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CopyMe: an Emotional Development Game for Children

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Abstract

Proper emotional development is important for young children, especially those with psychological disorders such as autism spectrum disorders (ASDs), whereby early intervention becomes crucial. However, traditional paper-based interventions are mostly laborious and difficult to employ for carers and parents, whilst current computer-aided interventions feel too much like obvious assistive tools and lack timely feedback to inform and aid progress. CopyMe is an iPad game we developed that allows children to learn emotions with instant feedback on performance. A pilot study revealed children with ASDs were able to enjoy and perform well in the game. CopyMe also demonstrates a novel affective game interface that incorporates state-of-the-art facial expression tracking and classification. This will be particularly interesting for CHI attendees working in the domain of affective interfaces and serious games, especially those that target children.

Author Keywords

Serious games; facial expression recognition; emotional development; affective interfaces; children

ACM Classification Keywords

H.5.m [Information Interfaces and Presentation]: Miscellaneous; I.2.1 [Applications and Expert Systems]: Games.

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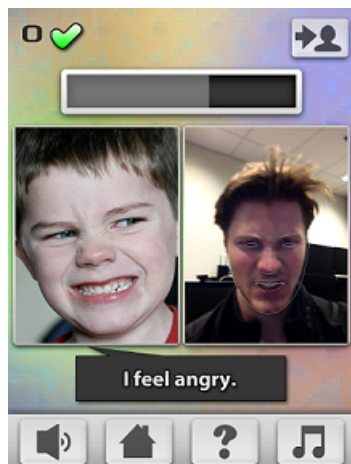


Figure 1: A player forming the angry face to mimic the photo expression in order to attain success in CopyMe.

Introduction

The emotional development of children with Autism Spectrum Disorders (ASDs) is commonly addressed by those involved in the study of interventions for children with ASDs. Paper-based interventions, such as written emotion identification exercises which may require the child to have literacy and writing skills, as well as many computer-based interventions, were found to lack the necessary components required to engage children of younger ages with limited hand-eye coordination abilities [3]. For example one challenge is that monitoring of progress is difficult and using these aids requires constant individual attention for each child [4]. Using automatic facial expression recognition technology, and following guidelines previously identified for how games could be developed for children with ASDs, the CopyMe game was developed to explore its effectiveness as an intervention tool for children with ASDs [5].

Specifically, the CopyMe game was developed for the Apple iPad with an aim to better understand how it might support the processes of emotional development of children with ASDs. This paper describes the game interaction design, provides a brief look at the important findings of a recent pilot study, as well as describes CopyMe's relevance to CHI.

Game and interaction design

The core gameplay mechanic of CopyMe requires the player to observe a photo of a human face making one of the six basic facial expressions and to attempt to copy it whilst viewing his/her own face via the live camera feed shown on screen. These facial expressions are happy, sad, angry, surprised, scared (fear) and yucky (disgust) [1] and are progressively introduced based on three levels of difficulties. The primary game input is obtained via the

iPad's front device camera. Touch input is only necessary to navigate the menus and skip expressions. If the face is successfully copied the player receives a point and is presented with a new expression to mimic.

CopyMe was designed primarily as a game, however later improvements were grounded in prior research [3] after its prospective usefulness as an assistive tool for children with ASDs became apparent during the review process of user interface (UI) design practises for children with ASDs, in particular in the emotion game genre. A summary of our design and its motivations are described as follows.

CopyMe was developed for the iPad due to the popularity of the device and hence ease of access for carers of ASD children. Figure 1 shows a screenshot of the gameplay, demonstrating the simple uncluttered user interface (UI) which is important to engage children with ASDs. There is an emphasis on the child's expression shown in the camera feed on the right side of the screen, and the face photo shown on the left. Scoring is used to record successes, however no penalties are given for failed attempts, with the aim to reinforce desired behaviour without causing stress. For game menus, common UI symbols, such as a speaker to represent sound, were used in order to support children with low functioning literacy skills.

