Creating Behavior Authoring Environment for Everyday Users

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Abstract

The design of interactive experiences is increasingly important in our society. Examples include interactive media, computer games, and interactive portals. There is increasing interest in modes of interaction with virtual characters, as they represent a natural way for humans to interact. Creating such characters is a complex task, requiring both creative skills (to design personalities, emotions, gestures, behaviors) and programming skills (to code these in a scripting or programming language). There is little understanding of how the behavior authoring process can be simplified with easy-to-use authoring environments that can support the cognitive needs of everyday users and help them at every step to easily carry out this creative task. Our research focuses on behavior authoring environments that not only make it easy for novices/everyday users to create characters but also provide them scaffolding in designing these interactive experiences. In this paper we present results from a user study with a paper prototype of an authoring environment that is aimed to allow everyday users to create virtual characters. The study aims at determining whether typical computer users are able to create character personalities in specific scenarios and think about character's mental states, and if so, then what kinds of user interfaces would be suitable for this authoring environment.

Keywords

Behavior Authoring, Personality, Believable Characters, Authoring Environments

1. Introduction

Creating personality rich characters is a complex task, requiring both creative skills (to design characters with personalities, emotions, expressions, gestures, responses, behaviors) and programming skills (to code these in a low-level scripting or programming language). Modeling systems (such as 3D Studio Max or Maya) enable designers to create character models and animations, but developing, coding, and debugging behavior scripts is still very much a black art restricting behavior authoring to select set of individuals that are well-versed in these skills. There is little understanding of how the behavior authoring process can be simplified through advanced easy-to-use authoring environments that can support cognitive needs of novice designers and help them at every step to easily carry out this creative task. Our research aims at creating behavior authoring environments that makes it easier for everyday users to create characters for interactive experiences. We are interested in gaining a fundamental understanding of the creative cognitive processes involved in designing behaviors; as well, we are interested in understanding the required scaffolding

for learning and development of such processes. A better scientific understanding of these cognitive processes would enable the development of future environments for novice designers that can effectively support them throughout the design process. In this paper, we present results from a user study that aims in this direction.

The behavior authoring process which users are typically involved in consists of three distinct stages: story creation, demonstration, and annotation. During the first stage, users generate stories which are to be acted out by the virtual characters. Stories may contain one or more characters, and can be of arbitrary length. An example might be a short story about a boy which meets a girl at the park, they talk and joke, and then become friends. Such stories provide a variety of situations in which characters behaviors are described; while at the same time providing scaffolding onto which artificial intelligence can be trained. The next stage in the process, demonstration, is performed by users who take a description of a story and act it out in the virtual world setting. Players take on the roles of characters in the story, and carry out the actions necessary to enact the story plot. As a result of this step, narrative descriptions of stories are converted into sequences of actions whose cognitive significance can then be described. The final step of the authoring process is annotation. At this stage, users provide the system with semantic information describing what story characters were "thinking" as they acted the plot. This step is crucial to the development of intelligence in our system, as it permits users to explain the internal workings of characters' minds in various situations.

Our group carried out two user studies, in order to determine whether a specific interface is appropriate for users to transfer their knowledge of character behaviors into our system. In both studies, participants were provided sample scenarios and asked to fill up information into paper-based prototype interface forms, as well as asked qualitative questionnaires about their authoring experience. The general results from the studies are summarized here, and will be elaborated below. The studies indicate that an authoring environment should provide frequent feedback by allowing users to see the implications of the authoring process. It should encourage group work, as working in a group allows people to validate each other's ideas and produce more creative content. The authoring tool should not use a one-fit-all approach, and instead focus on catering for user differences. Further, as the primary users of the system are novice designers, the tool should guide the users by providing examples whenever available.

The rest of the paper is organized as follows. We first present the related work followed by the results from the first pilot study that is aimed as a precursor to the main study. We then move on to describe the main study that incorporates results from the pilot study, and we present the results from the analysis of this study. Finally, we conclude with plans for future work.

