VISUAL GENDER AND ITS MOTIVATIONAL AND COGNITIVE EFFECTS – A USER STUDY

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Abstract. Cognitive and motivational effects of more neutral or androgynous-looking virtual characters versus more pronouncedly feminine-looking or masculine-looking virtual characters are explored. In a user study, 158 students aged 17-19 encountered four virtual characters that were visually manipulated to represent gender stereotypicality versus androgyny. One aim was to explore students' attitudes towards the different characters as seen in how they ranked them as preferred presenters and how they articulated their arguments for doing so. Another aim was to look for patterns as to which character(s) influenced female and male students most positively with respect to their attitudes towards a university level computer engineering programme. The combination of these two aims allowed us to compare more conscious and articulated with less conscious and unarticulated, user responses. Results from the study are presented and discussed. We conclude by pointing towards future research and applications.

Keywords. Virtual characters, gender, visual design, femininity, masculinity, androgynities, computer engineering, educational choice.

1 BACKGROUND

The idea of *role models* or *social models* is central in social learning theory as presented by Bandura and others (Bandura 1997, 2000; Bandura & Schunk, 1981). Importantly, role models can be more or less powerful. Bandura (1997) highlights the significance of similarities between a social model and a learner in respects such as gender and ethnicity. With higher degrees of similarity, the likelihood increases that the behaviour of a role model will be imitated.

According to the related self-to-prototype matching theory (Hannover & Kessels, 2004) any decision-making of importance to a person, whether it regards what kinds of jobs to accept, in which areas to look for a new apartment, or how to spend ones vacancies, the decision making process involves an element of self-identity construction or self-identity affirmation. The decision-maker makes use of her mental images, or cultural schemas, of *what kind of person that would make such a choice,* and matches these to the image of her self. Is this me? Is this someone I want to be like, or want to be associated with? Who acts like this? In other words: Is there any role model for this kind of decision or choice that I can or want to identify myself with?

Specifically, it appears to be crucial for young peoples' *educational* choices, such as subject domain choices or educational programme choices, that they can find adequate role models (Hannover & Kessels, 2004; Kessels, 2005; Rommes et al., 2007).

Baylor and collaborators have demonstrated (Baylor & Plant, 2005; Baylor, 2005; Baylor et al., 2006) that the use of virtual pedagogical coaches, portrayed as young and attractive females, can increase the willingness of female students to choose technically oriented courses and to help increase their self-efficacy with respect to technical content. The mechanisms behind this seem to involve pedagogical processes such as role modelling and identification (cf. Bandura 1977; Bandura & Schunk, 1981). The female students find it easier to person-

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ally identify with these coaches compared to virtual coaches portrayed as "typical male engineers". (See Figure 1.)

Figure 1. Example of two alternative engineering coaches (young, attractive female versus 'typical male engineer') in Baylor et al. (2006).

Upon analyzing Baylor et al.'s results in detail, however, it appears that the increase in self-efficacy at least partly stems from the conception of a "female, feminine, young and attractive" engineer being *less competent* than a "real, typical male engineer". It seems that the prejudice of females, and in particular of feminine females, as less competent in technical domains spills over to the virtual area, generating increased self-efficacy of the kind "If she is able to do it, I can do it!". (C.f. Baylor, 2005).

Now, this implies a potential conflict between a *short-term* pedagogical goal of recruitment and boosted self-efficacy in female students, and a *long-term* pedagogical goal of changing rather than reinforcing and disseminating gender prejudices and stereotypes.

In looking for ways to avoid this conflict, the present study explores possibilities of using more *androgynous-looking* virtual coaches – instead of prototypically male/female virtual coaches – for recruitment purposes. We focus on students applying for an educational programme with strong male dominance, and thus associated with gender stereotypes. Our intention was to explore motivational and cognitive effects of more neutral- or androgynous-looking characters versus more typically feminine-looking female and masculine-looking male characters.

