cards attached to their monitors and the interface for the two tasks had a black border. However, a sign saying either 'blue team' or 'red team' identified the two banks of three computers (this was designed to create a sense of an area of the room dedicated to each team). Participants were told it did not matter which computer they used, but that they should work on one of the computers in their team area. The questionnaires completed by participants were printed on red paper for members of the red team and blue paper for members of the blue team.

In the human-computer team condition, participants were randomly given a subject number printed on either red or blue cardboard and told they would be working as part of the red or blue team, respectively. As per the human team condition, the two banks of three computers were identified by a sign saying either 'red team' or blue team'. In contrast to the control and human team conditions, the computers had either red or blue identification cards and the task interface had either a red or blue border. Participants were asked to use a red computer if they were on the red team and a blue computer if they were on the blue team. The questionnaires completed by participants were printed on red paper for members of the red team and blue paper for members of the blue team.

Thus, the control condition was differentiated from the human team and human-computer team conditions on the basis of whether participants were led to believe they were working on their own or as part of a team. Furthermore, the human team and human-computer team conditions were differentiated on the basis of whether the computer was made to appear to be part of the team. The purpose of this latter difference was to allow the separation of the effect of being on a team with other people from the effect of being on a team with a computer.

### *2.4 Measures*

Participants' degree of experience was measured using an item asking "In general, how experienced are you with computers?" The median value for this measure was 6 on a 9-point scale ranging from "not at all" to "very experienced" (mean = 6.2). On this basis, participants who scored 6 and below were defined as having low experience and participants who scored above 6 were defined as having high experience.

After all interaction with the computer was complete, participants completed the written questionnaire. Except where otherwise identified, all responses were made on 9-point Likert scales. In order to assess mood, the questionnaire included the Positive and Negative Affect Scale; 20 mood descriptors rated on a 5-point Likert scale designed to assess positive and negative mood states (Watson, Clark et al. 1988).

Participants' attitudes towards the 'Text Rating Task' and the 'Desert Survival Task' were assessed using three items each (e.g. "How much fun was the text rating [desert survival] task?"). Participants also rated the quality of the information provided by the computer with three items (e.g. "How relevant was the information the computer provided?"). To assess the degree of openness to influence from the computer, participants rated seven items drawn from Nass and colleagues original study (1995; 1996) (e.g. "How receptive were you to the computer's suggestions?"). In addition to these measures, demographics (gender, age, and enrolled degree) were collected.

For each task participants were asked two questions related to similarity of their ratings/rankings ("How similar were your initial ratings [final ratings] to the computer's ratings?").

For analysis, these measures were combined by subtracting each respondent's initial rating of similarity from their final rating. This variable represented a subjective measure of the degree to which respondents felt their ratings/rankings had became more similar to the computer's suggestions.

For both the TRT and the DST, objective measures of the extent to which participants were influenced by the computer were recorded. For the text rating task, the total difference between the participant's final ratings and the computer's suggested ratings was calculated, such that participants who were more influenced by the computer's suggestions received lower scores, and participants who were less influenced by the computer's suggestions received higher scores. Since the computer suggestions were based on a systematic alteration of the participants' initial ratings/rankings, these measures are directly comparable between participants. Similarly, for the desert survival task, the total difference between participant's final rankings and the computer's suggested rankings was calculated, such that participants who were more influenced by the computer's suggestions received lower scores, and participants who shifted their rankings further from the computer's suggestions received higher scores.

## *2.5 Scale development*

Where relevant, exploratory factor analyses via principal components were conducted to identify sets of variables that could be combined into scales. Factor analysis of the 20 PANAS items showed, as expected, a two-factor solution, with the 10 positive mood descriptors loading on one factor (Positive mood; Cronbach's alpha = .78) and the 10 negative mood descriptors loading on another factor (Negative mood; Cronbach's alpha = .74). The three items assessing ratings of the test rating task loaded on a single factor (TRT rating; Cronbach's alpha = .91). Similarly, the three items assessing ratings of the desert survival task loaded on a single factor (DST rating; Cronbach's alpha = .87). The three items rating the quality of the information provided by the computer loaded on a single factor (Information quality; Cronbach's alpha = .85), as did the seven items assessing the respondent's openness to influence (Openness to influence; Cronbach's alpha = .91).

## 3. Results

A series of one-way ANOVAs were conducted on the dependent measures, with the experimental manipulation (control, human team and human-computer team) as the independent variable. Checks of the ANOVA assumptions of linearity, normality, and homogeneity of variance for these analyses indicated no reason for concern. Results from these initial analyses were non-significant. Prior findings suggest that media equation effects are more apparent amongst people with more extensive experience with computers (Johnson, Gardner et al. 2004), so the sample was split into two groups of respondents (low and high experience with computers). Subsequent one-way ANOVAs were conducted separately for the low experience and high experience respondents. The ANOVAs conducted on the low-experience respondents (N = 32) showed no significant effect of experimental manipulation for any of the dependent measures (see Table 1).