2. Background: User Generated Content

Media Content development has traditionally been restricted to the experts who are proficient in the concerned domain. Advent of newer technologies like open source, free software and other tools that

are accessible and affordable to the general public, has opened up the way for User generated Content (UGC) that is publicly available and is produced by end-users. The growth of UGC has been seen for many media forms, namely: photos and videos, wikis, blogs, discussion board, product reviews among others [1]. UGC has been in a latent form in one way or another since the very early days of Internet. However, in the past few years, it has become one of the prominent forms of global media. In the area of virtual worlds, games and interactive stories as well, UGC has been one of the prominent ways of expanding the content [2,3,4,5]. One of the primary reasons for this phenomenon is opening up the tools of production (also called democratizing the tools of production [5]) in any domain to everyday users. Some of the tools like open source, free software already exist in some areas to allow for UGC whereas in others, basic research is required to understand the everyday user's cognitive processes and the required scaffolding required for learning and developing these cognitive process. Our goal is to conduct this research in designing intelligent game characters, as a better scientific understanding of these cognitive processes would enable the development of future environments for everyday designers of character behaviors that can effectively support them throughout the design process. There have been other works in academic circles with similar goals. Scratch is a tool aimed at helping young people of ages 8 with very little or no programming skills to develop and share interactive creations [6,1,2]. It contains a graphical programming language that allows kids to control the actions and interactions among different media by simply snapping together graphical blocks, that represent constructs in a programming language. There are other tools that make focus on the creation of story based games. ScriptEase, for example, provides ability to the users to create story based game through a pattern catalog, identified through rigorous analysis. In order to increase usefulness of the system to new stories and domains which cannot be covered by existing patterns, the authors need to design new patterns [7]. Scribe provides a tool that allows for the visual creation of interactive story content [8]. In the area of virtual characters, Sims 3, a commercial game populated by allows their users to create new characters using predefined personality traits [9]. Creating personality through such a mechanism on one hand makes the job of the user to create characters easier, however, on the other it limits user's creative freedom. Our focus is on allowing the user to have more creative freedom by allowing him to create new personality elements. This is a difficult task, as it requires fundamental understanding of the cognitive needs of users, as well as an understanding of the necessary scaffolding required in a tool aimed at the creation of detailed character personalities. Our study is focused in this research direction.

3. Study

3.1 Pilot Study

Our pilot study consisted of two subjects who participated in two experimental sessions each: one "group session" where they worked in a team to perform the experimental tasks, interacting with each other in person, and one "individual session" in which they performed similar tasks without being able to interact with each other. Each of the sessions lasted 1 hour. Prior to the sessions, the experimental tasks were described to participants through a sample pamphlet. In both sessions, the participants were given a brief description of a story setting. For example: "You are a boy who will take a girl to a

prom". Two such story settings were provided to participants, one for each of the experimental sessions. Story settings were selected from what we believed participants could relate to - the first story was a situation about a boy taking a girl to prom, while the second story involved an armed robber who holds up a person. From the brief description of the story settings, participants were asked to create a short story, then annotate several of the mental activities which a story character experiences. We asked participants to describe the story using a graphical format which describes story events and character behaviors. Figure 1 illustrates a sample story graph generated. The graph illustrates how behaviors are linked to other behaviors, perceptions, emotions, and likes/dislikes.