1.1 Study: Overall set-up

In the empirical study 158 17-19 year old students participated. A multimedia presentation was developed for the study, featuring four different virtual presenters of a university programme in computer engineering. The characters (presenters) were *visually* manipulated and evaluated to represent: *a young feminine woman*, *a more androgynous young woman*, *a more androgynous young man*, and *a young masculine man*. Each participant encountered one of the four characters in the role as presenter as shown below in Figure 2. (The characters are further presented and described on pages 3-4.)

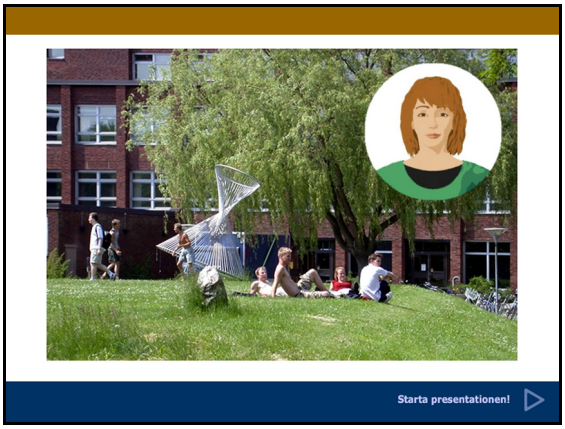

Figure 2. Screenshot from the multimedia presentation with the 'more androgynous young woman' presenting the computer engineering programme at Lund University.

The participants were then asked whether and how the presentation had affected their attitude towards the computer engineering programme. They were also asked what they thought of the presenter. Afterwards they were presented with all four characters and were asked to rank them in terms of which one they themselves would prefer as the presenter of the computer engineering programme. Finally they were asked why they placed the characters they did in the first and fourth place, respectively.

About a fifth of the participants also participated in focus group interviews following the presentations. These interviews centred on masculinity and femininity in appearance, behaviour, style and in occupations, as well as on the topic of androgyny.

1.2 Issues in focus

In the study we wanted to:

1a) Explore students' attitudes towards the different characters, as seen in how they ordered them as preferred presenters of the computer engineering programme: Which characters would be most and least preferred? Would the more neutral, androgynous characters be preferred to the more gender typical characters, or vice versa? Would the rankings of female students differ from those of male students?

1b) Explore how students articulated their attitudes towards the four characters: What reasons would they give for their first and last choice? Would they mention gender aspects as reasons for their choices? How would they speak about the different characters? Would the concept of 'computer nerd' come up in their reasoning?

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2) Look for possible patterns as to which character(s) influenced female and male students most positively with respect to their attitude towards the computer engineering programme: Would there be any patterns in which presenter(s) were involved when female and male students changed their attitudes positively towards the computer engineering programme?

We opted for a study design that would enable us to *compare*:

(i) the more explicitly revealed preference patterns seen in participants' ordering of characters and in their arguments for this ordering (1a and 1b above), with

(ii) the more indirectly or implicitly revealed preference patterns seen in the degree of positive influence of the different characters on the participants' attitudes towards the educational programme being presented (2 above).

It was not given beforehand whether there would be a concordance or not between the character(s) that the students *explicitly chose and argued that they preferred* most as presenters, and the character(s) that had the most *positive influence on their attitudes* to the educational programme presented.

There are studies that have shown that *perceptual gender-related stimuli* can have a considerable impact on peoples' non-conscious cognitive processes which is not necessarily in concordance with what the same people are aware of and consciously report (Brave & Nass, 2005; Bem, 1993; Morishima et al., 2001).

One example is a study by Reeves, Nass and collaborators (Reeves & Nass, 1996; Voelker, 1994) in which a message was given in a female voice, electronically altered to be either more *feminine-sounding* or more *masculine-sounding*. Participants listened to either the more feminine-sounding or the more masculine-sounding voice and were asked to evaluate the speaker and the message on a number of scales. Then a comparison was made between the two groups of participants. The result indicated that when the female speaker's voice was more masculine-sounding, what was said was perceived as being *significantly* more persuasive and intelligent than when the voice was more feminine-sounding[1].

