Research Article

REACTION TIME AS A PREDICTOR OF TRUST: EMPIRICAL EVIDENCE

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ABSTRACT

Automation Trust is created when human operator interacts with machines. It is more obvious when machines work in automation more. Operators interact and at times machines fails to take decision on their own and require human intervention. Reaction Time (RT) acts a predictor of trust. This paper has tried to study the relationship between trust and reaction in two conditions i.e. 90% reliability condition and 25% reliability condition. The result reveals that, there is a high RT in former condition vis-à-vis latter condition.

***Key Word**: Automation, Reaction Time, Trust*

Introduction

Automation is the technology that actively selects data, transforms information, makes decisions, or controls processes. Such technology exhibits tremendous potential to extend human performance and improve safety; however, recent disasters indicate that it is not uniformly beneficial. On the one hand, people may trust automation even when it is not appropriate. Pilots, trusting the ability of the autopilot, failed to intervene and take manual control even as the autopilot crashed the Airbus A320 they were flying (Sparaco, 1995).

Trust, a socio-psychological concept seems particularly important for understanding human automation partnerships. Trust can be defined as the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability. In this definition, an agent can be automation or another person that actively interacts with the environment on behalf of the person. Considerable research has shown the attitude of trust to be important in mediating how people rely on each other (Ross & LaCroix, 1996). Sheridan and Hennessy (1984) argued that just as trust mediates relationships between people; it may also mediate the relationship between people and automation. Many studies have demonstrated that trust is a meaningful concept to describe human automation interaction in both naturalistic (Zuboff, 1988) and laboratory settings (Muir, 1989; Muir & Moray, 1996). These observations demonstrate that trust is an attitude toward automation that affects reliance and that it can be measured consistently. People tend to rely on automation they trust and tend to reject automation they do not. By guiding reliance, trust helps to overcome the cognitive complexity people face in managing increasingly sophisticated automation. Trust guides – but does not completely determine – reliance, and the recent surge in research related to trust and reliance has produced many confusing and seemingly conflicting findings.

Human- Machine Trust:

Trust is a multidimensional concept that has emerged as a central focus of organizational behavior, interpersonal relationships, and human-computer interaction (Lee & See, 2004). The diverse interest in trust has created many definitions. Some definitions characterize trust as an attitude or expectation (Barber, 1983), or an intention or willingness to act (Johns, 1996). Mayer, Davis, and Schoorman (1995) defined trust as a willingness of a party to be vulnerable to the actions of another party. This willingness is based on the expectations that the trustee will perform a particular action important to the thruster. Other definitions maintain the importance of the goal orientation nature of trust (Johns, 1996; Mayer et al, 1995).

From the above description, it is evident that there are many inconsistencies in the definition of trust. Perhaps the most appropriate definition of trust was provided by Lee and See (2004). These researchers conducted a comprehensive review of the trust literature and proposed a more general and parsimonious definition of the concept. They suggest that trust is "an attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability". In this definition, an agent can be automation or another person that actively interacts with the environment on behalf of the person (Lee & See, 2004).

Reaction Time:

Reaction time refers to the total time passed between exposing a psychology study participant (or anyone) to something (within the domain of a psychology study, this something is known as a "sensory stimulus") and the reaction (a psychology study also has a fancy phrase for this, "behavioral response"). Discrimination reaction time test is the most complex type of reaction time test, though still relatively simple. In this type of psychological study, participants are asked to quickly indicate, which simultaneously presented stimuli best fits a certain specification. For example, a discrimination reaction time test may call for a participant seated at a computer to quickly determine which of two triangles is a brighter shade of blue is by hitting an appropriate button on the keyboard.

Method

Participants:

The sample selected for present study consisted of twenty male students age ranged from 17-21 years (M=19.6; SD 2.4), who aspire to opt for the different services in flying branch and were randomly selected for the experiment.

Materials and Apparatus:

This experiment was conducted on new version of MAT Battery Task. A computer with P IV processor and joy stick was used for the study.

Procedure:

Biographical questionnaire was administered on the participants. Then their eye sight was checked by SNELLEN CHART and only those were selected who have 6/6 or 6/9 with or without glasses. A detailed instruction was given to the participant about the functioning of various components of the MAT-B task with a 5 minutes demo. After demo, 10 minutes practice session was given to the participant. Only those participants were retained for further testing, who scored more than 70% in practice session. The main session of 45 minutes was administered on the retained participants. The same procedure was applied in booth 25% and 90 % reliability condition.

Design

2 (Trust Level: 25%, 90%) X 3 (Time block: 15 min each) mixed factorial design has been used with repeated measures on last factor. Reaction time was measured for each trial (block of 15 min) and for both 25% and 90% reliability condition.