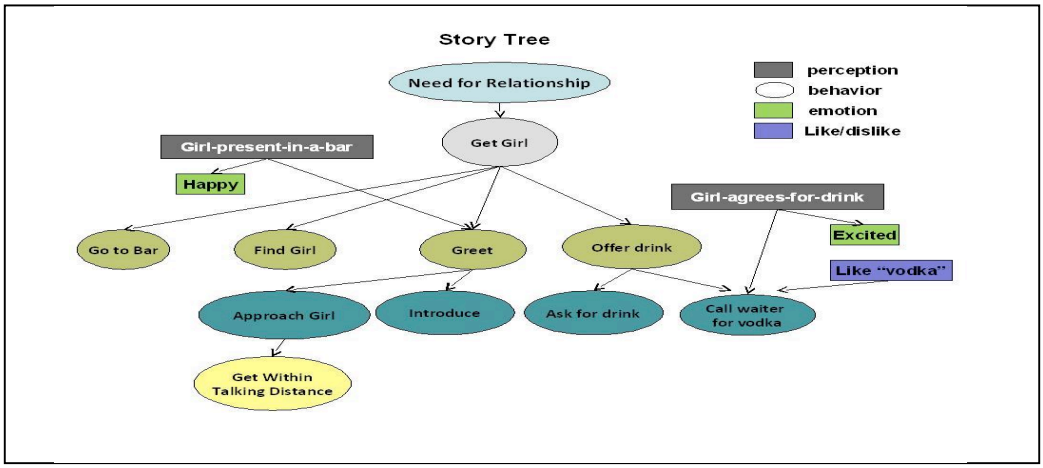

Figure 1: A sample story graph used to describe story events and character behaviors

Participants are then asked to describe character mental activities, by filling details about character mental states. Template forms were provided for each of the mental entities outlined previously – behaviors, perceptions, emotions and likes/dislikes. Figure 2 shows a sample of form relating to a character goal. The templates required users to select several mental concepts which occur in a character's mind during the story, and to provide details about these. Participants were asked to fill one form for each entity type, thus a total of 4 forms were filled besides the story graph, for each of the group and individual sessions. Short interviews were then performed with the participants prior to our collection of their materials. In analyzing the results, we focused on points of difficulty or ease which participants had encountered while carrying out the activities.

During the pilot study, participants expressed that the group activity was more fun than the individual session. They also felt that filling the behavior templates was time consuming and tedious, specifically because they required verbose written experimental session. The participants could not finish filling in the forms by the end of the time allocated for each experimental session. We also observed that allowing open-ended answers for describing mental entities caused confusion in the participants, as they did not know at which level of detail to provide the descriptions. Also, participants report that the open-ended forms were not enticing enough to maintain their interest. Participants noted that the process was not enjoyable and much too complicated. Furthermore we observed that participants did make frequent use the mental entities of emotions or likes/dislikes in their story description As a result

Goal Form	Percepts
When is this goal activated ?	How do I react to it being activated?
How do I know it's progressing well ?	How do I react to it progressing well ?
How do I know it's not going well ?	How do I react to it not going well ?
When do I know it has completed successfully ?	How do I react when it is a success ?
When do I know it has failed ?	How do I react when it fails ?

Figure 1 : A sample template form which users had to fill as part of the pilot study

the pilot study, we improved the forms by constraining the type and amount of answers which participants can enter; additionally, we decided to provide participants a sample situation in which the story graph and mental entities have been filled.

3.2 Main Study

The main experiment consisted of seven experimental sessions. Two people participated in each session, for a total of fourteen participants. Similar to the pilot study, each experimental session consisted of two parts: a group session and an individual session, and participants described one story per session. For the group session, participants collaborated through a Web-based video conferencing environment. The experiment design contained the same two stories as in the pilot study, and stories were randomly assigned between group and individual sessions. Additionally, participants were given a sample story package, which contained a sample story and examples for how to fill the story graph and mental entity forms.

