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Creating Engaging Artificial Characters for Games

Game developers and researchers aim to model human behaviour in order to create more engaging, entertaining and satisfying artificial characters for computer games. It is a popular belief that intelligent behaviour is the key to creating better game AI. However, as yet there is no empirical evidence to support this theory or to indicate whether other attributes, such as social interaction, realistic behaviour and communication, should also be considered. This study aimed to find out which attributes people desire in team members and opponents in computer games. The study employed a questionnaire, administered to a group of university students, directed towards ascertaining the importance of different aspects of player behaviour in games. It was found that there are two different, non-homogenous groups, each with separate needs and wants that game developers should consider. Firstly, it was found that people who prefer playing computer games with other humans tend to value intelligent behaviour and social interaction more than people who prefer computer players. Secondly, it was found that people who prefer computer players do so for convenience, practice and a preference for games that can only be played individually. It is recommended that game developers should aim to model intelligent behaviour for the first group and that the second group require an in-game learning environment for skill-development.

Introduction

It has been proposed that human-level artificial intelligence (AI) can impact on games by creating enemies, partners and support characters that act like humans, enhancing the player's gaming experience and recreating the experience of playing against other humans, without a network connection (Laird & van Lent, 2000). Accordingly, game developers and researchers aim to model human behaviour in order to create better game AI. By anticipating the situations that the AI will be in and by considering what a human would do in these situations, game developers are able to encode responses that seem feasible. However, in order to create artificial characters for computer games that give people the same challenges, entertainment and interaction as playing with human players, it first needs to be assessed which aspects of human players should be embodied in these characters to fill the virtual shoes of the human player.

Therefore, an important question to ask is "why do people like playing computer games with other people?" A popular theory is that people prefer human opponents because they play computer games intelligently (van Lent, Laird, Buckman, Hartford, Houchard, Steinkraus & Tedrake, 1999; Laird, 2001), in that they create new strategies, exploit weaknesses in their opponents and provide greater challenges. Laird and Duchi (2000) used a variation of the Turing Test to investigate which aspects of behaviour impact on a player's perception of skill level and humanness. They found some interesting trends concerning decision time and aiming skill, although their results were inconclusive.

However, while intelligence is important, there are other factors that should be considered when creating human-level AI for computer games (Dautenhahn, 2000). Other such factors include social interaction, ease of communication and how realistically the characters behave. But which of these attributes needs to be encoded into

game AI to make it a viable substitute for human players? The main problem is that there is no empirical evidence to answer this question, only speculation by game developers and researchers alike.

Therefore, the aim of this study is to determine which aspects of human behaviour are most desirable in other players in computer games. The means of this investigation will be a questionnaire delivered to game players, asking them which attributes are most important in team members and opponents in computer games. A questionnaire will be used so that the opinions of a large group of people can be surveyed. There are four main aspects that will be investigated, namely intelligent behaviour, realistic behaviour, social interaction and ease of communication, as well open-ended questions that will allow the subjects to nominate other attributes that they find important. The aim of this questionnaire is to provide initial empirical data for identifying the attributes that artificial characters need to possess in order to fulfil the role of an acceptable and satisfying alternative to playing with other human players.

Method

Participants

The questionnaire was administered to a group of third year computer science students during class. Eighty-one subjects completed the questionnaire (50 males and 27 females). The mean age of the participants was 22.35 years. Eighty percent of the subjects were frequent game-players, with 25% playing computer games once or more per month, 12% once or more per fortnight and 43% once or more per week. Out of the 81 participants, 79 indicated a game-type preference (50 males and 25 females). Figure 1 shows the number of all subjects, males and females that preferred each type of game. The six categories of games shown are real-time strategy (RTS), first-person shooter (FPS), role-playing game (RPG), turn-based strategy (TBS), simulation (SIM) and sports games (SPT).

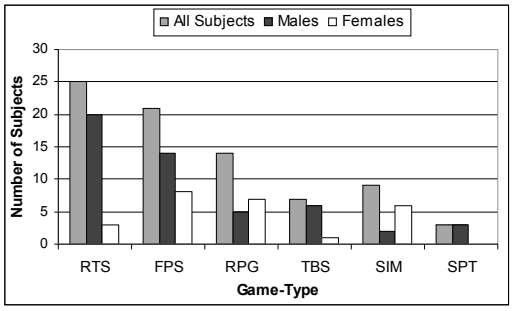

Figure 1: The number of all subjects, males and females that preferred each game type

Measures

There were three between-subject variables, namely gender, player-type preference (human or computer) and network-type preference (internet or local area network). Player-type preference was assessed by asking subjects to indicate their preference for human or computer players on a 7-point Likert scale, on which 1 indicated "strongly prefer humans" and 7 "strongly prefer computers". Network-type preference was assessed by asking subjects to indicate their preference for playing multiplayer games over a local area network (LAN) or over the internet on a 7-point Likert scale, on which 1 indicated "strongly prefer LAN" and 7 "strongly prefer Internet". As well as these ratings, the subjects were asked to give three reasons for each of these preferences. Finally, the subjects were required to complete 20 7-point Likert scales (1 not at all to 7 very much) related to the importance of ease of communication (COM), social interaction (SOC), intelligent behaviour (INTEL) and realistic behaviour

(REAL) of characters in computer games.

