Artificial Intelligence and Dynamic Design: Adaptive Real Time 3D Characters

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Abstract

Creating design that relates to the dynamic nature of a conversation is what this project explores. As a focus of intent the exploration pursues the interaction that people have with reactive visually dynamic web based agents. This is in an attempt to expand on the concept on Human Computer Interfaces by creating design specific, emotive and responsive. The current focus is on a single real-time 3-D character with the design concept encompassing elements of conversational artificial intelligence.

1. Introduction

The challenge of creating artifacts that adapt according to the interaction of the viewer, changing the emotive quality of the design as the human interacting with it changes in detectable emotive response is the aim of this research. Focusing on the interplay between the user, interaction and design; and seeking to develop agents that have an innate though artificial intelligence that is closely related to their visual design is also primary. The result being the creation of a contemporary set of artifacts in the form of virtual 3-D characterizations that have an innate though simulated intelligence, an interactive ability that is contained by design parameters and dynamic environments suited to the function of the artifact.

Extensive research has been explored involving Agency Theory[4]. Research already undertaken has involved belief, desire and intention studies (BDI) involving human characteristics in agents[3]. A formalism based on a branching model of time, in which belief, desire and intention accessible worlds are themselves branching time structures[1].

The purpose of this research is not to revise these Agency Theories but to implement them into contemporary artifacts e.g. 3-D characters in dynamic environmental designs. These spaces as such are virtual environments where the agent therein detects and interacts with the human viewing it in a way that is emergent upon the interaction that the human initiates. This is initially set up as a conversational game.

2. Current Research

In the process of creating an intelligent real-time 3d artificial agent for live interface from interaction via the internet, certain problems focused around the agents physical design and personal affability become evident. These problems persist along side other problems related to technology; in particular, using design to coaxing the user to easily download and install the 3-D player software. Along with these marketing and technical issues creating a dynamic method to handle the way that agent responds to the content that is being discussed must be addressed.

The agent or virtual character must be able to respond to the user in a way that suggests emotive response that is copacetic with topics discussed in the conversation. The agent must have a wide range of issues to available within its database to draw upon during a conversation that are topical and current. Tackling problems like the characters ability to speak in multiple languages and cultural contexts also must be addressed. This would make the characters, generally speaking more accessible. The primary goal is to make agents that have a familiarity and charm that the visitor to the site is readily accustomed to seeing.

In the current pipeline used for conversational agents the design is limited to 3d characters (see Figure 1). In this existing structure the characters are accessible via the internet and have interactions with people on a world wide basis. The content of their discourse is recorded in a log file. The file is then checked for content and topic relevance in relation to the characters design. These topics are determined by interactions with the user. Changes are made to the both and uploaded for further refinement.
2.1. Artificial Comedy

The content this phase of my work consists of the creation of detailed 3d characters that are interfaced with artificial intelligence and brought to life via animation synthesis techniques. Designed with current popular motifs in mind, my focus is in the interplay between simulated and real. Having created the character Nadia (see Figure 2) for view on the internet in Windows XP based browsers (best if viewed with Internet Explorer) the character has interacted with tens of thousands of people in the past half year on the site http://CLONE3D.com. The current display is a stand alone version that does not require internet access. The work attempts to define artificial personalities in cyberspace contrasting them with the intelligence of the person viewing the piece. Given the particular interaction the character will provide information or chide the user with witticisms. The content also includes prerecorded audio in the form of automatically lip-synced vocalizations.

In terms of design the agents forms are modeled in a non-photo realistic stylized manner. By doing so the normal tendency to associate the characters/agents with bizarre monstrous creations is avoided, e.g. The Uncanny Valley Effect.[2] The lighting models are relatively naturalistic and use standard lighting techniques. The behavioral models are designed to emulate human gestures however they are stylized to reflect animation conventions. The primary goal in favoring this design style is to bring the audience into friendly discourse with the characters.

3. Goals and Methods

Focusing on virtual characters, the interaction that a user has with the agent is captured in the form of a dialog based log file. This file is then analyzed and evaluated in terms of content explored and requests made by the user. The results are applied to the design and actions of the character. Developing the 3d characters spontaneous animated response in a way that coincides with the given discourse.

