User-Centered CBR Technique for Characters Design in MMORPGs

Ching-Han Kao[1], I-Hsin Fan[2], Chun-Ming Yang[3]

[1, 3] Department of Industrial Design, Ming Chi University of Technology,
[2] Institute of Information and Society, National United University No.1,
TAIWAN.

[1] Kaoch@mail.mcut.edu.tw, [2] magfan@nuu.edu.tw, [3] cmyang@mail.mcut.edu.tw

ABSTRACT

This study conducts a user-oriented approach to create concepts for new game character design. We use a vector, involving a number of character attributes, to represent a character. The characters' attributes are defined by how game-players perceive and interact with the character, by following the initiatives of user-centered design. A character database is established by collecting these characters and their attributes. The database provides default characters as benchmark to create new character concepts. We use case-based reasoning technique to retrieve "sufficiently relevant" characters from the database to be the benchmark characters. The features of the benchmark characters are manually screened to identify creative and preferable concepts for generating candidate characters. A preliminary prototype system based on this approach has been established.

Keywords: User-centered design, Case-based reasoning, character design, Character attributes, MMORPG

INTRODUCTION

Character design is getting more important ever since Massively Multiplayer Online Role-Playing Game (MMORPG) is introduced. The MMORPG is a genre of modern role-playing video game that provides a virtual world to support thousands of people playing together on the Internet (Ducheneaut, Yee, Nickell, and Moore, 2006). The term MMORPG was coined by Richard Garriott, the creator of Ultima Online, in 1997. The MMORPG generally requires more powerful hardware and software resources to provide player with more magnificently virtual cinestrip and multiple gaming elements. Jointly with the game platform development, character development creates powerful social, emotional or cultural connections with players through the act of game play, resulting in greatly increasing players' audio-visual feel. In the MMORPG, players could generate some of the emotions and experience they would not be able to undergo in real life. Furthermore, MMORPG provides player more real-time social interaction and dramatic inter-player interaction through character in virtual world, where a large number of players can simultaneously join in a persistent gaming experience. This genre of games, such as World of Warcraft, Dark Age of Camelot, Asheron's Call, Lineage, EverQuest, and Ultima Online, has spawned a multi-billion dollar market and has attracted a huge amount of subscribers worldwide (Woodcock, 2008). Therefore, the MMORPG industry is no longer a youth-oriented business, but a digital entertainment lifestyle that is popular among youth and adults alike.

In MMORPG, Choi et al. (1999) classified the game design factors into users' perceived fun and cognitive fun. Perceived fun means that the player is simply having fun from the character immersion. Cognitive fun means that the player is having fun and also realizes that it's only a game character. As players immersed and had fun in games through controlling

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characters (Poole, 2000), characters were considered as one of the core elements of computer games (Lankoski and Heliö, 2002; Yee, 2007). Hence, the character design is more important for MMORPG. Hsu et al. (2005) pointed out that the character's appearance is the important fun features for game design. An attractive character may induce players to have affectionate feelings for the avatar, and in turn, make game play more fun (Hsu, Kao, and Wu, 2007).

Characters from the traditional games are generally simple visual figures without personality or depth interaction in their design, while characters from MMORPG are built with human ability, social class, gender, appearance, personality, emotional and life story, etc. When people enter MMORPG they integrate with the character and meet other players' and non-players' characters in the platform. Due to the vivid character representation in MMORPG, games nowadays attract players not only in younger generation, but also in other generation; MMORPG results in popularizing a digital entertainment lifestyle among all ages (Lo and Wen, 2010).

Since game machine design and game content design are gradually followed user-oriented approach, it needs to take users' physiology, psychology and society factors into consideration. A number of user-centered design (UCD) techniques have been evolved to support each stage of the game design process, from concept through post-production. Therefore, by following the UCD approach, the character designer must understand the users' basic needs as well as their initial expectations of the character.

