RELATIONSHIP BETWEEN INTERFACE ALERTS AND COMPLACENCY ON HUMAN-AUTOMATION INTERACTION: A THEORETHICAL APPROACH

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Keywords: *Human-Automation Interaction, Complacency, Users' Behavior*

1 Context

The arrival of automated systems have brought new chalenges to the field of human factios and ergonomics, specially when it comes to the human role on the development of the task. According to Parasuraman & Sheridan (2005), the introduction of automated elements on an environment changes the users' role, from an operational position to a passive monitor of the system workflow. Within this logic, the user needs to be attentive to sudden changes on the environment and also be capable to identify extreme cases, where he/she might need to interveighn.

Parasuraman & Manzey (2010) claim that after long exposition to automated task, human vigilance capabilities are gradativelly diminished, in a phenomenom called automation-induced complacency. In other words, the removal of the user's operational function on the task, if not treated correctly, ends up making the him/her unable to perceive failures on automated system, exposing the whole environment to potential risks.

Being said that, this article defends the idea that the interface for human-machine communication, if well designed, can collaborate to the mitigation of the complacency, in the same way that bad interface design may accelerate the process of loss of user's vigilant capabilities.

2 Method

The goal of this paper was to conduct a theoretical analysis of the phenomenon of users' complacency over automated systems in the perspective of the signal detection theory and the radical behaviorism. This study looked for the comprehension of the role of interaction design in users' vigilant behavior during an automated task.

In order to do so, a model-based analysis was made to compare those two theories. The models of each theory were depicted in which factors may affect human vigilant behaviour and what are the most relevant causes for its diminish. With that in hand, differences between the models were highlighted and relationships were stablished between the impact of those discrepancies and the practice of interface design for autonomous systems.

3 Results

The signal detection theory (SDT) defines attention through a mathematical model, which defines the capability of certain individual to identify the presence of relevant stimuly in one uncertain environment. (HEEGER, 1998). See the model below (figure 1):

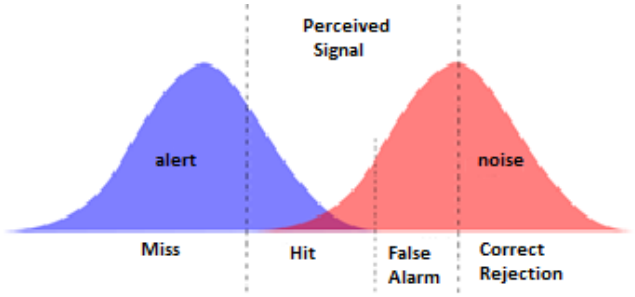

Figure 1- SDT Model (RITTER et al., 2014) (Authors' adaptation)

According to the model, the threshold for perception of certain alert is in constant change based on how successful were the individuals' previous experiences with similar stimuli (RITTER et al., 2014). In other words, false alarms and misses are of paramount importance for vigilant behavior shaping. Nevin (1969) introduces the phenomenon of signal saturation, which can be defined as the individual's loss of capability to attend to certain alert due its constant repetition. This has directly relationship with Human-Automation Interaction, once most of the alarms of the system are redundant and a relevant (emergency) case is extremely rare, making the interface communication to be considered a source of false alarms (JONES, 2007; HSE, 2003).

The radical behaviorism defines attention as one constant shaping process, based on rewards and punishments for the outcomes of certain behavior as an enforcer for its perpetuation (SKINNER, 1953). In other words, whenever we perceive some relevant information on the system interface, we feel tempted to continuously attend to it. See the model below for the cause/consequence stimuli relationship (Figure 2):

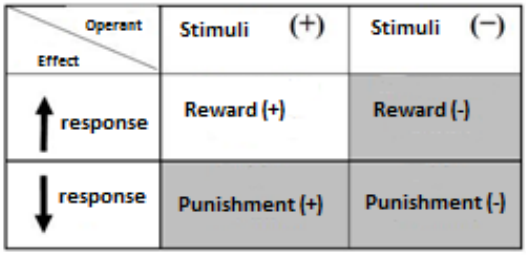

Figure 2- Stimulus-Response Model (HUNZIKER, 2011) (Authors' adaptation)

On this line of thought, authors on this theory strongly defend the importance of a constant reinforcement of the vigilance for its perpetuation (REYNOLDS & LIMPO, 1969). In case the stimuli for attention is removed and/or the alarm to be attended to is very rare, the vigilant behavior tends to extinction (SKINNER, 1953). This issue is critical on the context of Human-Automation Interaction, once the removal of operational control of the task can be considered one negative stimuli for users' attention (PARASURAMAN & MANZEY, 2010), and the supervision of an automated task is mostly composed by apathy (LYONS et a., 2016).

4 Conclusions

The results pointed out to a theoretical conflict that impedes the generalization for the best practices in automation interface design. By carefully compairing the two models presented above, it can be concluded that constant communication between the automated system and the operator can lead to the saturation of the interface stimuli (according to the SDT), in the same way, a more discrete communication approach can lead to a behavioral extinction of the vigilant behavior (based on the radical behaviorism theory).

Once there is no generall rule for approaches for interface design in automated systems, more empirical studies are needed to model the different cases applicable. Whith those findings in mind, this article deffends the need for a human-centered design approach during the conception of interfaces for communication with this kind of system. By understanding the specific needs of the human operator on each context, it is possible to adapt the thoretical models to better fit the situation.

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6 Acknowledgments

We would like to thank, CAPES for the scholarship provided to the project and to Mauricio Cardoso for helping with the literature review.