INSERT TABLE 1 ABOUT HERE

The ANOVAs conducted on the high-experience respondents (N = 28) showed significant effects across the experimental manipulation for several measures. There were significant differences across conditions for the ratings of both the text rating task and the desert survival task. Examination of the mean scores (see Graphs 1 and 2) indicated that high experience participants in the human team and human-computer team conditions rated both tasks more positively than their counterparts in the control condition. No such pattern existed for low experience participants. This finding suggests that for high experience (but not low experience) respondents, simply being placed in a team was sufficient to promote more positive attitudes to the tasks than working alone (in the control condition).

INSERT GRAPHS 1 & 2 ABOUT HERE

For high experience respondents' subjective measures of how much they altered their ratings to be like the computer's suggestions, there were significant differences across conditions for the text rating task, but not the desert survival task (see Table 1). Mean scores for the text rating task (see Graph 3), suggested that respondents reported less alteration of their responses in the human-computer team condition than in the control and human team conditions. High experience respondents, who were working in a team with other people and a computer, subjectively rated themselves as being less influenced by the computer in the text rating task than high experience participants in either the control condition or the human team condition. This effect was not present for the desert survival task.

INSERT GRAPH 3 ABOUT HERE

High experience respondents showed significant differences across conditions for both their ratings of the quality of information provided by the computer, and their openness to influence from the computer (see Table 1). Mean scores for these measures indicated that high-experience respondents in the human-computer team condition rated the quality of information from the computer lower (see Graph 4) and reported lower levels of openness to influence from the computer (see Graph 5) than their counterparts in the control and human team conditions. When high experience participants were placed in a team with a computer as well as other humans, they were less positive about the quality of information provided by the computer, and described themselves as being less open to being influenced by the computer.

INSERT GRAPHS 4 & 5 ABOUT HERE

Amongst high experience respondents, there were significant differences across conditions for the extent to which respondents' final ratings/rankings differed to the computer's suggestions for both the text rating task and the desert survival task (see Table 1). Mean scores for these measures indicated that high-experience respondents in the human-computer team condition had ratings/rankings that were further from the computer's suggestions in both the text rating task (see Graph 6) and the desert survival task (see Graph 7) than their counterparts in the control and human team conditions. High experience participants in a team with a computer were less influenced by the computer in both tasks, than high experienced participants in the human team and control conditions.

INSERT GRAPHS 6 & 7 ABOUT HERE

# 4. Discussion

## *4.1 Experience*

The pattern of results, at first glance, provides at least partial support for the media equation. However, more in-depth consideration reveals that the pattern of results is fully in keeping with the media equation, as detailed below, and provides further support for the idea that high experience participants are more likely to show a media equation effect than are low experience participants. No significant findings were found for low experience participants whereas significant effects were found across conditions on a variety of measures for high experience participants. This finding further supports the explanation that media equation behaviour (treating computers as though they are real people and places) results from a state of mindlessness. More experienced participants are more familiar with computers and computer based tasks than less experienced participants, and hence, less likely to be mindful during the computer based tasks completed as part of this study. As a result of being in a less mindful state they are less likely to notice all the cues presented in a situation (including those which would remind them that they are not dealing with a human) and instead, they react to certain cues which suggest humanness on the part of the computer. In other words, more experienced participants are more likely to be relaxed in the environment and to be acting on ‘autopilot’, the human-like cues presented by the computer are less likely to be consciously or unconsciously inspected or questioned, and behaviour that is generally applied when dealing with other humans results. Obviously, further research is needed to assess this explanation more directly. Regardless of the process underlying the phenomenon, this is the second study to find evidence of the correlation between experience and the degree to which behaviour consistent with the media equation is displayed.

## *4.2 Extensions of Prior Research*

While Nass, Fogg and Moon (1995; 1996) found no effect for identity (i.e., the categorization of participants in to arbitrary teams) in their original study, there was evidence in the present study of team affiliation effects as a result of the identity manipulation. High experience participants rated both the text rating and the desert survival tasks more positively when they were part of a team (in comparison to participants who were working on their own). Whether the team was a human team or a human-computer team did not affect this result – high experience participants on both kinds of team rated the tasks more positively. This suggests that there is a benefit to computer users in team environments. Whether or not the computer is made to be part of the team, computer users in a team environment enjoy computer-based tasks more than computer users who are not part of a team environment[7].