To conduct a UCD approach, we have to analyze the preference of players. Based on the players' preference, a "social map" is drawn to illustrate the concept of characters. Based on the social map, two designers emulate the activities of players and create new character ideas by discussion. The social map approach is essentially a human-based approach. The quantity and quality of new character ideas, in a human-based approach, are undoubtedly limited by the capacities of designers. To address these issues, this research proposes a computer-aided technique that will be employed to create new character ideas. Based on the UCD paradigm, a character is represented by a vector consisting of 36 elements. Each element represents a character attribute, which relates the character to players from a user-centered perspective. By such a character representation scheme, a large amount of characters are coded in vectors and stored in a database. To create new ideas for an existing character (called benchmarking character), we use the case-based reasoning (CBR) technique to retrieve other characters that are "sufficiently relevant" to the benchmarking character. The functions of the retrieved characters are the new candidate to be added on the benchmarking character.

The remainder of this paper is organized as follows. Section 2 reviews the user-centered deign (UCD), and case-based reasoning (CBR). Section 3 introduces the game character representation scheme. Section 4 describes how to create new game character ideas by using the proposed approach.

LITERATURE REVIEW

This section briefly describes the applications of user-centered design (UCD) and case-based reasoning (CBR) techniques

User-Centered Design

User-centered design (UCD) is a concept to discuss design issue in which end-users influence how a design to express. UCD, originated in Norman's research LAB at the University of California – San Diego in the 1980s, became widely used after the publication of a book entitled: *User-Centered System Design: New Perspectives on Human-Computer Interaction*

(Norman & Draper, 1986). Norman built further on the UCD concept in his seminal work *The Psychology of Everyday Things*. He suggests four basic perspectives on design process: (1) Make it easy to determine; (2) Make things visible; (3) Make it easy to evaluate; and (4) Follow natural mappings (Norman, 1988). Norman (1988) also suggests seven principles of design for facilitating the designer's task. The same period Shniederman (1987) articulated a similar set of principles in the form of eight golden rules. Nielsen (1993) adapted and popularized these fundamental concepts to produce heuristics for usability engineering. The ISO 13407 standard also provides a framework for applying UCD. Alongside the UCD concerns, there is an increasing interest in issues concerning enjoyment, fun, and pleasure (Blythe *et al*., 2003; Jordan, 2002). Meanwhile, game research is distinct from the traditional UCD methodologies by analyzing the components of pleasure in gaming. J¨arvinen *et al*. (2002) suggest that the audiovisual and social dimensions of games and gaming should be studied in addition to functional and structural factors. In other words, widely adopting different types of emotion and pleasure to be experience in relation to principles of user-centered design has raised the perspectives of user and context of use to be the focus of the design process. Instead of analyzing user needs and validating user requirements, which are typical traditional user-centered design approaches, users are encouraged to fiddle and experiment with the tools. According to the standard, the following four UCD activities need to start at the earliest stage for developing a product: (1) understand and specify the context of use, (2) specify the user and organizational requirements (3) produce design solutions, and (4) evaluate designs against requirements.

UCD has been widely used in industry. Some example applications of UCD involve the design of modern microelectronic products (Buurman,1997), the design of a website (Coory, Fric, and Hansen, 1997), the design of a user interface of notebook, the user-interface design of a chemical process (Kontogiannis, and Embrey, 1997), the design of software (Viedenburg, 2003), and the design of new product concept (Kankainen, 2003).

Case-Based Reasoning

Case-based Reasoning (CBR) is one of the problem-solving techniques. Schank and Abelson (1977) divided it from the domain of artificial intelligence. CBR is very similar to the way human beings learning from previous experiences to make the analogical decision when solving problems in real world applications. It is the process which researchers solve a problem by finding a similar past problem case and adapt it by extracting the knowledge needed to solve the new problem case (Kolodner, 1993; Haque, Belecheanu, Barson, and Pawar, 2000).

Basically, CBR is a reasoning procedure or framework instead of a specific algorithm. Hence, CBR is a reasoning system based on cases. A CBR system is operated by three components: (1) a case representation scheme, (2) a similarity metric, and (3) a case-retrieval mechanism. A case representation scheme is to model a case by a set of attributes, which are intended to characterize the case for a particular application. It collects and organizes the existed problem cases in its database. A similarity metric is designed to measure the similarity between any two cases that are described by the case-representation scheme. Generally, in order to solve design problems having numerical features, the nearest neighbor method is used to extract similar cases (Kim, Wi and Seong, 2003). A case-retrieval mechanism is to retrieve the past cases that are similar enough to the new case, according to a predetermined similarity threshold. It helps make judgments on new cases of the system.