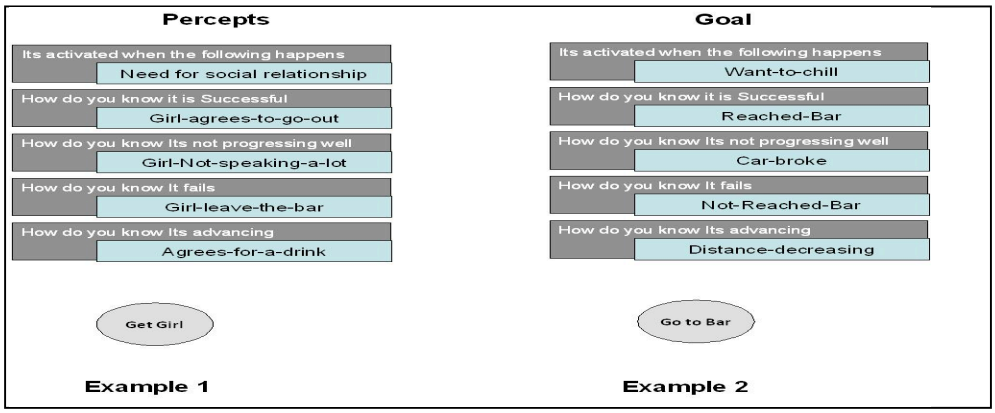

Figure 2 : The table shows the forms that user fill in to provide details about perception and goals

The main experiment required users to fill mental entity forms which were different from the previous pilot study (a sample form is shown in Figure 3). Instead of filling verbose descriptions for each mental entity, participants had limited space to describe mental entities, typically being restricted to several words. Furthermore, the sample package showed participants the appropriate level of abstraction to describe mental entities. From the previous study we also learned that the entities of emotions and likes/dislikes were rarely used by participants, thus we decided to remove these from the forms. Instead, we added two more forms for describing how higher level perceptions are generated from low level perceptions, and for describing how low level goals are expressed as character actions.

In this study, participants were also asked to fill questionnaire forms which contained open-ended questions which allowed participants to elaborate on the tasks performed. The procedure for analyzing data collected from this study consisted of comparing and contrasting participant responses, as well as determining points of difficulty gathered through the template and questionnaire forms, as well as through the interviews and observations. The participants' performance was also compared with an initial survey that asked them how much experience they had playing video games, story creation, computer science, etc. Participants provided a wide variety of stories and explanations for mental states through the forms provided. The overarching difference observed was in the level of detail at which participants described character behaviors. Some participants enjoyed providing detailed explanations at various levels of abstractions, having multiple layers between high level activities and low level behavioral actions and perceptions. Others did not enjoy the decomposition process, and usually jumped between high level and low level states in their explanations. Both types of users, however, were comfortable with the notions of explanations at high and low level of detail.

Participants typically reported that they enjoyed building the story graph. Typically they followed the layout and simplicity of the example provided. However, as noted above, some provided less hierarchical details (~3 levels of abstraction), whereas others provided more (~5 levels of abstraction). Similarly, there was wide variety in the amount of details of the graph – some participants preferred describing only character behaviors, while other participants also detailed perceptions, emotions and likes/dislikes. Furthermore, users had different styles of building the story graphs, as some users created stories that are clearly hierarchical in nature, being created directly out of the internal goals of one character; on the other hand, some users created stories which are sequential, in which story events progress linearly but are not driven by one character's intentions. Out of the mental entities we provided, behavior goals were the most frequently used, followed by perceptions, emotions and likes/dislikes. Some participants reported difficulty with the task of constructing the story graph, because this required them to both (1) build a story from the provided situation, and (2) think of story events from the point of view of a character's mental activities. Group activities were widely reported to be more enjoyable than performing the tasks individually. We believe this may be because participants were able to brainstorm together, and did not feel as much pressure to produce an "expected" design.

4. Design Implications

Our experimental findings provide us with several heuristics useful designing authoring environments in which users are required to describe mental processes.