Participants in the current study also displayed differences in terms of ratings of the information the computer provided, openness to influence, perceived similarity to the computer, and responses to the two tasks as a function of team membership (these results will be discussed in greater detail below). The pattern of results strongly supports the notion that participants can be made to feel part of a team with a computer as a result of an identity manipulation. The key difference between the present study and previous research conducted by Nass and colleagues (1995; 1996) is the presence of another team. As in human based, minimal group and social identity research the present study incorporated the presence of two distinct teams in all team conditions. In light of the lack of effect found by Nass and colleagues it seems likely that the presence of another team (or at least knowledge of the existence of another team) is an essential prerequisite for team affiliation effects to occur in a computer based task environment.

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[7] It should be noted that this effect is not a result of interaction with teammates or other similar variables. The only difference between control conditions and team conditions in the study was whether participants were told they were working as part of a team or working on their own. There was never any interaction between participants during the study. The same numbers of people were in the room, seated in the same configuration in all conditions.

### *4.3 The effects of being on a team with a computer*

An unexpected but consistent pattern of results arose for high experience participants across the human team and human-computer team conditions. Initially, these results appear to be contrary to social identity and group formation theory. Broadly speaking, high experience participants in the human-computer team condition rated the quality of information from the computer lower, felt they were less open to influence from the computer, perceived their own responses to the text rating task to be less similar to the computer's ratings, and were less influenced by the computers response in both the text rating and desert survival tasks than high experience participants in the human team condition. This finding is in contrast to the findings of Nass and colleagues (1995; 1996) (and also contrary to typical minimal group or team formation research) in which participants perceived the computer as having more influence, rated the quality of information from the computer more highly, and conformed more to the computers recommendations when the computer was made a part of the team.

The contrary pattern of results obtained in the current study is intriguing, as it is not possible to conclude that the identity manipulation did not work. Firstly, team affiliation effects are present for high experience participants in terms of rating of the tasks. Secondly, those in the human-computer team condition did not show the same attitudes and behaviour as those in the human team condition. Those who had a computer teammate as well as human teammates generally reacted negatively towards the computer in comparison to those who were part of a team without the computer as a teammate. This finding suggests that there is something unique about being on a team that includes a computer that leads to a negative reaction towards that computer.

This raises the question of why these high experience people would be inclined to disregard or undervalue the computer's recommendations. Our initial consideration of the social identity literature led us to hypothesise the opposite pattern of results. We expected high experience participants to be more likely to treat the computer as a team member and thus, expected them to be more likely to be influenced by the computers ratings and rankings in the two tasks, when the computer was made part of the team. The pattern of results obtained contradicted these expectations, high experience participants working with the computer as a team member were less influenced by the computer than either low experience participants or participants in which the computer was not a team member.

However, further exploration of the social identity literature leads to explanations of the high experience participants' behaviour that are in line with the media equation explanation of people's reactions to computers. Research has been conducted identifying a phenomenon known as 'The Black Sheep Effect' whereby group members may reject another group member based on that group member's deviation from the group prototype (Marques and Yzerbyt 1988; Branscombe, Wann et al. 1993; Hogg, Hardie et al. 1995; Jetten, Spears et al. 1997; Marques, Abrams et al. 1998; Marques, Paez et al. 1998; Biernat, Vescio et al. 1999; Matheson, Cole et al. 2003). These studies highlight unfavourable evaluations and derogation of ingroup members as a form of ingroup bias that marginalises members who threaten positive ingroup identity. If the current findings are considered in light of 'the black sheep effect' then they can be interpreted as a clear example of media equation behaviour. Specifically, high experience participants placed on a team with the computer (but not low experience participants) treat the computer like a person to the extent that they perceive the computer as a member of the ingroup, albeit a member of the group that does not contribute positively to their group identification. As a result, high experience participants derogate this less positively perceived group member (the computer) by placing less value on its recommended ratings and rankings and generally perceiving the information it provides to be of less value. This derogation of the computer and the information it provides does not occur among high experience participants unless the computer is implied to be a member of the team. Low experience participants, on the other hand, do not exhibit a media equation pattern of results; even when it is implied that the computer is a team member, the computer is not perceived as a member of the group and thus no negative reaction towards the computer as a group member results. This explanation is strengthened by the fact that the results extend beyond subjective ratings and into objective behaviour. The pattern of results was consistent for subjective ratings of the quality of information provided by the computer, subjective ratings of the degree to which participants felt they were open to influence from the computer, subjective ratings of the degree of similarity between participants' and computers' text ratings, and objective measures of the degree to which participants actually changed their ratings and rankings in the text rating and desert survival tasks.

It would seem that while high experience computer users tend to treat computers like real people and places to the extent that they will accept the categorisation of the computer as a fellow group member, the effect is not strong enough for them to perceive the computer as a positive addition to the group. Rather, high experience users seem to be prepared to accept the computer as a teammate, but presumably because of deviations from the assumed group prototype, the computer is reacted to negatively and its input is marginalized or disregarded. According to the black sheep theory of group formation, this derogation of the marginal ingroup member (in this case the computer) serves to strengthen and protect the existing team identity.