Amodt and Plaza (1994) concluded the process of CBR consisting of four steps: retrieve, reuse, revise, and retain. The retrieve process is to find most similar case from database. The reuse process is to solve new problem from experience of past case. The revise process is to

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retrieve most similar and adjust the solving method. The retain process is to save new solving case to support future problem. The four major procedures are illustrated in Fig. 1 (Slade, 1991).

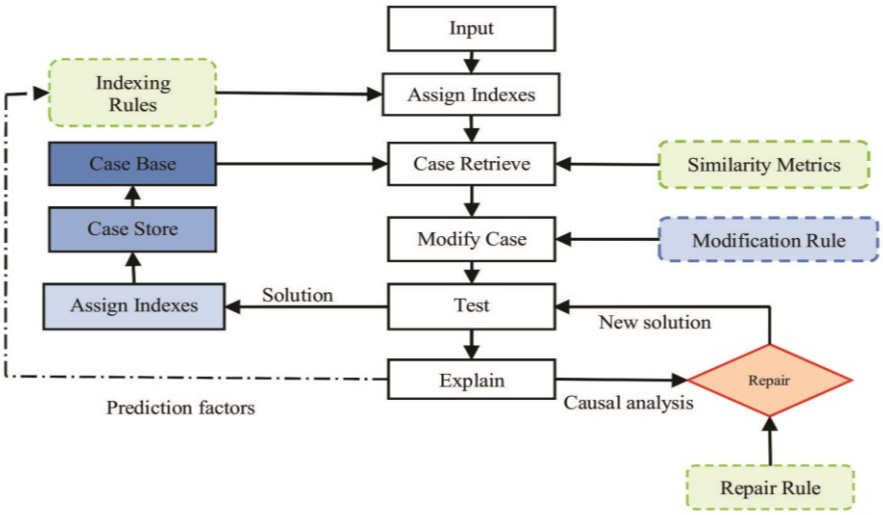

Figure 1. The CBR procedure

The CBR method has been applied in a variety of design problems. The applications include mechanical design (Maher and Garza, 1997), architecture design (Trousse and Visser, 1993), product design and some other design problems. But, rare study is applying CBR to create new game-characters. This paper's focus is to deal with how to apply CBR to create new and player-like of game-characters for a given game.

CHARACTER REPRESENTATION

In this study, a character is modeled by a vector consisting of a number of character attributes. Based on the UCD perspective, these character attributes are developed from four dimensions: (1) character identity, (2) character appearance, (3) character capability, and (4) interaction aspects. These four dimensions are further deployed into 11 sub-dimensions that are further to yield 36 attributes (Figure 2).

Character Image

The first dimension-character image is to describe how a player identifies a character. Here, the character mirrors the expectation of a player. This study classifies the character identity into three sub-dimensions: (1) demographic, (2) personality, and (3) race. In modeling the demographic, the following three demographics are taken as character attributes: (a) gender, (b) age, and (c) occupation. The personality base on five attributes: (a) agreeableness, (b) conscientiousness, (c) extraversion, (d) neuroticism, and (e) openness to experience. The race classifies three attributes: (a) spirit, (b) human, and (c) monster.

Character Appearance

The second dimension—character appearance shows a character's look that is preferred by the player. According to players' needs, the characters' appearances are categorized into three sub-dimensions: (1) scale, (2) facial, and (3) accessory. In modeling the scale, the following two human scales are taken as character attributes: (a) symmetric, and (b) asymmetric. The facial is composed of four attributes: (a) triangle face, (b) ellipse face, (c) rectangle face, and (d) circle face. The accessory involves four attributes: (a) topknot, (b) helmet, (c) armor, and (d) boots.

