Virtual assistants and social cues: retail interactions and consumer experience

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ABSTRACT
This paper describes a multi-disciplinary approach to informing the design of a Virtual Assistant (VA) for use in a self-service checkout (SSCO). SSCO transactions require high levels of attention as people attempt to perform multiple tasks in the shortest possible time. This is often effortful, affecting performance and satisfaction. One proposed solution is a VA to help guide users' attention to relevant areas. This paper discusses three key positive outcomes to cueing attention with a VA. It also highlights the advantage of adopting a multi-disciplinary perspective to providing solutions to business problems in a modern retail context.

Author Keywords
Interface Agent; Virtual Assistant; Social Cueing; Nonverbal Behavior; Attention.

ACM Classification Keywords
H.1.2 Models & Principles: User/Machine Systems-*Human Factors; Human Information Processing;* H.5.1 Information Interfaces and Presentation (e.g., HCI): Multimedia Information Systems- *Animations*

General Terms
Experimentation; Human Factors; Psychology; Performance.

INTRODUCTION
NCR is a large multi-national technology company at the center of the self-service revolution [10]. Their self-service checkout (SSCO) solutions are a global success [11]. SSCOs (Figure 1) are the proposed alternative to the traditional checkout encounter where buyers are engaged in scanning and bagging their own shopping instead of relying on an employee to do it for them. NCR identify benefits for the consumer and retailer including speed and control for consumers and increased revenue for retailers [11].

Current on-screen instructions demand user effort in the reading of text, searching for relevant items, and making

correct decisions. Moreover, with interruptions caused by the need for intervention, cognitive processes are disrupted, inhibiting performance.

Figure 1: The front-view of the typical self-service checkout (SSCO) implemented in supermarkets as an alternative to the traditional checkout encounter.

Currently implemented in SSCOs is a virtual character with its back towards the user and a voice that is separate from this character, providing somewhat disjointed guidance. This is likely to demand more attention from novice users and to be ignored by more experienced users. If on-screen instructions can tap into more natural psychological mechanisms such as social cueing, the experience of SSCOs could be improved.

THE VIRTUAL ASSISTANT
A virtual assistant (VA), like that depicted in Figure 2 – designed specifically to guide users through the retail transaction process via a two-way interaction – could alleviate some of the cognitive load imposed on novice users as well as increased engagement for more experienced users, having positive behavioral effects for both. Within our applied research we ask: *How can psychology inform VA design to benefit the overall consumer experience?*

Figure 2: An example of one of the female VAs for use in some of our studies

Research continues to address the role of social interaction in HCI in anticipation of gaining a better understanding of the potential social impact of technology and leading to better experience design [8]. This relies on the understanding that human-human interaction resembles human-computer interaction [16]. According to this view, users identify with and respond to computing technology according to accepted social rules, but are generally unaware of this tendency due to the integral part that social interaction plays in everyday interaction [14].

Several online retailers seem to be making the most of this by implementing VAs that replace the traditional online help-center and support/search tool. We argue that an animated VA would also be well placed in SSCO. However, rather than providing general information to consumers, a VA in SSCO could provide observable benefits in terms of the sub-constructs of usability as defined by the ISO 9241-11: efficiency, effectiveness, *and* satisfaction [1]. We briefly discuss multi-disciplinary studies and work in progress aimed at determining whether animated VAs offer benefits to SSCO users associated with a VA's capacity for nonverbal social cueing, as part of an ongoing collaboration between industry and academia.

Benefit 1: Increased Speed (Efficiency)

SSCO users are required to distribute and switch attention between transaction-related processes/tasks and on-screen content, such as reading on-screen words and symbols, listening to instructions, searching for items, and scanning and packing items. This has an impact on transaction speed because shoppers have limited cognitive capacity for processing all available information during a self-service transaction.

Social cues, like those that could be offered via a VA, receive a high level of perceptual processing, and thus should be particularly effective at capturing and cueing attention [2, 4, 7, 8]. In psychological research, even iconic gaze cues have been shown to be effective at shifting attention to cued locations [1, 4, 5]. This suggests that an animated VA should possess the power to shift attention to relevant areas of on-screen retail contexts, including SSCOs, assisting in the completion of transaction goals. Work in progress has revealed shorter reaction times to detect relevant on-screen changes when they are cued by the gaze and head movements of an animated virtual character.