Now, if one *asks* people whether their evaluation of the persuasiveness and intelligence of a message from a female speaker depends upon how feminine-sounding she is – and that they probably will perceive what is being said in a more masculine-sounding voice as more intelligent and more persuasive than when the same message is given in a more feminine-sounding voice – most people will say that this does not apply to them. But empirical evidence shows that it does for most people.[2]

This is the reason why we designed our study to collect *both* mindful and articulated responses and responses that reflect mindless and less conscious influences and processes.

2 STUDY

2.1 Participants

One hundred and fifty eight 17-19 year old students, 86 women and 72 men, at four different high schools in two different cities in southern Sweden participated in the study. Two of the schools are considered high status with a dominance of theoretically oriented programmes. Of the two other schools, one has a large proportion of students with immigrant background, and the other has a dominance of practice oriented programmes. About half of the participating students were in programmes that qualify them to apply for university studies in computer engineering. The reason was that the study is associated with a more pragmatic project concerning recruitment of students, particularly female students, to university studies in computer engineering. However, for the project as a whole, we were interested in also having a variety of student backgrounds.

Given the differences between the schools, and in order to be able to compare results between schools, our goal was to have equally many male and female students from each school encounter each of the four virtual presenters. We reached this goal with the exception of one school, where 16 young women but only 8 young men participated.

2.2 The virtual characters

2.2.1 Visual appearance

The design aspect manipulated in the four virtual characters (Figure 3) was their *visual appearance.* These were developed by one of the team members (educated in visual arts) according to *gender schemes* used in design practice, and to some extent

[1] Of course, the categories *feminine* and *masculine* are complex and culturally dependent since they are derived from the culturally dependent *male-female* categories. However, in the present case with voices, it is quite established which features of a voice make members of Western cultures perceive it as feminine or non-feminine. For further reference, see Brave & Nass (2005).

[2] We had a similar result in a study (Gulz et al., 2007) where we instead manipulated two female virtual medical doctors so that one was more and one less *feminine-looking*. (Their voice and their medical message were identical.) Again, evaluations of persuasiveness, intelligence, empathy, etc. of the characters and their messages differed according to gender stereotype predictions.

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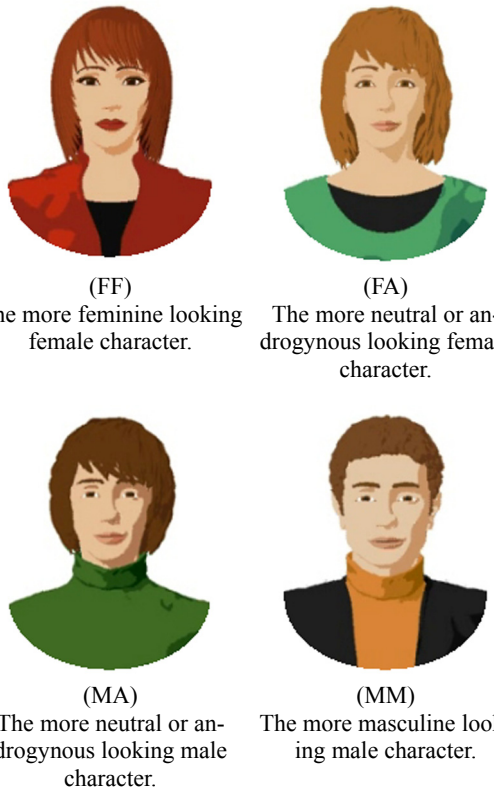
documented in literature on design and visual perception (e.g. Brown & Perrett, 1993).



(FF)
The more feminine looking female character.

(FA)
The more neutral or androgynous looking female character.

(MA)
The more neutral or androgynous looking male character.

(MM)
The more masculine looking male character.

Figure 3. The four virtual presenters used in the study.

