A Single-User Tabletop Card Game System for Older Persons: General Lessons Learned From an In-Situ Study

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Abstract

This paper discusses some general results from an in-situ study of the use of a tabletop system for card playing that differs in several ways from most tabletop systems: 1. It was designed primarily for use by senior citizens with little or no computer experience. 2. It is a single-user system, though social interaction with nearby persons during its use is typical. 3. It includes a simple conversational agent (representing the game's other player). 4. It is used in a setting (a senior citizens' center) in which the users also play cards in the traditional ways. A total of 42 regular visitors of the center participated over a 4-week period. From our observations and results, we draw several conclusions that should apply to other tabletop systems that share one or more of the characteristics just listed.

1 Introduction

Previous research on tabletop systems has mainly focused on lab settings (e.g., [1], [3]) and on the observation of the performance of short-term group tasks by adults or young persons (e.g., [6]). Two recent exceptions are [7], which reports on the use of a direct-touch tabletop in a workplace by one marketing executive over a year; and [5], which discusses a system aimed mainly at keeping older persons integrated in their families.

There are still many application scenarios and settings for tabletop systems that remain to be explored. This paper aims to expand our understanding of the design and acceptance issues that arise in diverse situations. We discuss the results of a 4-week in situ study of a tabletop system that is unusual in several respects.

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Figure 1. The BriscolaTable in the study setting.

1.1 The Briscola Game and the BriscolaTable System

Briscola (see, e.g., http://en.wikipedia.org/wiki/Briscola) a popular Italian trick-taking card game that is usually played by 2–6 players with a deck of 40 cards. In northern Italy, many older people enjoy playing it in social contexts like pubs and community centers, the main appeal lying less in the game itself than in the accompanying social interaction.

The BRISCOLATABLE (see Figure 1) is a tabletop system that allows a single user to play Briscola against a simple conversational agent (named Alice). The original motivation for designing it was to see if some alternative form of Briscola, helping to maintain memory and cognitive abilities, could be offered to older persons who were (perhaps temporarily) restricted to their homes. The agent Alice was intended to reproduce some aspects of the typical social interaction in at least a modest form.

Since it would have been impractical to test the system in potential users' homes, we arranged for an extended test in a local senior citizens' center. To encourage visitors to use it,

we placed it in an easily accessible location. An unintended consequence was that players often interacted with the system in the presence of one or more of their friends. As a result, the study ultimately yielded less information about the isolated use of the system in a home environment than about a fortuitously discovered use: as an alternative way of playing Briscola in a fundamentally social environment when for some reason a player is unable or uninclined to play with other persons (e.g., because not enough persons are available at the moment; or simply for variety).

1.2 Issues Addressed

This unusual system and setting ultimately yielded insights concerning several general issues:

1. What are the potential and limitations of tabletop systems for older users with little or no computer experience? In particular, do they have an intuitive usability that makes them an attractive alternative to conventional interfaces for some types of application, even when there is only one user at a time? How do motor limitations associated with aging need to be taken into account?

2. When is it desirable (or undesirable) to stick closely to the metaphor suggested by the original physical horizontal system—in particular in settings where users regularly alternate between using the electronic and the physical tabletops?

3. What roles can a conversational agent play as a supplementary component of a tabletop system—in particular in a setting where transitions between the use of the system and other social interactions are typical?

2 Method

System: A user played individually against the conversational agent Alice (cf. [2]) by sitting in front of the horizontal tabletop surface (40×25 cm) and the associated vertical display, interacting with the tabletop using one finger (cf. Figure 1 and the video figure for this paper). The tabletop was a surface capacitative screen of Elo TouchSystems that is classified by the manufacturer as exhibiting generally excellent dragging performance. The user performed drag-and-drop actions on cards displayed on the tabletop. Alice's card movements were implemented as slow Flash animations. Alice regularly commented on the user's moves and on the events in the game, using colloquial formulations and in some cases the local dialect. For example, after an ill-considered move by the user, Alice might say "You may live to regret that!"

Participants: Forty-two regular visitors of a local senior citizens' center (55% females) in the age range 55–91 (mean $= 75.5$) participated in the study. The overall level of computer experience was very low, 87% of the participants never having used a PC.