An alternative explanation for this pattern of results would be that participants found the concept of having the computer as a teammate ridiculous. In response to being forced into an absurd situation, participants became belligerent and deliberately changed their responses to be contrary to the recommendations made by the computer. However, this explanation cannot account for the fact that only high experience participants rated the information provided by the computer as less useful, perceived themselves as less influenced by the computer, perceived themselves as less similar to the computer, and changed their responses away from the recommendations made by the computer. Nor can it account for the fact that high experience participants reported enjoying the task more when they worked as part of a team regardless of whether the computer was part of the team.

### *4.4 Implications*

The results provide further support for the theory that media equation behaviour results from mindlessness in that, as per our previous research, only high experience participants displayed media equation behaviour. While the results of these two studies provide strong support for the theoretical connection between mindlessness and the media equation, future research, directed at testing this theoretical link directly, is required.

The study also provides further support for the notion that being made to feel part of a team when working on a computer based task leads to more positive reactions to the task itself (among high experience participants). This suggests the value of creating a team environment amongst computer users facing tasks that might otherwise be perceived less positively. Although there is no evidence to suggest that the positive impact of being part of a team extends to low experience computer users, neither was there any evidence that such users react negatively to being part of a team environment. Thus, a group of more experienced computer users (e.g., office workers), or a group with varying degrees of experience with computers (e.g., high school students) will be likely to react more positively to computer based tasks if they are presented in an environment in which the users are encouraged to perceive themselves as a team.

However, the results of the study suggest that it is unwise to attempt making the computer itself a part of a team of humans. No benefits of making the computer part of the team were found for low experience participants, and for high experience participants a strong negative reaction resulted. This implies that where team environments are employed in computer based task settings, no attempt should be made to encourage team-members to consider the computer a part of the team.

### *4.5 Conclusions*

Our first hypothesis, that participants would show group affiliation effects as a result of being placed on a team with a computer, was strongly supported but not in the manner we initially expected. Rather than reacting with increased positivity and openness to influence towards a computer that was made part of a team, participants derogated and marginalized computers that were made to appear as part of the team, that is, they treated the computer as a black sheep. This negative reaction towards the computer teammate is a team affiliation effect, in that the computer must be perceived as a teammate for there to be any reason to react negatively towards it and the information it provides (evidenced by the fact that no negative reaction towards the computer resulted in the human team conditions). According to the black sheep theory, the derogation of the computer and the information it provided is a means of protecting the team identity and affiliation for the other (human) team members.

Our second hypothesis, that affiliation effects would be stronger for participants with a greater degree of experience was also strongly supported. Low experience participants in the present study showed no evidence of media equation behaviour at all. High experience participants, on the other hand, showed a range of media equation reactions, both in terms of subjective responses and objectively measured behaviour.

The present study extends the original study conducted by Nass and colleagues, by showing that the presence of a second group or team allows for the creation of a team identity in the absence of any interdependence between the computer and the human participants. The present study further extends previous research by showing that high experience computer users will accept the computer as a team member, but not a valued or positively perceived team member.

Broadly speaking, the results provide further support for the media equation theory and additional initial support for the notion that media equation behaviour is more prevalent amongst more experienced computer users. The results also provide an intriguing insight into a potential limit of the media equation effect. Future research directed towards confirming and further exploring the tendency of high experience participants to accept the computer as a team member but treat the computer as a black sheep, is likely to be of great theoretical value.