First, an androgynous bust was developed (in Autodesk 3ds Max 9) by manipulating attributes such as: head shapes, jaw, nose, shoulders, mouth, and colour scheme. Out of this androgynous (neutral) bust, the two *more neutral or androgynous-looking* characters were developed, henceforth called FA (the feminine version) and MA (the masculine version). Actually, the basic shapes of the two busts were almost identical, the difference between them stemming from:

- the hair cut (differing primarily in length)
- the eye brows (with FA having more regular and slightly plucked eye brows)
- the clothing (somewhat neutral as to fashion but gender specific)
- FA having short eye lashes accentuating the eyes (whereas MA has none)
- MA having a somewhat darker colour scheme, producing slightly larger and more pronounced shapes (shadows)

A more *feminine-looking* female character, henceforth called FF, was developed by manipulating feminine attributes such as the *baby-face* scheme (rounded head shapes, bigger eyes and smaller nose), shoulders, hair and make-up. In this case, the following changes took place (based on the neutral or androgynous torso of MA and FA):

- the overall shape was modelled to be slightly more narrow
- the overall shape of the head was made softer
- the nose was modelled smaller and hence less pronounced
- the cheeks were lifted and slightly more pronounced
- the eye brows were tuned to look neatly plucked
- the eyes were enlarged and slightly twisted
- long, dark eye lashes were added
- the mouth was modelled with fuller lips and painted red
- the hair was given a distinct feminine, modern, coloured and young style
- the overall colour scheme was more saturated (compared to FA) since this, in contrast to a paler colour scheme, produces more distinct features and strengthens a categorization with respect to gender[3]

Note! The only make-up attributes added to FF were: longer and darker eyelashes lipstick, and hair colouring, i.e. no rouge and no eye shadow.

A more *masculine-looking* male character, henceforth called MM, was designed by using masculine attributes such as broader, angular and more pronounced head shapes, broader shoulders, pronounced eyebrows, etc. The following changes were made (based on the 'neutral or androgynous' torso of MA and FA):

- the shape was modelled to be broader
- the shape of the head was made more angular
- the jaw was made more angular and more pronounced
- the nose was made bigger and hence more pronounced
- the cheeks were modelled slightly broader
- the Adam's apple was made more distinct
- the mouth was modelled longer and thinner
- the hair was given a distinct masculine style
- an overall slightly more saturated colour scheme (compared to FA) was used, which reinforces gender categorization

[3] A paler colour scheme reduces the number of distinct features and thus weakens any categorization of gender.

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The characters were evaluated to ensure that they were perceived as intended in terms of femininity and masculinity in appearance by the target group. For this pre-validation, 10 adolescents (5 females and 5 males) were asked to rank the two female characters in terms of femininity and the two male characters in terms of masculinity. Eight of them ranked both the male and female characters as predicted by the design schemes. One young woman held FA to be the most feminine, and one young man held MA to be the most masculine.

2.2.2 Androgynous versus gender stereotypical visual appearances

In an earlier design phase, FA and MA were even more similar to one another, and in particular FA appeared as more clearly androgynous. In a corresponding earlier pre-test that involved these characters eight adolescents participated and were shown the four characters. They were asked whether they thought that the characters would be suitable as virtual presenters in computer programs for young people, and if there was something they did not like about them. Four participants then declared that they at first were uncertain whether the more androgynous girl character was a woman or a man, and that they found her – they all finally decided it was a girl – rather unattractive.

This was undesired in view of the rationale of the study, namely to compare potential effects of more androgynous versus more gender differentiated visual appearance. This requires, namely, that all characters are comparable in the sense that none of them is perceived as being particularly unattractive, or more irritating, strange or unusual than the others. Such an effect might otherwise interfere with the potential effects of what is to be explored: effects of more androgynous versus more gender differentiated visual appearance. Therefore small changes were made in the haircut and colour scheme of FA, together with a new arrangement for the lightning (producing the shading)[4], and another pre-test was carried out – this time without 'objections'.

This need to avoid strange or unusual characters is, however, a dilemma since it makes the use of more *pronouncedly androgynous-looking* characters difficult. Not being able to decide whether someone is a man or a woman is known to induce insecurity and unease in people (Brave & Nass, 2005). In order to progress from here, our next step will be to use less naturalistic-looking, more cartoonish characters. More of this in Section 5(Future research).

