

Collaborative Strategies in Multitouch Tabletop to Encourage Social Interaction in People with Autism

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ABSTRACT

In this paper, we propose a set of collaborative strategies in a collaborative game for multitouch tabletop in order to encourage social interaction between people with severe autism. We evaluated the collaborative strategies with a group of youth with high impairment autism in social interaction. The results suggest that collaborative strategies and the multitouch game encouraged the youth to perform different verbal and gestural social interaction expressions with their partners to cooperate and achieve the game goal. These collaborative strategies could be used in other collaborative applications for people with autism.

Categories and Subject Descriptors

K.4.2 [Computers and Society]: Social Issues - *Assistive technologies for persons with disabilities.*

General Terms

Design, Human Factors, Experimentation.

Keywords

Autism; Collaborative Strategies; Multitouch Tabletop.

1. INTRODUCTION

Autism is characterized by deficits in three areas: communication, social interaction, and repetitive behaviors [1]. The severity of autism varies for each individual according to the intensity of impairment in these areas. People with more severe autism exhibit characteristics of absence of language, strong degree isolation, intellectual disabilities, and impairment in verbal and gestures expressions [5]. The lighter autism is known as High-Functioning Autism (HFA) [5]. In this text we use the term “autism” referring only to people with severe autism.

Different collaborative applications in multitouch tabletop have been developed to mitigate the difficulties of these people [2-4]. These studies presented important results in contributing to users' social skills. However, most of these studies were not specifically developed for people with autism with high-impairment. Our goal is to propose a set of collaborative strategies designed according

specific requirements of users with autism in order to encourage their social interaction.

We conceived the collaborative strategies as interaction restrictive strategies on elements in collaborative applications of multitouch to force/motivate collaborative activities among users. We followed this methodology: (a) we selected a group of five youths with autism (ages between 10 and 17 years) and we got their requirements (they have difficulties in social skills, verbal communication, and repetitive behavior, among others); (b) we followed recommendations of experts responsible for the therapy of these users; (c) we studied previous work about applications for people with HFA. Finally, we developed a collaborative game called PAR using the proposed collaborative strategies, and evaluated it with the selected group of users.

2. COLLABORATIVE STRATEGIES

We proposed a sequence of four collaborative strategies; three of these impose restrictions on interaction to gradually motivating users to understand the necessity of being aware of the partner's action to collaborate. A fourth strategy has no restrictions, allowing the collaboration among users in a free interaction after they have interacted with the restricted strategies.

1. Passive Sharing Strategy: users **share resources** to achieve a collaborative goal. Each user has only to realize his/her own task and to know the result of the tasks of the partner, independently of identifying who executed the task and how it was executed.

2. Active Sharing Strategy: in addition to share resources, each user receives information from the partner about how cooperate (**information exchange**). Users recognize the role of the partner in collaboration.

3. Joint-Performance Strategy: In addition to share resources and information exchange, this introduces **simultaneous actions** of users. Users now identify that the participation of both is strictly necessary to achieve a collaborative goal.

4. Unrestricted Interaction Strategy: It allows a **free interaction** to collaborate. It is expected that users perform the activity together, although this cooperation is not strictly required.

We included the collaborative strategies in the PAR game. PAR has three collaborative phases. It consists in getting the pieces of uniforms (t-shirt, shorts and sneakers) and to dress the soccer players of a team. To obtain the pieces of the uniforms, the cooperation of two users is required. So, one user is located in the upper side of the tabletop (User 1), and the second user is located in the lower side of the tabletop (User 2). User 1 should put each piece in a box and send to User 2 who should receive it in a car.

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Interaccion '14, Sep 10–12, 2014, Puerto de la Cruz, Tenerife, Spain.

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DOI: <http://dx.doi.org/10.1145/2662253.2662266>

When the car is full with the three pieces of a uniform, it is necessary to take it to the parking lot and to dress the soccer player.