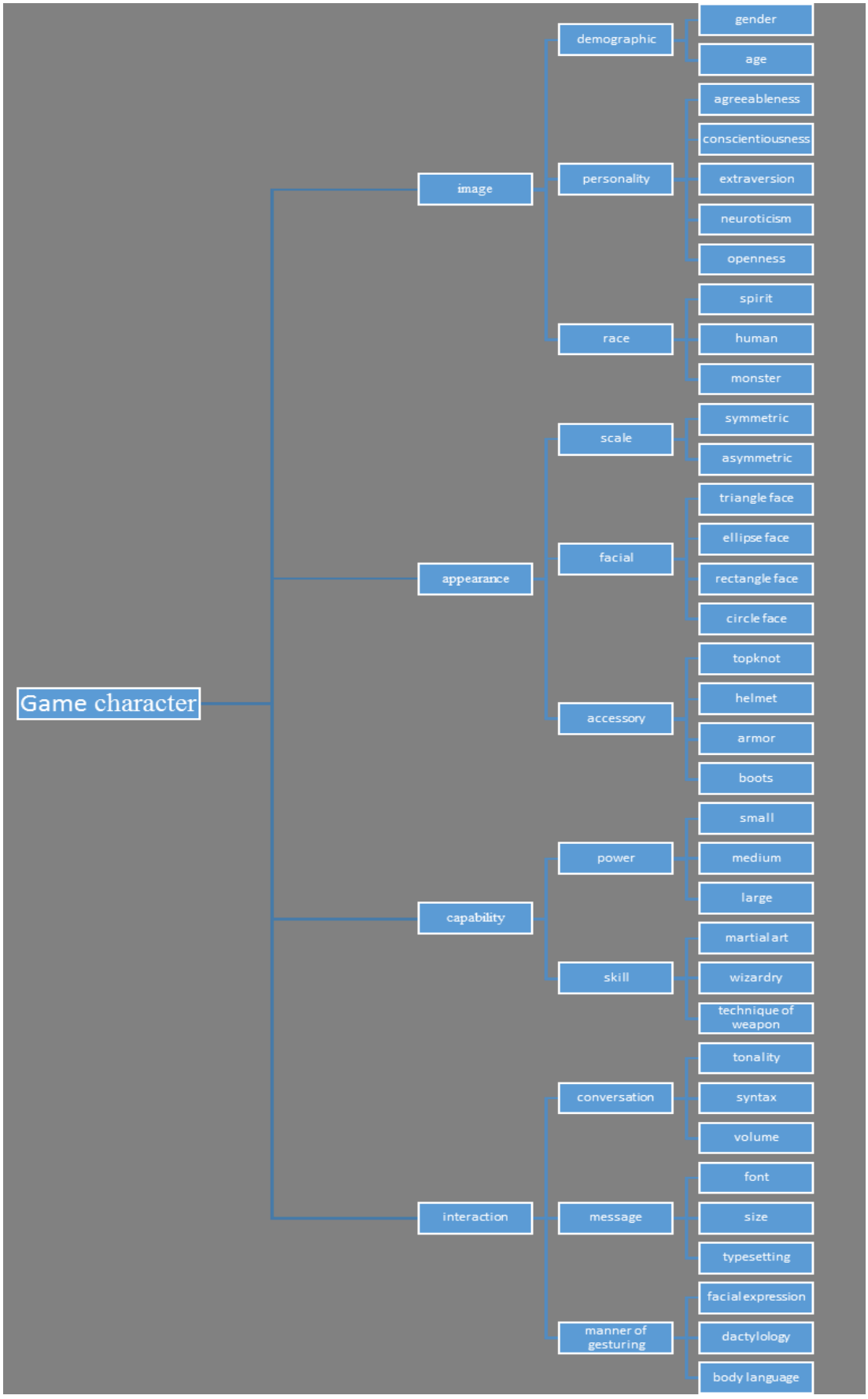

Figure 2. Character Attributes

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Character Capability

The third dimension of the character representation is character capability. This dimension is composed of two sub-dimensions: (1) power, and (2) skill. In modeling the power, the following three power levels are taken as character attributes: (a) small, (b) medium, and (c) large. The skill is categorized into three attributes: (a) martial art, (b) wizardry, and (c) technique of weapon.