Figure 4. Examples of visual gender stereotypes in computer based media. Above: two characters from the console game *Ninja Gaiden Sigma* that reflect parts of the computer game domain's action/fantasy genre. Below: two characters designed by pseudonym *Andromega* in the on-line-world *Second Life*. The Second Life characters were retrieved from a featured exhibition of user provided avatar art (fan art) at the *Showcase* webpage directly under the main menu of Second Life (http://secondlife.com/showcase/).

In sum, FA and MA were not *pronouncedly* androgynous. The FF and MM characters were, on the other hand, not *pronouncedly* gender stereotypical in their visual designs (in particular a pronounced bimbo stereotype for FF was avoided). A reason for this was that over-explicit visual stereotypes like a female character looking like Pamela Anderson, and a male character looking like Arnold Schwarzenegger (c.f. Figure 4 above), probably would initiate deliberation about gender, gender stereotypes and political correctness. A risk would be that these conscious reflections would dominate – and even rule out – more non-reflected responses, but we were interested in both kinds of responses.

Furthermore, there was a methodological balancing involved in deciding on the "strength" of visual stereotypicality and androgyny. With more strongly differentiated stimuli – given that they simultaneously were not *too* apparent, as discussed above – the likelihood that they would have effects on user responses would increase. With weaker stimuli there would be a risk that there would be no effects. However, in the case where weaker stimuli do yield effects, this is more striking as a result.

[4] In the final rendering, FA, MA and MM had the same arrangement for lightning, whereas FF had another arrangement diminishing the nose and pronouncing the cheeks.

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2.2.3 Character features other than visual appearance

Since we wanted to explore possible effects of the characters' visual appearance, we strived to keep all other character variables constant, or at least comparable, between the four characters. The visual content of the presentation was identical (i.e. the slide show accompanying the characters), as well as the information communicated by the characters. The characters' facial expressions and head movements were basically identical, following the very same animation scheme. As to voice, one and the same recording – originally a woman's voice – was digitalized into a female and a male voice. In this way features such as dialect and warmth of tone were better controlled for. It was also important to choose a female voice that would work with *both* the female characters, and a male voice that would work with *both* the male characters since *mismatches* between look and voice, like other inconsistencies in virtual agents, are known to disturb or irritate people (Nass et al., 2000).

2.3 Procedure

The computer program was run on four laptops that were brought to the schools. The participants all used headphones to ensure that they were able to concentrate and to hear what the presenter was saying. Participants were seated at the first computer that was free to use and assisted by one of the two research assistants who conducted the study. Each of the four laptops had one of the four presenters running on it.[5] The number of female and male students that had been using each computer was noted, and towards the end of a session (at each school) participants were directed towards particular computers in order to have an even distribution of encounters (for each school) of the four different presenters as well as an even distribution of the numbers of females and males who encountered each of the presenters. As already related, there was nevertheless a small surplus of girls, and at one school in particular, there were four girls and two boys for each presenter.

After filling in demographic data on the screen (Figure 5a), the participants was presented with brief texts about seven university level educational programmes and were asked to what extent they could imagine themselves as students in these different programmes. For each programme they were asked to check one of the following alternatives: <never>, <unlikely>, <perhaps>, <yes> or <absolutely> (Figure 5b).

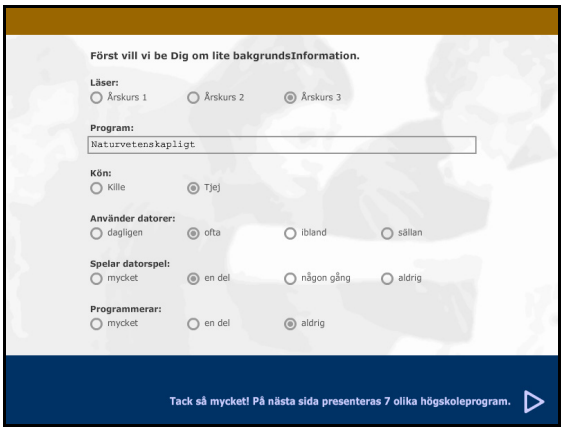

Figure 5a. Screenshot from the multimedia presentation: Demographic data form (Year of study; Programme; Gender; Use of computers; Use of computer games; Programming skill).