Timing and data Collection: The BRISCOLATABLE was installed near the coffee machine area in the senior citizens' center during the four weeks of March, 2008. During Week 1 and Week 4, there was an individual 1-hour session with each participant who had volunteered: The participant played three games (with some hints from the researcher during the first session). Then a semistructured interview was conducted, during part of which participants made ratings on semantic differential scales based on commonly used scales concerning factors such as ease of use, enjoyment, and intention to use. During Weeks 2 and 3, participants were free to use the system whenever they liked; a member of the research team was always present to observe, making notes in a logbook, and to help with any problems. During all 4 weeks, video recordings were made of some of the sessions to enable in-depth analysis of users' interaction patterns (cf. the annotated excerpts in the accompanying video figure).

3 Discussion of Results

In this short paper, we report and discuss only the results that are relevant to the issues listed in Section 1.2.

3.1 Usability and Entertainment Value

The quantitative and qualitative data show that participants quickly reached a point where they found the BRISCOLATABLE easy to use. The top two histograms in Figure 2 show the relevant results from the questionnaire ratings in the final (fourth) week: They show that the system was found almost unanimously to be "easy to use" and "clear and comprehensible" (the corresponding results for the first week are essentially the same).

The bottom two histograms show the extent to which the BRISCOLATABLE as a whole, and the agent Alice in particular, were considered "entertaining". Here as well, we see that almost all responses are on the positive side of the scale.

The generally good usability and acceptance is confirmed by the number of games that participants played spontaneously during the second and third weeks of the study despite being able to choose freely between BRISCOLATABLE and other activities at the center: 22 players played a total of 67 games. During the final week, all but 5 of the 27 respondents gave a positive response to a question as to whether they would continue to play at the BRISCOLATABLE if it remained available at the center.

Given that this overall pattern was confirmed by observations and by the participants' verbal comments, we can view this study as an illustration of how a tabletop system in which interaction closely mimics a familiar physical activity can be learned and accepted quickly by older persons with little or no computer experience.

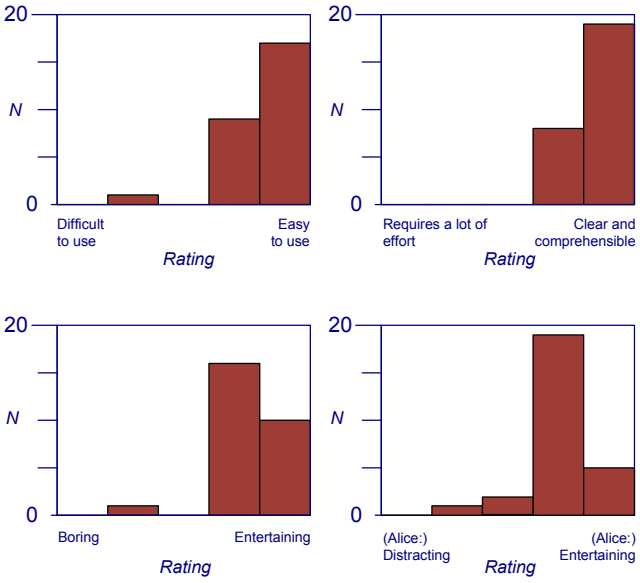

Figure 2. Frequency distributions in Week 4 of ratings on 5-point semantic differential scales. (*N* refers to the number of participants who made each rating.)

3.2 Manipulation Problems and Their Consequences

Despite this positive overall result, more detailed observations revealed that usability could be improved with greater attention to motor limitations associated with age.

The main difficulty that our participants had with the BRISCOLATABLE consisted in correctly completing a drag-and-drop action and dropping the card at the exactly right place.[1] For example, often a player would interrupt the dragging action briefly, lifting their finger from the table. The system's behavior in such cases was to show the card in question flying back to its original position. This behavior may be appropriate under the assumption that interruption of the dragging action is always intentional; but for users who often interrupt unintentionally, some behavior would be better that allowed them to continue the dragging action from (more or less) the point at which they had interrupted it. Similarly, there should be minimal negative consequences when a user intentionally terminates a dragging action but does so at a position that is not precisely as intended.

In line with previous research (see, e.g., [8]), we found evidence of the effect that a deterioration of the sense of touch can have on older adults' interaction with tabletops: Some participants were less effective in moving cards over the tabletop because they pressed either too hard or too lightly on the interactive surface.

The difficulties just listed were particularly frequent during users' first session of play, but they persisted in the later sessions for participants with dexterity problems or as a consequence of fatigue.

