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Virtual Pedagogical Agents: Stylisation for engagement

Virtual Pedagogical Agents

Virtual characters are long established within computer games and entertainment. Recently they have also started appearing on websites and in chat forums. In parallel to this, *virtual pedagogical agents (VPAs)*, i.e. computer generated characters in pedagogical roles, populate cyberspace in increasing numbers. One may encounter them as virtual teachers, mentors or learning companions from nursery to university; as virtual medical counsellors and exercise coaches; or in edutainment and infotainment settings. Game characters and chatbots on the other hand can be considered pre-scripted and user controlled; VPAs are generally modelled upon pedagogical theories and implemented through artificial intelligence.



Figure 1 Virtual Pedagogical Agents: AutoTutor (University of Memphis) and characters from FearNot (VICTEC/ eCIRCUS).

Engagement

Along with the development of computer generated characters in general, VPAs have been extensively researched with respect to artificial intelligence, pedagogical strategies, natural language, gestures and facial expressions. A central motive for this research is to enhance learning in students. Several potential benefits in adding a VPA to a digital learning environment have been proposed and to some extent also demonstrated [1]. One of the most established benefits of VPAs is their potential to make the user experience of a program *more engaging*, e.g. [2]. And if a learning environment is found engaging – i.e. experienced as involving, interesting or as having impact – users are likely to become more active, stay on longer and produce more.

Look

Given the importance of engagement, surprisingly little attention has been paid to the *appearance or look* of VPAs. Whereas visual *dynamic* qualities like facial expressions have been extensively researched, the underlying *static* visual appearance in terms of facial shape, body, costume, graphical style, etc., has been more or less neglected. This is surprising, considering the importance paid to these basic visual qualities within advertisements, theatre, film and not least animated film, where the *visual appearance* of characters is assumed to considerably affect people's expectations, attitudes, understanding and motivation [3]. This is also the case in interaction between human beings, something that is thoroughly studied and documented within academic fields including social psychology.

Design aspects

The neglect of basic visual properties in VPAs is also reflected in the absence of corresponding design guidelines. In an

attempt to establish a ground for more detailed guidelines we propose three basic design dimensions comprising:

1. *Degree of humanness*: a VPA may be modelled upon humans, animals (or other creatures) or non-living objects, or some combination of these entities.
2. *Basic physical properties (shape and colour)*: such as body-type, face, skin, hair, clothes and various attributes. Representations of age, gender and ethnicity can be reflected in these properties.
3. *Graphical style*: artistic and aesthetic qualities that can be described in several ways. Two dimensions of VPAs are suggested, comprising:

Detailedness vs. simplification: a colour photo may be referred to as detailed, but can also be reduced to a simplified two-colour photo. Note, though, that in comparison to 'naturalism vs. stylisation' below both are naturalistic representations (cf. Figure 2).

Naturalism vs. stylisation: This is a complex dimension without any simple linear relationship especially as stylisation spans a wide range of expressions. Consider a character from *The Sims* representing near naturalism to a Picasso-styled face or a *Peanuts* inspired face representing different stylised expressions (Figure 2).

It should also be noted that 3D does not equal visual naturalism/realism but is rather an aspect of graphical style. To illustrate, a 2D black-and-white photo is a far more naturalistic representation than a 3D rendered low polygon computer game environment.

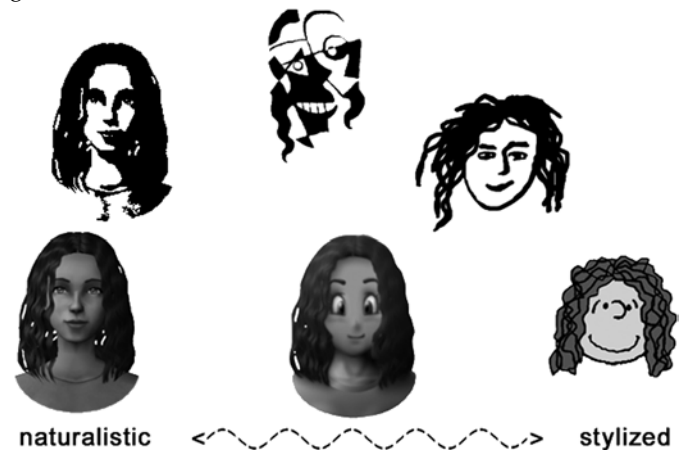


Figure 2 Graphical style: naturalism vs. stylisation.