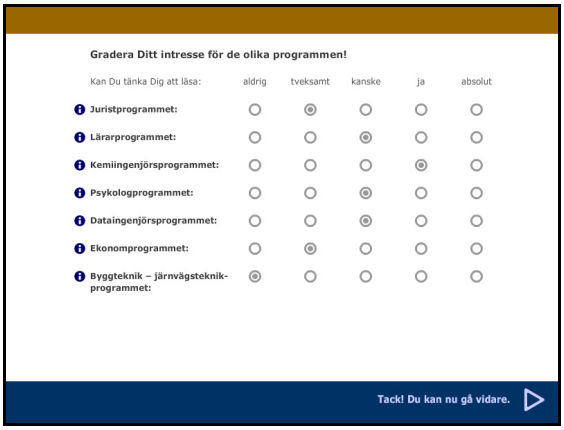

Figure 5b. Screenshot from the multimedia presentation: Evaluation of the seven university programmes (Law; Teacher education; Chemical engineering; Psychology; Computer engineering; Economics; Civil engineering – railway construction).

Thereafter they were informed (in the digital environment), that a new presentational media was being developed, which they were invited to help evaluate and that the presentation in question would concern the computer engineering educational programme. (From their perspective seemingly randomly chosen among the seven educational programmes they had just read about and evaluated.)

At this instance the virtual presenter appeared (Figure 5c). She or he spoke about the computer engineering programme for about 2 minutes, with an accompanying slide show presentation. The content of the presentation was based on web information about the programme in computer engineering. Parts of it had been pre-validated or pre-approved (as to its content and style) by other students in the same age group who had participated in a previous and related study (Altmejd & Vallinder, 2007).

[5] To balance possible deviances in the laptops due to different sound cards, video cards, monitors, screen calibrations, etc., it was alternated between sessions which presenter was run on which laptop.

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Figure 5c. Screenshot from the multimedia slide show with the virtual character presenting the university programme in computer engineering.

When the presentation was finished and the presenter had thanked the listener for her or his attention, a number of questionnaires and questions followed. All were presented on-screen and filled out on the computer. First, the students were asked to evaluate on a Likert scale whether the presentation had influenced them – in a positive or negative direction and to what extent – in their attitude towards the computer engineering programme. Thereafter they were asked to write in free text *why* they had been influenced in this way (Figure 5d).

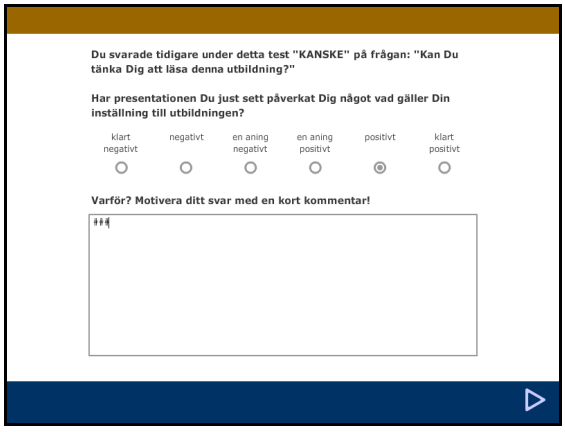

Figure 5d. Screenshot from the multimedia presentation: Evaluation of attitude influences after the slide show presentation.

The next question regarded their view of the presenter. What did they think of her/him? Thereafter all four alternative presenters were shown (the order in which they appeared alternated according to a random scheme), and the participants were asked to rank them from 1 to 4 in order of preference: Who would they prefer as guide of the multimedia presentation of the computer engineering programme they had just seen? (Figure 5e). Following this, the virtual character they had ranked as number 1 appeared and they were asked to motivate in writing why this was their first choice. Thereafter the character they had ranked as number 4 appeared and they were asked to motivate in writing why this was their last choice. Finally, the participants were thanked on the screen for their participation and asked to turn to one of the experimental leaders for debriefing and to receive a lottery ticket for cinema vouchers.