Thus far having concentrated on creating a conversational 3D avatar based character the focus has been on setting up a character whose visual narrative fits it’s cognitive design. Here is a list of elements that have been addressed:

- An animation synthesis technique is in place allowing the animation to be created from numerous cycles resulting in a non-repetitive look to the character’s motion
- Motion derived from key-framed animation and motion capture with the ability to blend the two, an animation synthesis technique is in place
- A straight forward automated lip-sync and TTS speech methodology is working via analyzed audio files and Sapi4.0 and Sapi5.0 as well as Sapi5.0 compliant TTS technologies
- A method to extract, edit and organize a knowledge base from existing AIML databases has been created
- Output to Mobile PC and Symbion mobile phone platforms is in place
- The ability to analyze data from the interaction of the characters with clients via the world wide web is in place
4. Future Directions

Living in Singapore and pursuing artistic academic research at technological university provides a unique opportunity to achieve dynamically adaptive intelligent artifacts that are developed and fully functional. Although my current work focuses on characters, along side of this development I plan to devise methods to create imagery that reacts to emotive changes in the human interacting undergoes during the interactivity session.

This kind of tool set will initially focus on background sets and expanded character emotive reactions. Another venue for this technology is in real world artifacts, bring the virtual into the physical. These items could range from toys to practical objects.

Ultimately it would be interesting to explore these techniques in non-objective, reactive spaces such as a multi panel or immersive gallery setting that would involve expand from characters to abstractions of design and audio. This would involve creating scene templates that flavor the experience as per the concept of the work. It would also involve methods to detect the human interfacing with it such as motion and audio sensing.

Moving forward from this approach would be creating methods to manipulate the human viewing the piece with emotive suggestions and haptic interfaces; thereby suggesting a visual and auditory solution that would steer the content of the artwork to a place that would be interesting to explore. In the case of conversational avatar based artificial intelligence, with the focus on visual and cognitive design, the following issues must be addressed:

- Methods to embed and exploit conversational and behavioral artificial intelligence in art objects and artistic installations
- Dynamic design sensitive methods to handle the way the agent responds to a given content suggesting a contextual emotive response within the art work, e.g. audio, color, geometric and volumetric changes
- A shared topic sensitive database that draws upon data gathered by other agents in the field
- The agent must have culturally sensitive communication skills
- Real-time, hyper-real and stylized design libraries: how the agents appearance relates to their response and query database
- Methods must be implemented that explore unique venues and methods for gathering data through interaction

5. Conclusion

Because of certain market forces, the design inherent to computer generated characters supports the repetition and emulation of particular archetypes. These archetypes appeal to a spectrum of people that gravitate toward the hosting media, e.g. feature animated films with redundant hero types clad in motif specific design; video games with sexually potent male and female characters. These characters are mostly one dimensional. This project explores this archetype and expands it by creating characters that though are hyper real are also intelligent in a way that only a machine can be. This is part of the challenge of creating a non-commercial intelligent emotive character. I am also led to consider as part of the artists craft, the visual and the technological design. Both are integral to the work. Where one suggests the other must deliver. From any stimulus that a character might receive from a Human Computer Interface a visual must follow or precede, creating a kind of sociological dance that involves the human with the virtual character. Therein lies the challenge of working with and expanding this medium.

5.1. Theme: The HCI Experience

A computer generated pseudo/theatrical event, responsive to random nonverbal and verbal input with the result being: A meta-narrative that dissolves the idea of intimate discourse; providing a spontaneous ability to shift from spectator to creator. Looking beyond questions such as archetypal adventures and interactivity in real-time games to a more immanent notion of discourse as gesture. This is
based on the formation of experience and subjectivity that results as a reaction to interactivity of artificial intelligence within a contextual field.

5.2. Theuth the Inventor

Here Plato expresses a double sense of wonder and risk in his story about the invention of reading—of writing and literacy. In the Phaedrus, Socrates tells a story:

They say that there dwelt at Naucratis in Egypt one of the old gods of that country, to whom the bird they call Ibis was sacred, and the name of the god himself was Theuth. Among his inventions were number and calculation... and, above all, writing... To [the king, Thamus] came Theuth and exhibited his inventions... when it came to writing, Theuth declared: There is an accomplishment, my lord the kind, which will improve both the wisdom and the memory of the Egyptians. I have discovered a sure receipt for memory and wisdom. Theuth, my paragon of inventors, replied the king, the discoverer of an art is not the best judge of the good or harm which will accrue to those who practice it... Those who acquire [writing] will cease to exercise their memory and become forgetful... What you have discovered is a receipt for recollection, not for memory... (Phaedrus, 95-96)

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