Voodoo: A System That Allows Children to Create Animated Stories with Action Figures as Interface

Pedro Ribeiro[1], Ido Iurgel[1,2], and Manuel Ferreira[3]

[1] CCG (Computer Graphics Center), Guimarães, Portugal
{iiurgel,pribeiro}@ccg.pt
[2] EngageLab, University of Minho, Guimarães, Portugal
[3] DEI (Industrial Electronics Dep.), University of Minho, Guimarães, Portugal
mjf@dei.uminho.pt

Abstract. Dolls, employed as tangible interfaces, have the potential to provide an easy to learn interaction device that allows children to animate virtual characters in an intuitive way. We assume that dolls and action figures are more compelling, easy to use, and immersive for children than standard interfaces to create movies. We present Voodoo, a prototype of a system where children take over the role of a movie director, animating virtual characters with action figures. Voodoo translates the action figures movements into animations, based on movement patterns and on the narrative context of a well-known story. We maintain that our approach will easily and joyfully empower children to create animated stories.

Keywords: Virtual Characters, Tangible Interfaces, Affective Interfaces, Toy, Children, Action Figures, Dolls, Computer Animation, Storytelling.

1 Introduction

The doll is a companion to the child during many years and regardless of gender. Playing with dolls provides children with the opportunity to build imaginary worlds that express their thoughts, feelings and fantasies. While playing, children create stories that are related to their experiences and to other stories. The fact that it is fundamental for children to tell stories with dolls is the motivation to our work: What if it were possible to empower children not only to invent stories with dolls, but also to use the dolls to create a movie, that they can watch over and over again, and show to peers and parents? If playing with dolls would result in animations of virtual characters (VCs), inserted into a story context? *Voodoo* is the system that is currently under development, and that shall enable this.

Two major open issues that our prototype shall help clarifying are "disambiguation" and "learning balance". The first major open issue, *disambiguation*, refers to the necessity of disambiguating underspecified input: Assuming that the animation system is capable of producing a vast amount of different, fine grained animations that much outnumbers the possible movements that a child can be sensibly expected to make: How can then the doll be nevertheless employed to create, in a controlled manner, these animations? E.g. a system may have the capacity to animate

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a Little Red Riding Hood (LRRH) VC that is suspiciously talking to the Wolf. With plastic action figures, it is impossible to deduce from the movement of the LRRH figure alone that LRRH is "talking", or even that this talking is "suspicious". Understanding how to best disambiguate input is currently the main focus of our work.

The second major issue refers to the *learning balance* between system and user. This is the question as to who is expected to adapt more in order to enable a fluid interaction – the user or the system? Doll based systems need not necessarily have a very powerful, adaptive system for recognizing the doll's movements. If the child knows that the system will take into account contextual information about the narrative role of the animated character, then he/she can adapt the doll movements to the expected interpretation, thus easing the recognition and interpretation task.

Further research questions relate to: The inclusion of possibly complex actuators into the doll (cf. [1] and [4]), in order to reduce the boundary between virtual and digital; Further unfolding usage metaphors, in order to promote the usability of the system; Enhanced computer vision or sensor networks, in order to improve the recognition of doll movements; The integration of research on Computer Graphics for animating of VCs, in particular the question of appropriate control parameters.

2 Related Work

Other groups have already employed dolls for the manipulation of VCs [5], also having in mind children as users ([1], [3] and [4]). Within this paradigm, children manipulate some kind of doll, and the computer system detects the movements and alters a VC´s state, resulting in some animation. Our system presents a new approach for the input disambiguation, and contextualizes this kind of user interface in the field of animated stories creations. In order to cope with the ambiguity and underspecification, we allow our system to recur to additional context information. This includes (i) the story role that the doll embodies, the (ii) relationship between the story persons, and (iii) the reference to a scene, either of a well-known story, or of an implied, typical context.

3 Integrating Story Context into Input Interpretation

The doll metaphor is even more powerful in the particular case of action figures, because these are based upon characters of a film or comic book, and therefore have a role context associated to them. This can be an excellent aid for the system to decide about which action the VC shall perform, based on the figures' movements, because the story context constraints the interpretation of the movements that the child makes. For example, choosing and playing with the action figure of Bauer from the TV series 24 will result in a specific animation appropriate for this character. If a child enacts a scene where the character Bauer has to open a door in a combat situation, probably Bauer will not rotate the doorknob, but kick it open.

The interpretation of the movements of a particular action figure will be influenced by the associated story as well [6], including information about the personal

relationships between the characters. For example, in the story of Hulk, much information can be extracted from the character Bruce Banner and his relationship with other characters and with the story environment: when angry, Bruce Banner is transformed into a wild and powerful creature, and this transformation is more likely to happen when General Ross is nearby: Bruce Banner will show an affectionate behavior when he is close to Betty Ross, but the transformation into Hulk can again occur when he is enclosed in a prison. Thus, the interpretation of the movements of the action figure can take a schemes of a story into consideration.

In order to provide this context to the child, we employ a DIN A4 paper map where the action figures can be placed upon (**Fig. 1**). The map contains areas with drawings that evoke a story context. Depending on the area of the map where the figure is above, the movements will be interpreted in a different way.

Fig. 1. System scheme and Screenshot of a *Voodoo*-made animation

We are developing a prototype that implements this idea of animating according to context: *Voodoo* (**Fig. 1**). Our current test case is inspired by the well-known story LRRH[1]. It targets at a single child tentatively of age six to ten, who can play with up to two figures at the same time, one in each hand. *Voodoo* relies on a computer vision module to determine in real time the environment that surrounds the action figures, the spatial relationships between them, as well as the kind of movements the child is making with them. The recognition is based on a color blob tracking of the actions figures and on the detection of markers printed on a paper map. These markers allow detecting the areas of the map; the areas correspond to story contexts, e.g. the house of the grandmother. The placement of the figures above some area of the map is determined through their color blob points. The movements of the doll generate in real-time specific animations of VCs on the screen. To recognize movements of the figures, we employ a simple movement recognition dichotomy: a gesture is either

[1] Prior to the implementation, in a first round of participatory design, an informal Wizard of Oz study with two eight years old participants of both sexes was conducted, with the result that the kids had no usability problems. We also learned that a rigid laptop webcam would not be appropriate if the animation were to be watched at on the laptop's screen, since the camera needs an inclination of approximately 45 Degrees to the paper map.

vertical or horizontal; additionally, the speed of the gestures is calculated. Thus, all of the animation details are determined by the aforementioned story contexts: (i) the action figure that was chosen, (ii) the area of the map above which the figure is placed, and (iii) the typical narrative relationship between the figures that are in this same area.

4 Conclusion and Future Work

We believe that tools that facilitate the interactive creation of linear stories, in particular for children, have an enormous entertainment and pedagogical potential. A major question regarding such tools is how to deduce complex animations and stories from simple input of intuitive input devices. We presented an approach where we integrate the contextual constraints of a story to enable a child to create animated movies with action figures as input devices. With *Voodoo*, it shall become easy for a child to reinvent a well-known story and eventually to create new stories. The stories that the child makes result in a computer animated movie. We do not know yet if it is mandatory to enable the child to somehow post-edit the animation. Later, even user emotions could be taken into consideration in order to choose the appropriate animation, as well as some automatic interpretation of what the child is saying. The collaborative use of the system is easily possible; for this, the size of the paper map must be increased, and larger displays would be required.

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