Figure 5e. Screenshot from the multimedia presentation: Ranking of the four virtual characters as presenters with respect to their visual appearance.

A number of students also took part in focus group interviews after they had completed the session just described. These students were not debriefed after the computer session but asked whether they would like to participate in an interview. They were also told that instead of participating in the lottery they would get a cinema ticket as remuneration. Each focus group interview included 2-4 students who knew each other in the sense that they came as a group when they volunteered for the first part of the study. In total, 32 students participated in the interviews that were tape recorded. The discussion during the interviews addressed a predefined list of topics.

- Who is a typical computer engineer?
- What are typically masculine occupations and why?
- What are typically feminine occupations and why?
- Why did they choose the presenter they did, and why did they least prefer the one they ranked as number four? (Here pictures of the four presenters were shown.)
- Does any of them look typically feminine or typically masculine?
- Is it possible to be both typically masculine and typically feminine in appearance, in behaviour, in style, in thinking?

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– Are there examples of people (artists, acquaintances, characters in books or comics, etc.) that in some way mix femininity and masculinity in appearance and/or in behaviour?

3. RESULTS AND ANALYSIS

3.1 Character choices

3.1.1 First and fourth places character ranking

The female participants most frequently chose MA and FA as favourite presenter with 29 and 28 choices respectively, versus 21 for FF and as few as 8 for MM.[6] As many as 32 female participants put MM in place number four, whereas 24 of them put FF there. Only 16 and 14 put FA and MA, respectively, in fourth place. In other words, the two androgynous characters were clearly preferred, and the least preferred was without doubt MM, followed by FF (Figure 6).

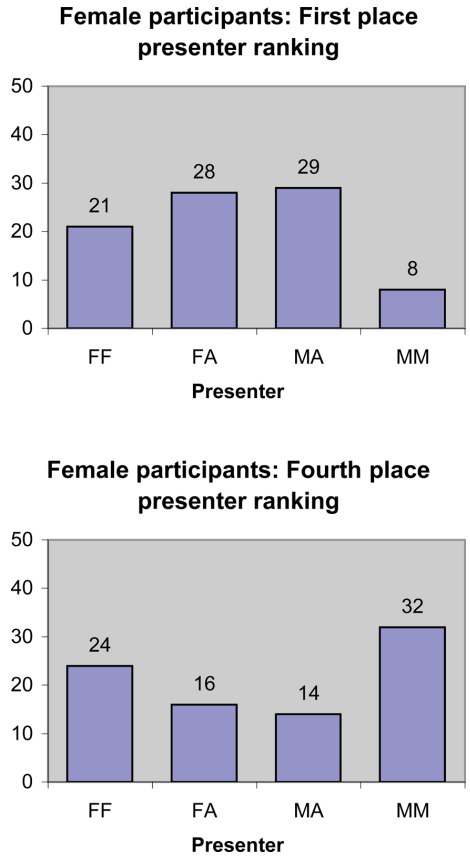

Figure 6. Female participants' first and fourth place ranking of the virtual presenters.

[6] Out of 158 participants, 66 (about 40%) put the presenter they had encountered in the first place. This is considerably more than random distribution of 25%. This influence is, however, relatively evenly distributed over the characters, between 35% and 40%, and a little more, 47%, for FF.

The first choice of the male participants was much more levelled out (Figure 7). As to which character was put in fourth place, the pattern was more pronounced with 28 votes for FF, 25 for MM, and only 9 and 10 for FA and MA. In other words, also the male participants revealed a preference for the androgynous characters, although this was primarily seen in their fourth place ranking (see Figure 7).