4.1 Strive for Simplicity

From the qualitative reports of the two studies, it appears that when people do not know what is expected of them, they will be less likely to enjoy the authoring tasks. Thus, an authoring interface must strive to provide examples whenever available, and/or constrain the types of information that

users are able to enter. For instance, when a user is are asked to describe causes or consequences of mental activities, the interface should, by default, access a community library where users can navigate a listing of content which other users have already entered in similar forms; only if the user cannot find an appropriate match, should they go through the process of creating a new item. Users in our study were able to describe stories in terms of behaviors, perceptions, emotions and likes/dislikes. When user input space was constrained to a few words and when appropriate examples were supplied, participants showed significant abilities to describe the details of mental activities such as triggers and effects of behaviors, as well as hierarchical composition of perceptions. Participants described mental activities through frequent use of behaviors and perceptions, yet rarely made use emotions and likes/dislikes. Thus these latter mental entities can be avoided if the system is able to provide a general model of emotions from behavior types, or if the system is able to deduce likes and dislikes from emotional responses.

4.2 Cater for User Differences

Although all users were able to complete the experimental tasks to qualitative success, a variety of users were observed in our study. In the story creation portion of the study we observed users which generate stories by focusing on one character's internal motivations, and we observed users which generate stories from a more holistic perspective. In the story creation and the mental-state annotation portion of the study, we observed users which directly jump from high level descriptions to low level descriptions, while also observing users which provide multiple layers of abstractions in their descriptions. We also observed a minority of users who preferred the individual portion of the experiment over the group portion. In order to provide an environment where users provide useful content while enjoying the authoring experience, we believe that the interface design should cater for the different user types. Different tools and authoring processes must be designed for various users, for instance two different story authoring environments, one which focuses on a protagonist perspective, while another enables a world view description of the story. Similarly, users should not be forced to provide a set amount of levels of abstraction; instead, they should be free to express as many or as few levels as they desire, and if the system decides one user's inputs to be insufficient or excessively detailed, other user types should be allowed to edit this content. Finally, users should be allowed to author only the types of content they are comfortable with, thus the user community would contain different sub-groups of story creators and annotators.

4.3 Provide for User Feedbacks

Participants reported that they felt uncomfortable about what they had produced because they were uncertain what the task was expecting them to do. This observation occurred frequently in the pilot study in which tasks were open ended and without example, and occasionally in the second study for the story creation activity. In light of these observations, we deduced that examples and feedback are important in such authoring activities. The authoring interface should therefore strive to provide examples of related content which other community members have produced. Additionally, whenever possible the environment should let users see the implications of their authoring process – for

instance, upon describing part of a behavior, the system should play a simulation of the behavior such that users can verify or correct their creations. The user community can also be employed for providing feedback, as users can be ranked and their creations be critiqued by other members of the community. Through this process, users validate and improve each other's skills and techniques.

4.4 Encourage Groupwork

For a majority of users, working in groups was a more pleasurable experience than individual authoring. Qualitative reports indicate that authoring through groupwork allows people to validate each other's ideas, and produce more creative content. The authoring environment should integrate group activities into the user interface, possibly in the form of competitive authoring games, or simply through online collaboration interfaces.

4.5 Separate User Task

In our experimental setup, users were first asked to create a story through a story graph which described the mental states of one story character. Some users which had trouble with this task have noted that they were trying to do two activities at the same time: generating a story, and thinking of character mental states. Progressing in both tasks at the same time is a problem because the authoring process differs between the tasks: to generate a story, users typically think linearly to create a sequence of story events; however, to generate mental states for characters, one must think both hierarchically and sequentially, in order to link mental entities to each other and across different levels of abstraction. This suggests that the authoring interface should separate these two tasks: first allowing users to a story in a typical script format, and only afterward permitting users to annotate the mental processes of story characters.

5. Conclusion

In this paper we have presented results from an experiment aimed at studying how users think about authoring intelligent characters. We gathered these insights using two studies conducted through paper prototypes of an authoring environment which would let everyday users create characters with rich personalities. We have started incorporated the design implications from the user study into our authoring environment and currently developing the first software prototype based on these results. We aim to conduct another study using the actual software prototype in the near future.

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