Stylisation and engagement

We will now elaborate on the *degree of naturalism* and its relation to engagement. First we present and comment on two main arguments for *visual naturalism* as a means to increase engagement. To make the text more readable we do not use the term engagement consistently but also use related concepts such as involvement, presence, and subjective relation.

Argument 1: Presence and immersion

Some researchers argue that *visual naturalism* increases involvement and the sense of presence in a digital environment. For instance, in the domain of computer games there is

... a desire to attain more and more realistic virtual worlds and characters [...] the reduction of the absolute difference between real and virtual environments leads to an *increase of presence and of immersion*. [4, p.218].

Against these lines of reasoning goes another argument based upon the Disney notion of *suspension of disbelief*. In order to be immersed and engaged in a story and characters that are not real but 'only' fantasy, one must suspend one's disbelief. Now, this can in several cases be more easily accomplished with the use of stylised characters since these are not expected to *behave and act* naturalistically in the way that humans do, whereas a visual appearance that naturalistically resembles a human being evokes more constrained expectations. Visual realism awakens people's awareness of reality and makes them more critical and disbelieving [4].

Argument 2: Subjective and personal relations and identification

An important motive for introducing VPAs is their potential to take advantage of natural human social affordances. This opens possibilities to recreate pedagogically valuable phenomena in the human-human context, such as emotional support, identification and role modelling. In turn, these phenomena may increase *involvement* and *engagement* in learning activities and environments.

One pedagogically central phenomenon with respect to social affordances is how human teachers, instructors, and mentors can function as role models. But the efficiency of a role model is known to increase when a student experiences *similarity* with the role model. Therefore, it is argued, the preconditions for role modelling must be superior if a character *looks really* like a human being. The above lines of reasoning have an intuitive appeal, but empirical evidence does not support it. On the contrary, it seems even easier for people to experience and form social relationships to, and identify with, stylised characters. Our own studies [5] indicate that when learners are allowed to make a choice between (i) visually more naturalistic vs. more stylised VPAs and between (ii) task oriented vs. more socially oriented VPAs, there is a significant *correlation* between the preferences for social communication and visually stylised VPAs. In a recent study, more targeted at issues of identification, learners were allowed to choose their avatar among more visually naturalistic (Sims-style) and more stylised (Manga-style) characters (see the two leftmost characters in Figure 2). Here, learners' comments on the two visual styles indicated greater affordances for *identification* with stylised characters. For example: "I prefer these [stylised ones]; there is more left for your own imagination here – you can express your personality or whatever you have inside."; "Well, these, the Manga ones, are more for your heart, because they really concern personality."

An interpretation of the results is that stylised VPAs are more easily conceived of as social and personal as well as being easier to identify with than visually naturalistic VPAs. This interpretation is in line with McCloud's thesis [6] that it is easier in the case of an iconic (stylised) character to add from one's own personal and subjective experiences. A naturalistic (realistic) character is a visual and socio-emotional fact, which does not leave much for a user to fill in. It is objectively there,

whereas an iconised (stylised) agent invites elaboration by the user, being "... an empty shell that we inhabit." [6, p.36].

Additional support in the same direction comes from Nowak & Biocca's study [7] on relatively naturalistic vs. heavily stylised characters in VR-environments. Here users rated the stylised characters significantly higher than the naturalistic ones as to their experience of a *psychological connection with the character*, in terms of co-presence and social presence.

A final argument in favour of stylisation to increase the potential for identification and engagement is that stylisation offers a greater and more flexible design space with which to meet individual variations in users. In gamer communities, where players themselves contribute to the design of characters, a remarkable diversity is observed. In the case of *visual naturalism*, however, such creatures may easily be experienced as disturbing or bewildering. This may open up for more explorative and engaged aspects of identification – something that may, in turn, be beneficial for the pedagogical tasks at hand.

Conclusion

In the design of the appearance or look of VPAs we argue that the design space of stylisation (compared to a naturalistic approach) offers a greater potential for different aspects of engagement and may increase learners' active participation in terms of intellectual as well as socio-emotional engagement. As a general guideline, this will certainly produce more questions than answers in practical design cases, and there are of course several circumstances where a naturalistic design is preferred. Clearly there is a need for further research in order to fully exploit the possibilities of VPAs.

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