Benefit 2: Greater Accuracy (Effectiveness)

Our lab-based studies also demonstrate a biologically ingrained tendency for people to look to social cues for relevant information about the environment, i.e., a tendency to spend longer looking at social cues for guidance. It suggests that animated VAs could increase engagement with the self-service transaction and therefore attention, reducing error rates. Additionally, our earlier research [12] suggests that, by allowing users to rely on more 'natural' interaction skills, (e.g., social cues), error rates can be reduced, and thus the need for staff intervention can be reduced also.

Psychological theory is also being applied to determine which visual characteristics a VA should possess. The more effortful a task, the easier the interaction with a VA should be, based on its ability to display social cues. Evidence suggests that when the look and behavior of VAs are in line with what would be expected based on social stereotypes, performance during the human-computer interaction should be improved [18]. Key social cues pertinent to the impact of stereotypes on performance are demographics such as gender and ethnicity. Thus, work in progress is looking at the impact of some VA demographics (e.g. gender) and other physical attributes (e.g. clothing) and their perceived appropriateness given a SSCO context on user performance.

Benefit 3: Satisfaction

Aside from reduced effort, psychological research suggests that stereotypes can have a positive impact on how others are judged, so long as they appear to meet stereotypical expectations [4]. Currently being explored is the preference for VAs in a SSCO context based on its overt attributes such as dress, realism, and implied gender. Preliminary results suggest an overall preference for female VAs, which is in line with the tendency for females to be seen as more helpful and approachable than males [4].

It could even be that, so long as a VA is appealing to users and appropriate for the context, it could be a welcome distraction where the need for intervention is inevitable (e.g. in the purchase of restricted items such as alcohol). This, too, can be implied from the lab-based studies where participants displayed a tendency to look to the forward-

facing virtual character for longer than a side-facing virtual character, suggesting that when the VA isn't giving nonverbal guidance, it could be used to engage shoppers and potentially reduce frustration.

It may even be a particularly useful 'help' tool, where users can look to a VA for advice instead of looking around for an employee. As a test of whether users would be willing to take the *advice* of a VA, a study based on psychological theory is under development that will look at the likelihood that participants will change their answers to questions based on a VA's suggestions. This is being looked at in relation to the VA's specific appearance-based social cues, including gender and nonverbal communication.

CAUTIONS

These benefits do not come without cautionary notes. First, while it is encouraging that the social cues provided by a VA draw attention, a VA should not be too distracting. Many factors can increase distraction from unexpected appearance-based factors given the context (e.g. clothing) [18], to high levels of realism leading to an "uncanny valley" effect where an extremely human-like VA can make the user feel uneasy [9]. Second, anthropomorphism can encourage users to misattribute human-like qualities to the technology that it does not have [17]. This could lead to over-reliance on the virtual character and disappointment when expectations about the technology's capabilities are not met. Finally, designers should be aware that individual differences (e.g., gender, learning style, and culture) could influence how a virtual character is perceived and whether it is accepted [9]. This means that whatever a VA's characteristics, it is unlikely to have a wholly positive or negative impact on each user.

CONCLUSIONS

Interaction with SSCOs may reduce queues and speed up transactions, but also require customers to apply cognitive effort to the task and follow instructions. Many SSCO users are frustrated with the lack of process clarity and the numerous interventions required as they try to get through the transaction as quickly as possible. Visual social cues provided by a VA could alleviate some of the load placed on shoppers by increasing their engagement with the self-service process, providing clearer, unobtrusive messages, and ultimately, speeding up the process with fewer errors and interventions and increasing satisfaction.

This paper highlights that findings from cognitive and social psychology can be used to advise contemporary business and design projects. We believe that such research can help inform the design of specific appearance and behavioral features of animated VAs in both lab-based and field-based settings so that such characters can meet their full potential in self-service technology.

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