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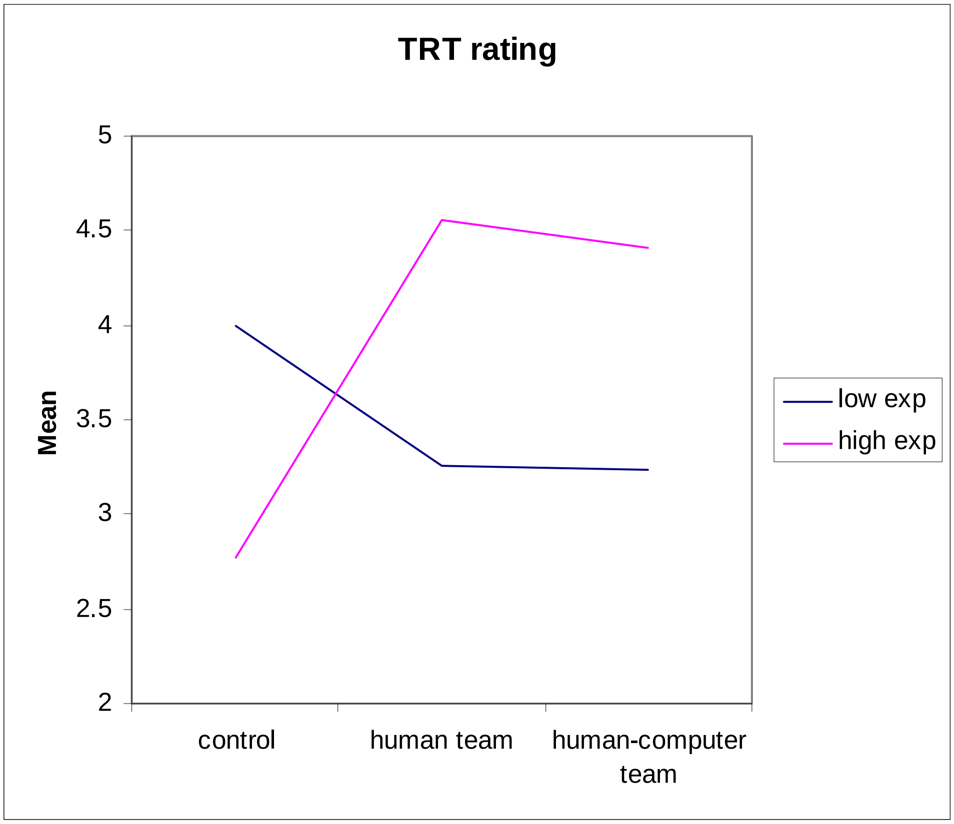
# Tables

Table 1

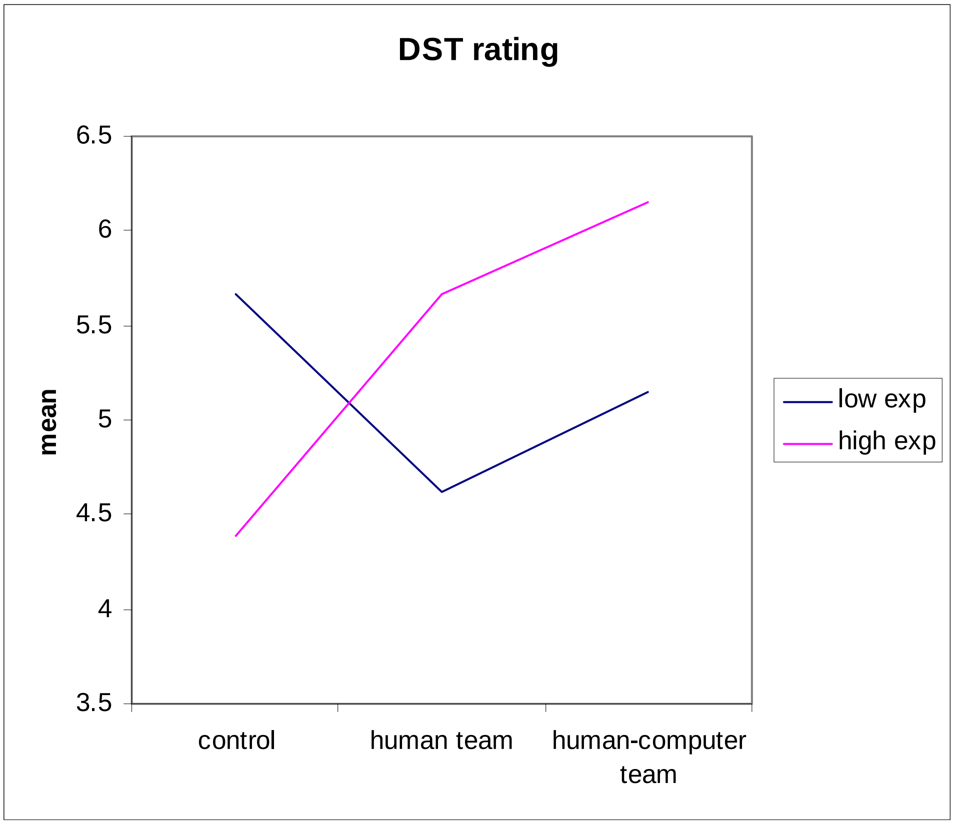
ANOVA results for respondents with low and high experience with computers.

| Measure | Low Experience (N = 32) | | High Experience (N = 28) | |
|---|---|---|---|---|
| | F (2,29) | Sig. | F (2,25) | Sig. |
| Positive mood | 1.677 | .204 | .707 | .503 |
| Negative mood | 1.618 | .216 | .927 | .409 |
| TRT rating | .909 | .414 | 3.870 | .034 |
| DST rating | 1.211 | .312 | 3.900 | .034 |
| TRT similarity | 2.188 | .130 | 4.098 | .029 |
| DST similarity | .280 | .758 | .601 | .556 |
| Information quality | .208 | .814 | 5.013 | .015 |
| Openness to influence | .672 | .518 | 3.768 | .037 |
| TRT difference | .120 | .887 | 6.072 | .007 |
| DST difference | .148 | .863 | 4.000 | .031 |

