

## **Systematic Investigation of Positive Interruptions in the Healthcare**

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**Primary Target Audience:** Health Care Providers, HF/E Professionals

### **Summary:**

The main purpose of this poster is to provide a theoretical framework to investigate positive interruptions in healthcare. The results of an extensive literature, and a working definition for positive interruptions will be presented.

Several fundamental research questions are raised: 1) How do we study the effect of interruptions on cognition? Research Question, 2) What characteristics of an interruption contribute to its negative or positive effects on performance? In other words, how do we categorize interruptions as positive interruptions or negative interruptions?, and 3) Can we improve the performance by mitigating only the negative interruptions while promoting the positive ones?

An extensive review of literature was conducted with the objective of identifying the related work in the literature. Although several definitions of interruptions were used to guide the previous research, 1) definitions do not differentiate between positive and negative interruptions, and 2) there are inconsistencies in terminology used. However, most of these definitions acknowledge four properties of interruptions:

- 1) Interruptions are generally caused by external events. All of the definitions except Anthony et al. (2010) exclude the case in which people interrupt themselves (i.e., self-interruption).
- 2) Interruptions are usually unexpected events. Although only Grundgeiger et al. (2008) explicitly states this characteristic, unexpectedness is somewhat implicit in other definitions. However, literature does not differentiate between unexpected interruptions and interruptions that were expected by the interrupted person nor is there any investigation of the difference between their effects on cognition or performance.
- 3) Interruptions divert attention from a primary task to a secondary task (15 out of 21 definitions found in the literature).
- 4) The secondary task could be related or unrelated to the primary task. All the definitions found in the literature (see Table 1 in the attached paper), except the one given by Wiegmann et al. (2006), do not differentiate between the interruptions that are directly related to, and provide additional information for the primary task, and the ones that are unrelated to the primary task.

Based on these four characteristics, interruptions can be defined as "externally or internally generated, usually unexpected events that may cause a break in the primary task (if they do not, they are merely distractions), diverting attention to a related or unrelated secondary task, which can have both negative and positive effects on the interrupter's or the interrupted person's main task." (Sasangohar et al., 2012, p. 2).

Although the interruptions that result in a break in the primary task will always have a negative effect on cognition due to assigning cognitive resources to a secondary task, some interruptions may still convey important information. Positive interruption can therefore be defined as: Interruptions that convey information directly related to the decision-at-hand or necessary for the execution of (primary or secondary) task-in-hand.

According to this framing positive interruptions in healthcare can be studied in terms of three important dimensions: context in which they happen, their content, and their properties. Context are The interrelated conditions in which interruptions happen. In general, these include people, environment, working conditions, and work procedures. Healthcare is a complex socio-technical system. In comparison to other socio-technical systems such as Nuclear Power Plants or Aviation, Healthcare is more loosely-coupled, distributed and in general more complex. That makes analyzing different layers of organizational, environmental, and cultural issues challenging. In investigating the context in observational studies, the immediate or time-dependent context in which the interruption happens should be documented.

In terms of content, the information that interruptions convey can be evaluated by their importance to the task goals (usually patient safety), urgency, and relevance to the current task. Interruptions' properties are also important in understanding their effect on cognition. For example length, method of delivery, stage in the current task, and input modality (auditory, visual, tactile).

Using this framework, this research will contribute to the human factors engineering domain by, (1) introducing a taxonomy of interruptions based on context, content, and properties of interruptions that considers both the positive and negative effects on task performance, (2) expanding the knowledge of the impact of interruptions on clinical errors, (3) proposing a systematic methodology to investigate interruptions in the ICU settings and similar clinical domains, (4) identifying and evaluating potential strategies to mitigate interruptions, and to reduce human error in similar complex settings.

### **Significance & Takeaway:**

Although the word "interruption" is largely associated with negative effects, in healthcare, interruptions are sometimes an integral part of the tasks and are inevitable. Therefore the reductionist approaches to interruptions may result in blocking some potentially valuable cues directly related to decision-at-hand or necessary for the execution of the task. Interruptions may also improve the performance by decreasing boredom or increasing the arousal in some repetitive tasks and long shifts. Although some researchers acknowledged potential benefits of interruptions, interruptions in general were assumed to contribute to increased cognitive workload. Therefore, lack of a systematic approach to differentiate between the positive and negative effects of interruptions on cognitive workload and task performance is apparent. In particular, previous research does not classify different characteristics of interruptions, which makes them adverse or helpful. Such an assumption explains the majority of previous reductionist approaches to prevent and mitigate interruptions.

### **Presenter Bio:**

Farzan Sasangohar is a doctoral candidate in Department of Mechanical and Industrial Engineering at the University of Toronto. He holds a BA in Information Technology and Society from York University, a BCS in Computer Science and a MASc in Systems Design Engineering from University of Waterloo, and a SM in Human-Systems Engineering from Massachusetts Institute of Technology (MIT). Before joining University of Toronto, Farzan was a research scientist at the Department of Aeronautics and Astronautics at MIT. His research interests are Human-System Integration, Information Visualization, and Human Interruptions in Health care.