Interaction Aspects

The fourth dimension of the character representation is interaction aspects. This dimension is characterized by the following three sub-dimensions: (1) conversation, (2) message, and (3) manner of gesturing. In modeling the conversation interaction, the following three factors are taken as character conversation interaction attributes: (a) tonality, (b) syntax, and (c) volume. The message interaction is composed of three attributes: (a) font, (b) size, (c) typesetting. The manner of gesturing is categorized into three attributes: (a) facial expression, (b) dactylology, and (c) body language.

CREATION OF CHARACTER CONCEPTS

Based on the UCD paradigm and proposed character representation scheme, this research applies the CBR method to create new character concepts. The concept-creation mechanism starts with a benchmarking character, which is an existing character. Adding new identities to the benchmarking character will generate new character concept. When its high-value attributes are greater than 0.75, the "sufficiently relevant" will be retrieved and selected as the benchmarking character. These retrieved characters are then screened and rated manually to determine the quality of new concepts. Here, the quality of new concepts implies how creative and valuable it is to add the main identity to the benchmarking character. The method for computing the relevance metric between two character vectors is described first in the following. Then, the CBR procedure for retrieving the "sufficiently relevant" characters is explained.

Computing Relevance Metric

After a character database has been built, which involves a large amount of characters and each character is modeled to be a vector by the proposed representation scheme. Let $C= \{C_i, i = 1,\ldots, K\}$ to be the database, where $C_i = [c_{ij}]$ $1 \le j \le 36$ represents the i-th character and c_{ij} is the value of its j-th attribute. Let $B = [b_j]$ $1 \le j \le 36$ represent the benchmarking character. Let AR (b_j, c_{ij}) represent the relevance metric of j-th attribute for character B and C_i. AR (b_j, c_{ij}) is defined below.

$$AR(b_j, c_{ij}) = 1 - |b_j - c_{ij}| \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Let $S = \{ j | b_j \ge 0.75 \}$ represent the high-value attributes set of character B. Some attributes in S are selected to be a key set, which are used to retrieving "sufficiently relevant" characters. Define $T \subset S$ as the key set. Let CR_i^T represent the character relevance metric between characters C_i and B, with respect to the set of attributes T.

CR_i^T is defined below, where $W_j \in [0, 1]$ denotes the weighting factor of j-th attribute given by users. That is, users can give their preferences on the attributes in T.

$$CR_i^T = \sqrt{\frac{\sum_{j \in T} [b_j \cdot AR(b_j, p_{ij}) \cdot W_j]^2}{\sum_{j \in T} [b_j \cdot W_j]^2}} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Procedure of CBR

The concepts presented above can be used to develop a character concept retrieval system, called CCRS. The procedure for using the CCRS to generate new character concepts is presented below.

Step 1: Initialization

Assign R_Set = ∅, A_SET = ∅

Ask user to determine the benchmarking character B.

Step 2: Determine S= $\{j|b_j \geq 0.75\}$, the set of important attributes for character B.

Step 3: Ask users to select attributes in S to form several key sets T_k (k = 1… n) and give W_j for each attribute in T_k.

Step 4: Retrieve "sufficiently relevant" characters from the character database

Ask users to determine a relevance threshold h ∈[0, 1].

Retrieve and place the "sufficiently relevant" characters in R_Set; that is,

$$\text{R\_Set} = \bigcup_{k=1}^{n} \{C_i / CR_i^T \geq h \ for \ i \in T_k\}$$

Step 5: Ask users to select creative and valuable character concepts from R_Set and place them in A_Set.

CONCLUSIONS

This study shows a cased-based reasoning (CBR) approach to generate new character concepts. A character is modeled by 36 attributes based on the user-centered design (UCD) paradigm. For each attribute, a character is assigned a 0–1 value. The higher the value, the more important is the attribute. For a benchmarking character, some of its important attributes are manually selected as keys for retrieving from database the characters that are "sufficiently relevant" to the benchmarking character. The identities of these retrieved characters are taken as candidate new functions of the benchmarking character. A preliminary prototype system of the proposed approach, called CCRS (character concept retrieval system), has then been established. These results provide useful reference for game designers and firms involved in the creation of vivid game characters.

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