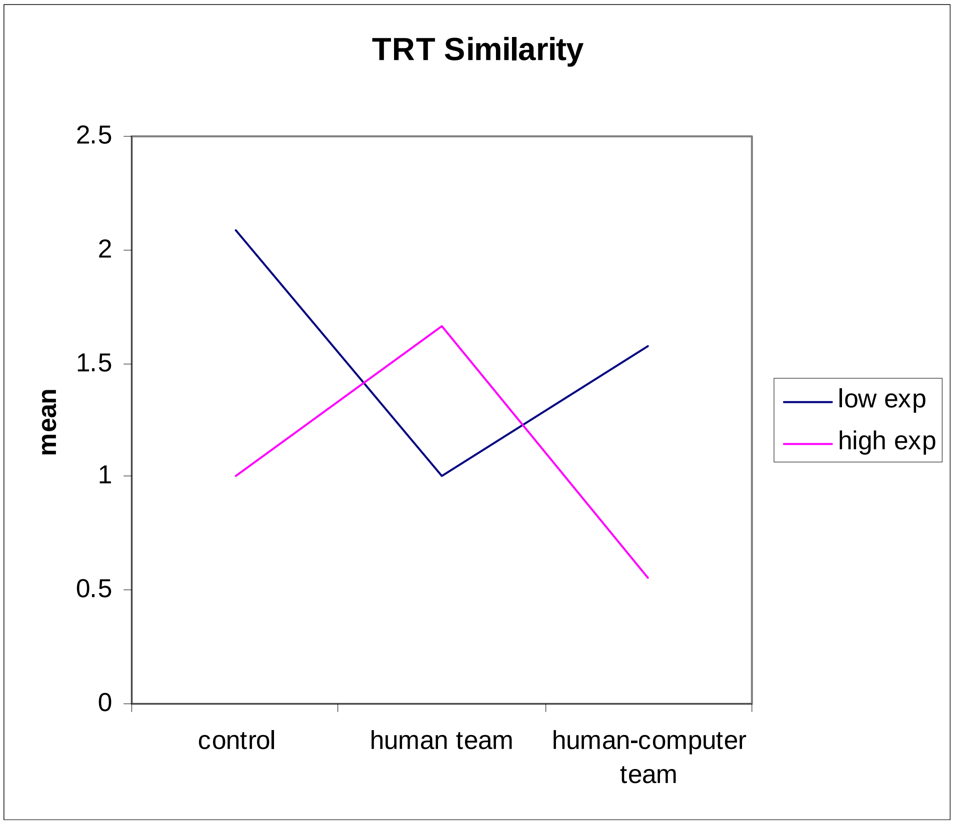
## Graphs



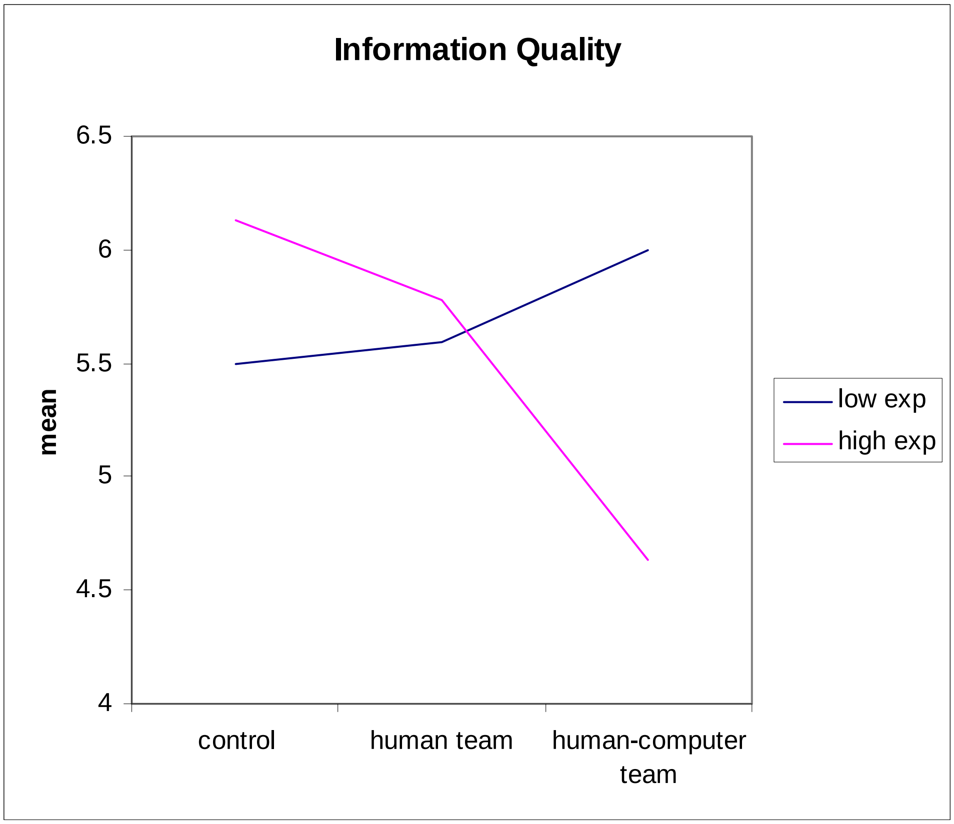

Graph 1


DST rating
mean
6.5
6
5.5
5
4.5
4
3.5
control
human team
human-computer team