In the first phase, the **Passive Sharing Strategy** is applied because User 2 needs only to take the cart to the position where the box is descending (Figure 1a). This position results from the action of User 1, but User 2 might not recognize that User 1 is responsible for this. In the second phase, the **Active Sharing Strategy** is applied because User 2 asks for any piece and User 1 sends the piece requested (Figure 1b). User 1 needs to know this information to execute his/her own action. In the third phase the boxes to put the pieces are closed at the time that each piece is requested. So, it is necessary that User 2 helps by pressing a button to open the boxes while User 1 puts the piece requested in the box (Figure 1c). This synchronous action shows the use of **Joint-Performance Strategy**. In the three phases, after the cart is placed in the parking area the **Unrestricted Interaction Strategy** is applied, where each user may take any piece in any order to dress the soccer player (Figure 1d).

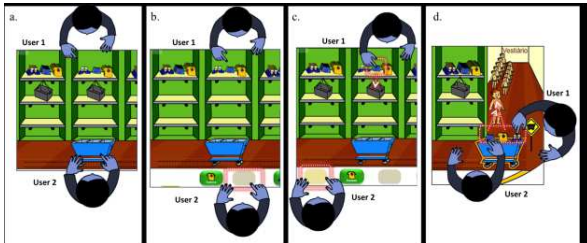


Figure 1. Collaborative strategies in PAR game.

3. EVALUATION

We conducted a pre-training stage with the five users separately, to explain the game, the interaction and manipulation of elements on the multitouch tabletop. After this stage, 51 test sessions were applied during six weeks. In each test session, two users participated (with the oversight of therapist and researcher). During each game test the pairs of users and their respective roles in the game were exchanged.

We categorize the social interaction expressions as verbal or gestural interactions: rectify, guide, ask question, answer, encourage, thank, help, complain, commemorate, and reject, and as gestural interactions: see, smile, laugh, perform task in the game, and physical contact. For analysis, we organize these expressions in *Interactive Situations* (refer to interactive expressions in which a user interaction leads to interactive response from the partner) and *Interaction Intentions* (refer to the intentions of users to collaborate with their partner without getting a response from the partner). We evaluated the following aspects: During the game progress was possible to observe a collaboration process growing? What is the collaborative behavior (*Interactive situations* and *Interaction intentions*) of users in each collaborative strategy? Which verbal and/or gestural social interaction expressions were obtained during the game?

3.1 Results

Each new collaboration strategy applied generated a greater need for collaboration among users, and therefore greater motivation to perform the tasks and to guide their partners through verbal or gestural interaction expressions. While the game progresses, users were more engaged in social situations, increasing the number of

interactive situations and *interaction intentions*.

In *Passive Sharing*, after sharing resources repeatedly, more active users identified that their partner is the responsible to execute the other action; they tried to guide the partner to execute his/her task. In *Active Sharing*, the users were more motivated to execute their tasks and to motivate their partners. They were more aware of the need of other's action to execute their own action. In *Joint-Performance*, the users paid more attention to execute their tasks by synchronous action, being less necessary to perform interactive expressions to motivate their partners. In *Unrestricted Interaction Strategy*, the users found ways to collaborate and they achieved a collaborative activity through gestural and/or verbal coordination expressions.

4. CONCLUSIONS

The results indicated that both the interaction on the multitouch interface and the aspects considered in the collaborative strategies proposed allowed engaging users in an attractive experience, encouraging social interaction and collaborative work gradually. We highlight the motivation generated in the users to interpret the intentions and actions of their partners throughout the sequence of collaborative strategies. More active users performed activities faster, and learned to respect the rules of the game, to help and motivate a partner to cooperate by means of orientation situations. Users with greater difficulty in the game, tried in any way to perform the required actions; they asked for help with verbal or gestural interactive expressions. It is advisable to perform more studies with other groups of people with autism to identify possible generalizations and limitations of this approach.

5. ACKNOWLEDGMENTS

We thank CAPES and CNPq for supporting this research.

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