Result

Fig.-1: Showing Mean Reaction Time estimated on various Trials (Trust Level: 25% and 90%)

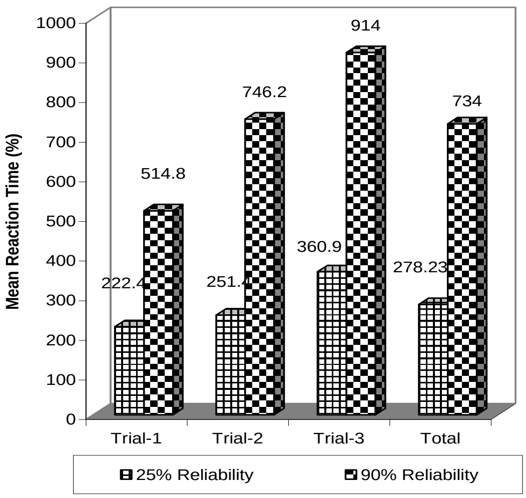

Table-1: Showing Means and SDs of Reaction Time estimated on various Trials (Trust Level: 25% and 90%).

Trial	**25% Reliability**		**90% Reliability**	
	Mean	**SD**	**Mean**	**SD**
Trial 1	222.40	82.00	514.80	339.03
Trial 2	251.40	64.02	746.20	307.87
Trial 3	360.90	234.16	914.00	127.15
Total	278.23	155.10	734.00	306.70

Table–1 reveals that the total mean Reaction Time (RT) for 25% reliability condition was 278.23 milliseconds (SD= 155.10), where as for the 90% reliability condition the mean RT was considerably high i.e., 734.16 ms (SD= 306.70). The block/trial wise trend in different reliability condition has also been analyzed. This shows that RT for first block in 25% reliability condition was 222.40 ms (SD= 82.00), where for last block was 360.90 ms (SD= 234.15). Similarly, the RT for first block in 90% reliability condition was 514.80 ms (SD= 339.03), where for last block was 914.00 ms (SD= 127.15). The common trend found that the reaction time increases over the increased time across the blocks/trials. The same has been pictorially presented in following graph.

The block wise trend in different reliability has also been analyzed. The common trend found to be increase in reaction time across the blocks. This meant RT for first block in 25% reliability condition was 222.40 ms (SD= 82.00), where for last block was 360.90 ms (SD= 234.16). The graphical representation depicts the trend.

The block wise trend analysis in 90% reliability condition has also been analyzed. The trend found to be increase in reaction time across the blocks. This meant RT for first block in this reliability condition was 514.80 ms (SD= 339.03), where for last block was 914.00 ms (SD= 127.15). The graphical representation depicts the trend.

Furthermore, a 2x3 ANOVA was administered for the analysis of multiple mean differences. The main effect for Group (25% & 90% Reliability) was found significant at 0.01 level [(F 1, 54) = 64.124, $p<0.01$ level]. The main effect for Time Blocks/Trials (Trial 1, 2 & 3) was found significant at 0.01 level [(F 2, 54) = 6.726, $p<0.01$ level]. However, the interaction between the Group and the Time Blocks (Trials) was found not significant.

Table-2: Showing Analysis of Variance of Means: 2 (Trust Level: 25% and 90%) X 3 Trials (Time block: 15 min each)

Source	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Group (25% & 90% Reliability)	3115848.82	1	3115848.82	64.13	0.000
Time Block (Trial 1, 2 & 3)	653642.23	2	326821.18	6.73	0.002
Group x Time Block	147966.23	2	73983.12	1.52	0.227
Error	2623932.90	54	48591.35	-	-

Discussion

The above experiment was conducted to establish the relationship between Reaction Time and Trust in the 25 % and 90 % automation reliability condition. It obvious from the above discussion that reaction time has a relationship with trust. In 25 % reliability condition (where there are less chances of complacency), RT was 278.23 milliseconds, which is as low as compared to 90% automation reliability condition, where the RT was 278.23 milliseconds. Similarly there was a gradual increase in within block RT, in both the reliability condition. In 25 % automation first block, the mean RT was 222.40 milliseconds, which increased to 360.90 milliseconds across the time. Similarly in 90% reliability condition, the first block RT was 540.80 milliseconds, which increased up to 914.0 milliseconds across the time.

The analysis of variance ANOVA) also showed that the main effect and as well as interaction effect were significant at 0.01 level.

Thus it can be concluded that Reaction Time can serve as a predictor of Trust in automation task. A low RT shows low level of perceived trust of an operator in a machine and low complacency, whereas high RT shows a high level of perceived trust and high complacency in the machine.

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