low exp
high exp

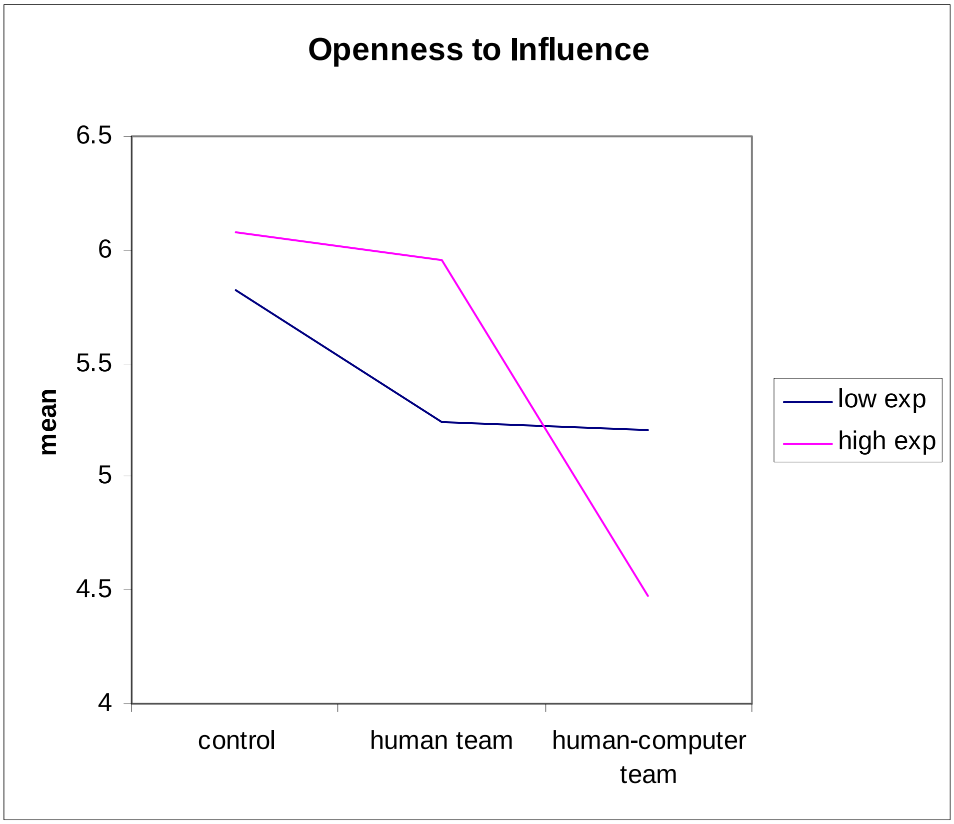
Graph 2


TRT Similarity
2.5
2
1.5
1
0.5
0
mean
control
human team
human-computer team
low exp
high exp