3.3 How Closely Should the Design of Tabletop Systems Stick to Metaphors?

The close correspondence between actions with the BRISCOLATABLE and normal card-playing actions is presumably largely responsible for the intuitive usability of the system; but as with any system that builds on an analogy with a physical system, the question arises of how closely the metaphor should be adhered to. Discussions of this general issue in the HCI literature have lead to a consensus that it is most often unnecessary and inadvisable to stick rigidly to a metaphor (see, e.g., [4]).

On the one hand, some of our observations are consistent with this idea. For example, there is evidence that the design of BRISCOLATABLE stuck too closely to the metaphor of normal card playing by not providing a shortcut (e.g., a button labeled "Deal the cards for me") by which the user could avoid having to deal the cards one by one—which was actually quite a tedious task. In consequence, players preferred to allow Alice to do all of the dealing—a tendency that distorted the results of the game.

On the other hand, there were cases where users would have preferred to be able to perform physical actions themselves: In the normal Briscola game, when a player has won a trick, they grab the cards that have been played and drag them to their own pile of won tricks. In the electronic version, Alice always dragged the cards to the winner's pile. Some users indicated that they would have preferred to drag the cards that they had won themselves. One reason given was that you don't usually trust another player to move your winnings into your pile. A more subtle reason may have been that there is a feeling of pleasure associated with dragging the cards that have been won, a feeling that you do not want to have automated away. More generally, tabletop gestures should not be seen simply as representing work that needs to be done by the user, which should be minimized wherever possible; instead, the (positive or negative) hedonic value of each gesture should be considered.

A point relevant to all of the above examples is the fact that users regularly alternated between playing with the BRISCOLATABLE and playing with their friends with physical cards—a circumstance that makes it more difficult to perform with the electronic version of the game actions that are inconsistent with corresponding actions performed in the physical version. This last point is illustrated by the observation that players generally hesitated to drag a card over a pile of other cards on the table, even though this movement was supported by the system; they tended to make

[1] Given the generally excellent dragging performance with this type of touchscreen (cf. Section 2), this problem seems unlikely to be due primarily to the technology itself.

considerably longer moves around the other cards. If they had in fact become used to dragging a card over other cards on the BRISCOLATABLE, this behavior might have been transferred back to the normal card-playing environment.

3.4 Roles of and Reactions to a Conversational Agent

Although embodied conversational agents do not usually appear as part of a tabletop interface, it is interesting to see what functions such an agent can have as a complement to a tabletop system in certain settings and what sorts of reactions it can evoke.

As is shown in the last histogram in Figure 2, the players generally found Alice to be entertaining rather than distracting, even though she generated only canned utterances. Moreover, although participants were regularly offered the opportunity to turn off the display of Alice before the game began, this offer was never accepted. Some of the responses to Alice can be understood in view of the fact that (a) users also regularly played with their human friends in the same context and (b) they often had friends sitting by while they were playing with the BRISCOLATABLE. Because of the first fact and the way in which Alice's comments imitated the style of real players, Alice's behavior in effect served as a mild parody of the human behavior that the players regularly experienced. The friends watching the game served as a sort of audience for the user's interaction with Alice, encouraging the user, for example, to make a witty response to a comment by Alice.

In addition to these subjective and affective consequences, Alice played an interesting role in helping users to switch their attention between the game and their friends. In the normal Briscola game, players often pause to converse and have to be reminded when it is their turn to play. Similarly, while playing with the BRISCOLATABLE, users would often fall into conversation with their friends. After a few seconds, Alice would remind them in an amusing way that it was their turn. More generally, a function of a conversational agent in a tabletop system may be to regulate the attention of users when they are switching their attention back and forth between the tabletop interaction and some other activity. In addition to the advantage of using spoken output, which can grab the user's attention, the agent can formulate reminders in a natural and contextually appropriate way.

4 Conclusions

By moving outside of the normal range of applications and settings for tabletop technology, and by observing users closely during a one-month period, we have been able to suggest some general design considerations for tabletop systems:

1. Tabletop technology can enable older users with little or no computer experience to begin interacting with a computer quickly and in a satisfying way; but typical motor limitations associated with advancing age, which may affect the quality of interaction even after extended use of a system, need to be taken into account in the design.

2. Decisions about how closely to stick to a physical metaphor should take into account the hedonic value of gestures; and if the same users regularly engage in the corresponding normal physical activity, possible negative effects of inconsistency should be anticipated.

3. An animated conversational agent can serve some subtle functions and enhance the user experience in a tabletop context when (a) the agent takes a role similar to that of persons with whom the users interact while performing the same activity physically; and/or (b) the interaction between the user and the agent is often accompanied by interaction with one or more other persons.

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