The interaction design process involved creating a user interface that highlighted the faces as the primary game components. The camera feed needed to be integrated in such a way that it coexisted seamlessly next to the face photo, as we felt this would make the content as relatable as possible to the child's own face. Game input was designed to be obtained purely through expression forming without the requirement for touchscreen interaction to achieve success. This design allows for the child to focus on facial movement rather than co-ordinating hand

movements with on screen functions. As shown in Figure 1, splines outline the face of the player so it is clear how the game is mapping one's expression, furthermore producing an effective form of real-time feedback.

Children can hear the emotion voiced via a narration, as well as being written on screen in the speech bubble. In accordance with our prior research [3], the narrator used a child-like voice to make the sounds relatable for children playing the game in order to maintain a stress free environment, which is important for children with ASDs, and a fun atmosphere to ensure CopyMe retains the feel of a game, not just an assistive tool.

The colours were selected to be non gender biased to make the game feel inclusive to all children. Instead of applying specific child oriented emotional themes to the gameplay, such as reactions to receiving presents or bad news, we focussed purely on the formation of the expressions themselves in accordance with our review [3] of research into repetitive actions for reinforcing desirable behaviours, and the positive outcomes this can have in assisting children with ASDs. This also suited the facial expression tracking framework [6] used as the foundation for the gameplay, which is based on deformable model fitting to accurately map the facial expressions.

The full literature review and design guidelines can be found in [3] and the detailed design and technical description in [5].

Pilot study: key findings

A pilot study on the usefulness of the game CopyMe for teaching emotions to children was conducted at a childcare centre in Sydney. The participants involved in the study were six children aged 8 to 10, two of which have an ASD (P5 and P6). Results from the ASD

affected participants provided valuable data and we will only highlight the findings from these two participants in this paper.

P6 achieved a perfect result when playing the game on Medium difficulty. He also found no problem in trying to emulate the faces, taking the expressions quite literally, instead of appearing to reflect his own perception of the required response which the non ASD affected participants had. As described in [2], the session itself can result in "repetitive self-regulating behaviours", which was something our researchers observed in P5 and P6. P6 in particular was very reluctant to give the iPad back once his play time had ended, due to his sheer enjoyment of continued successful attempts. It was also found that it would be beneficial to implement an in-game function that aids the child in forming the correct face, which would appear after a number of incorrect attempts. It is also necessary to improve upon the facial expression classifier itself, so that it is more sensitive to subtle differences in how an individual expression may be formed, allow for more individual forms of expression.

In general, CopyMe also demonstrated that gameplay quality is of key importance to serious games. At present the children with ASDs did seem to enjoy playing the game; however the non ASD affected participants expressed boredom at the lack of variability in gameplay. Therefore it is planned to add more variants of our core gameplay mechanic in order to improve the fun factor for all children, so that CopyMe can be considered more as a game, instead of just an assistive tool. As discussed in prior work [3], children with ASDs will feel more inclined to use it if it does not feel like a medical aid.

Audience and relevance

CopyMe investigates the use of state-of-the-art computer facial expression tracking and classification to enable a novel affective gaming interface. It also implements guidelines from prior studies that have worked on computer interfaces for children. Having a first-hand experience with CopyMe therefore acts as a platform for discussion and inspiration in these areas.

Although interacting with CopyMe would be interesting to CHI attendees in general, researchers/practitioners working in the areas of affective interfaces, children and serious games would find it particularly valuable. These areas are also traditionally well-represented in CHI.

Future work and conclusion

From our pilot study, CopyMe shows promise as a useful intervention to aid the emotional development of children with ASDs, as the children participants, especially the two with ASDs, appeared to show high levels of motivation, enjoyment and performance during gameplay. However, the study also unveiled several crucial issues to work on in the next iteration.

As a next step of our evaluation, the game will soon be available on the Apple App Store for free download, coupled with an online survey to obtain a larger set of data that can be analysed to improve the game further.

It is hoped that CopyMe has demonstrated that a creative use of computer vision technology can result in an effective tool to provide assistance to children with ASDs, as well as a way for carers to monitor the progression of a child's emotional development in general.

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