Graph 3

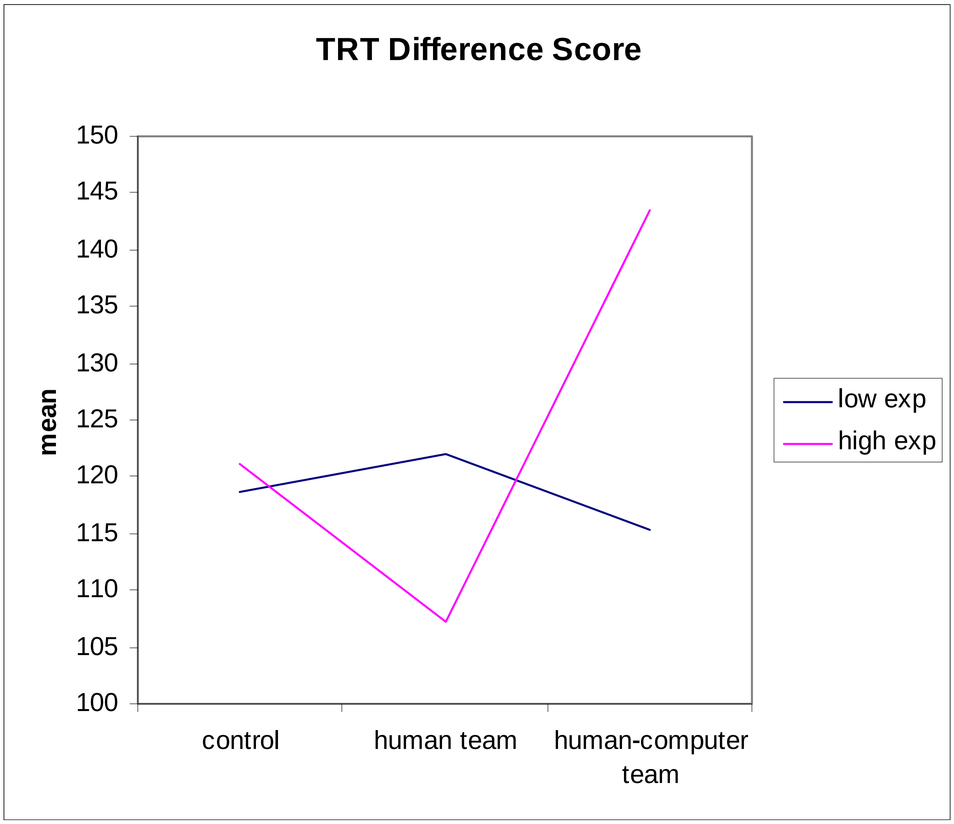

Information Quality
6.5
6
5.5
5
4.5
4
mean
control
human team
human-computer team
low exp
high exp

Graph 4

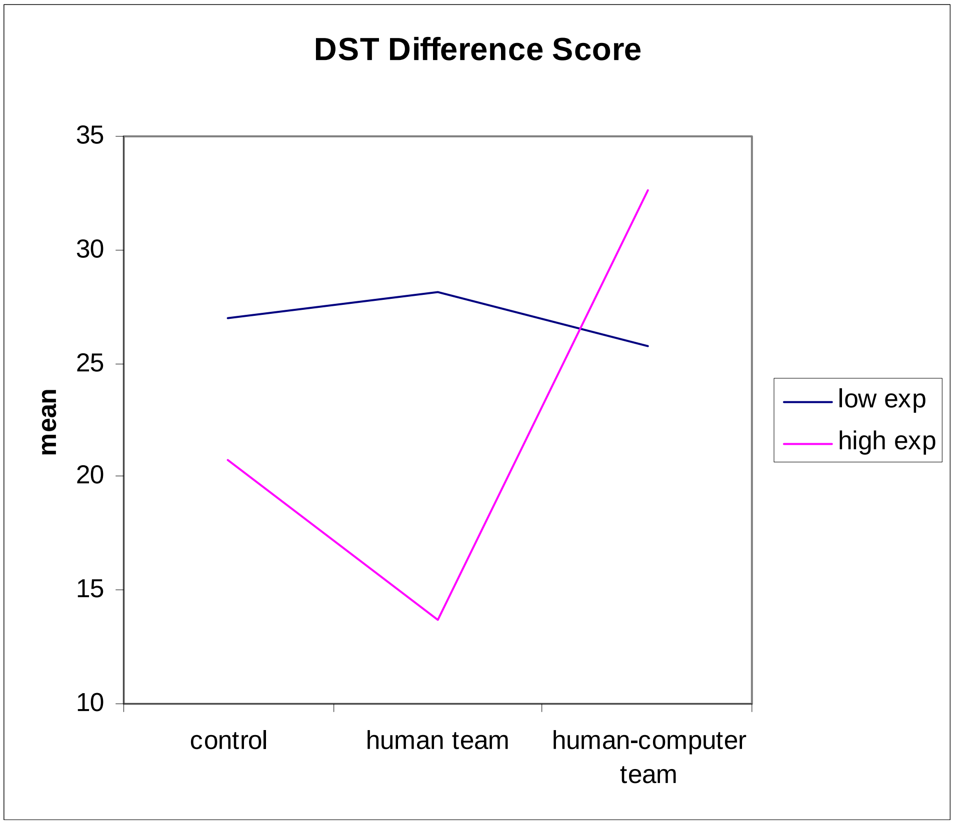


Openness to Influence
6.5
6
5.5
5
4.5
4
mean
control
human team
human-computer team
low exp
high exp


Graph 5


TRT Difference Score
mean
150
145
140
135
130
125
120
115
110
105
100
control
human team
human-computer team
low exp
high exp

Graph 6


DST Difference Score
35
30
25
20
15
10
mean
control
human team
human-computer team
low exp
high exp

Graph 7