REAL The importance of realistic behaviour was assessed using three items related to a character's self-preservation.

INTEL The importance of intelligent behaviour was assessed using four items related to a character's ability to create strategies, to be challenging to play, and to improve and adapt as they play.

SOC The importance of social interaction was assessed using three items related to a character being "fun" to interact with, being entertaining and the importance of social atmosphere.

COM The importance of ease of communication was assessed using three items related to making and executing plans together and the ability to communicate in a shared natural language.

Results

Empirical distinction among dependent variables

To examine the empirical distinction among the sets of items designed to assess perceptions of the importance of REAL, INTEL, COM and SOC, a principal components analysis with varimax rotation was performed. On the basis of the eigenvalues greater than one criterion, a four factor solution was obtained accounting for 75.8% of the variance. The four items assessing INTEL loaded on the first factor (eigenvalue = 6.22, factor loadings ranged from .65 to .81), the three items assessing REAL loaded on the second factor (eigenvalue = 1.39, factor loadings ranged from .71 to .84), the three items assessing SOC loaded on the third factor (eigenvalue = 1.23, factor loadings ranged from .78 to .83), and the three items assessing COM loaded on the fourth factor (eigenvalue = 1.02, factor loadings ranged from .69 to .80). There was, therefore, evidence that the items were assessing distinct attributes of computer game characters. Based on the principal components analysis the relevant scales were created and all were found to have acceptable levels of reliability (Cronbach's alpha's were as follows; REAL = .85, INTEL = .83, SOC = .84, COM = .85).

Qualitative Analysis

For the purposes of qualitative analysis, participants' responses to the items assessing reasons for player-type preference were coded into categories. Two raters independently assessed the questionnaires and coded the responses into categories. These initial categories were refined by the raters through discussion, resulting in eight categories (social, enjoyment, intelligence, realistic, communication, convenience, confidence, prefer individual games). Cohen's Kappa coefficient was calculated to assess the inter-rater reliability (Kappa's = 0.88). Subsequently, all inter-rater categorisation discrepancies were resolved through discussion.

The majority of subjects (N=47) indicated that they preferred playing with human players (Mean=2.98, where 1=Human and 7=Computer), rather than computer players (N=9) and 54 subjects gave reasons for their preference. Subjects' reasons for preferring human players most frequently fell into the category of intelligent behaviour (N=33). The responses in this category referred, on the one hand, to humans as cunning, flexible, unpredictable, challenging to play against, original and able to adapt and vary their responses and strategies and on the other hand, to computer players as being less

intelligent and predictable. Actual responses about humans included “more challenging”, “unpredictable”, “smarter”, “harder to beat”, “humans can think about what they’re doing” and that “strategy used by humans can be different each time”. Typical comments regarding computers were “predictable”, “too easy to defeat”, “get boring playing the computer all the time”, and “it can’t come up with a new strategy”. Also, subjects’ reasons for preferring human players frequently related to social interaction (N=30). The responses relating to this category referred to increased interaction, increased competition, ability to cooperate and ability to chat and talk about the game. Actual responses given by participants included “games are more meaningful when played against humans”, “comradeship”, “more social aspect” and “play real person”. Also, there was a strong indication of subjects’ increased enjoyment in seeing other players’ reactions and expressions and the satisfaction of beating a human and then gloating about it: “more satisfying to beat a friend”, “can’t see the reaction when the computer loses” and “you can gloat”. Additionally, many subjects commented that they preferred playing with humans because it was more enjoyable (N=12). Typical comments from participants were “more fun” and “more entertainment”. Additionally, several reasons given for preferring human players referred to realistic behaviour (N=8), giving rise to greater engagement and suspension of disbelief. Participants’ responses included “more realistic behaviour”, “real”, “feels more alive”.

Of the subjects who preferred computer players, the most frequent reason given was that it is more convenient to play with computer players (N=9). Responses included “computer opponents are always available”, “less hassles to get a game started”, and “often no one else around”. Additionally, several subjects indicated that they simply prefer single-player games (N=4), “some games are not feasible with humans players”, and “don’t enjoy the type of games that others can play too”. Furthermore, a few subjects said they preferred playing with computer players as they do not think they are good enough to play against human players (N=3) and the computer players provide good practice. Comments included “need to practice playing with computer before playing with humans”, “start with computer, then go to human”, and “feel more comfortable trying new strategies”.

Quantitative Analysis

Regression analyses were used to examine the main and interactive effects of gender, network-type preference and player-type preference on the measures of REAL, INTEL, SOC and COM. The main effect terms were entered into the regression equation followed by the two-way interaction terms.

The main effect terms, but not the two-way interactions, accounted for a significant increment of variance in REAL ($F(3,62) = 4.923$, $p < .05$). A significant main effect of player-type preference was found ($\beta = -.445$, $t = -3.82$, $p < .05$) indicating that preference for human, rather than computer, opponents and teammates was associated with higher levels of REAL. The main effect terms, but not the two-way interactions, accounted for a significant increment of variance in INTEL ($F(3,62) = 10.027$, $p < .05$). Again, a significant main effect of player-type preference was found ($\beta = -.493$, $t = -4.64$, $p < .05$) indicating that preference for human, rather than computer, opponents and teammates was associated with higher levels of

INTEL. The main effect terms, but not the two-way interactions, accounted for a significant increment of variance in SOC ($F(3,62) = 9.061$, $p < .05$). Significant main effects of player-type preference ($\beta = -.477$, $t = -4.42$, $p < .05$) and network type preference ($\beta = .289$, $t = 2.73$, $p < .05$) were found indicating that preference for human, rather than computer, opponents and teammates was associated with higher levels of SOC and preference for playing on the internet, rather than a local area network, was associated with higher levels of SOC. Finally, the main effect terms, but not the two-way interaction terms, accounted for a marginally significant increment of variance in COM ($F(3,62) = 2.731$, $p < .052$). Once again, a significant main effect of player-type preference was found ($\beta = -.33$, $t = -2.72$, $p < .05$) indicating that preference for human, rather than computer, opponents and teammates was associated with lower levels of COM.

Discussion & Conclusions

In summary, player-type preference was a predictor of each of the four factors, realistic behaviour, intelligent behaviour, social interaction and ease of communication. Each of these factors was regarded as more important by subjects who prefer to play with humans than by subjects who prefer to play with computers. Furthermore, a desire for social interaction and intelligence were the most frequent responses given for preferring to play with humans. Additionally, network-type preference was a predictor of social interaction, revealing that subjects who prefer to play on the internet regarded social interaction as more important than did subjects who prefer to play over a LAN. It is also important to note that subjects who prefer computer players described a completely different set of motivations for their preference, as well as regarding each of the four factors as being less important.

The game-type preferences of the group sampled for this study should be taken into account, and although it is possible that the distribution is representative of the population's game-type preference, this group showed a strong preference for real-time strategy, first-person shooter and role-playing games. Therefore, it is possible that a group consisting predominantly of subjects who prefer other types of games, such as sports and simulation games, may have entirely different opinions.

From this study, it can be determined that people prefer to play with humans and computers for different reasons and in different circumstances. Firstly, all of the subjects who prefer to play with computer players do so for convenience. Some of these people feel more comfortable playing against the computer, as they can lose and not be embarrassed. This makes it ideal for practice and means that when the human player does win that it is a personal victory. Also, some people enjoy games that can only be played individually, such as some role-playing games.

Secondly, for people who prefer to play with other humans, playing with the computer is often not "meaningful", despite how hard it is to beat. This is because these people like playing with their friends, seeing their expressions and knowing that when they win they have beaten a human. Also, they enjoy the increased challenges that come from playing with characters that are intelligent, unpredictable and that readily adapt to new situations. Therefore, it seems that the user community is split into two groups. This gives rise to two questions: i) how

can AI be made to fill the role of human players for those who prefer to play with people? and ii) how can the gaming experience be improved for people who prefer to play with the computer? It is therefore necessary that these groups' needs be addressed separately.

For the first group, those who prefer to play humans, it is necessary to decide which aspects of human behaviour should, and can, be incorporated into game characters. The evidence from this study suggests that the characteristics that make humans more enjoyable to play with include intelligence and social interaction. In terms of intelligence, people want AI that is not predictable, that doesn't cheat, that is cunning, flexible, challenging and original, and that adapts and varies according to the changing environment. In terms of social interaction, people want more interaction, fun, entertainment, competition, cooperation and chatting about the game. The intelligent behaviour that a human player provides is something that game developers can strive to recreate. However, it is unlikely that the social interaction provided by a group of friends playing games on LAN will be able to be replicated by computer-controlled players. For the second group, those who prefer to play with computer players, it is necessary to determine how games can provide a learning environment for developing their skills and building confidence.

This study has provided an initial investigation into where the future potential in game AI lies, as well as empirical evidence to assess what it is that gamers want from the AI characters. It has been shown that there are two groups of users within the gaming community, those who prefer to play with humans and those who prefer to play with computers. Furthermore, both groups have their own, unique motivations and needs. The next stage is to focus attention on ascertaining which aspects of intelligent behaviour need to be modelled in artificial characters in games to improve the experience for people who prefer to play with humans and to determine how the games might be better geared to develop the skills and confidence of those who prefer computer players.

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