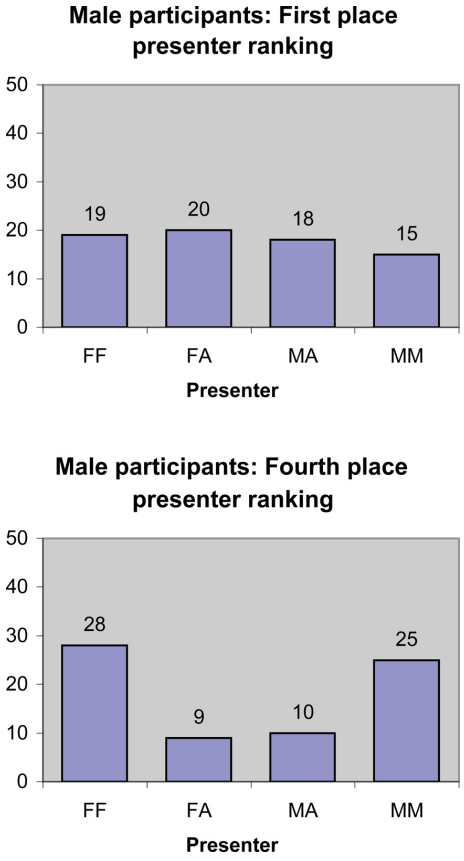

Figure 7. Male participants' first and fourth place ranking of the virtual presenters.

Summing up the preferences for all participants, FA and MA were preferred most, by 48 and 47 participants, respectively, FF was preferred less, by 40 participants and MM least, by 23 participants. The results were inverted for the fourth place: MM was chosen by 57 participants, FF by 52, FA by 25 and MA by 24.

3.1.2 Same-gender characters ranked in the first two places

Two other choice patterns are interesting from a gender point of view. First, it can be examined to what extent participants ranked *the two female characters*, or the *two male characters*, in first and second place.

Thirteen female and 12 male students, in sum 25, which corresponds to random distribution, ranked the two female characters in first and second place (see Figure 8, leftmost staple). Ranking the two

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male characters in first and second place occurred much less often. Ten male students and only 6 female students, in sum 16, is clearly less than the random distribution (see Figure 8, second leftmost staple). In other words, even though computer engineering is an educational and professional field with strong male dominance, students and in particular female students, tended not to place two male characters in first and second place (Furthermore, four of the 6 female students were notably, from the same school – a practically oriented school with a very strong gender-stereotypical distribution as to the students on their programmes.)

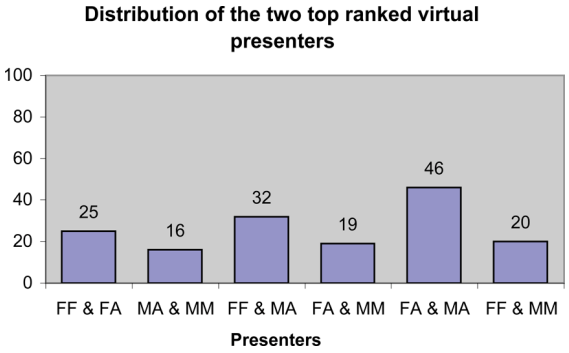

Figure 8. Distribution of the different combinations of the two top ranked (first and second) virtual presenters (χ^2[total distr.] = 23,595; Significant at $\alpha = 0.001$).

3.1.3 The two androgynous characters ranked in the first two places

Secondly, and as a central issue given the focus of the study, one can examine how many participants put *the two more androgynous characters* in first and second place. Here we found that 28 female students and 18 male students did so, 46 in total, which is considerably more than the random distribution of 26 (Figure 8, staple: "FA & MA"). Going into more detail, the ordering MA first and FA second was chosen by 16 females and 6 males. The ordering FA first and MA second was chosen by 12 females and 12 males. All together, there was a clear tendency, significantly above what is expected by chance, to rank the two androgynous characters as the first two choices of presenter.

Placing the two more gender stereotypical characters in first and second place, on the other hand, was a little less common than would be expected by chance. The ranking of FF first and MM second was chosen by 5 females and 6 males. The ordering MM first and FF second was chosen by 5 females and 4 males (Figure 8, staple: "FF & MM").

An emerging pattern is that the *combination of one female and one male character* (in any order) for first and second place was chosen in 46 instances with the two androgynous characters but in only 20 instances with the more gender stereotypical characters (Figure 8, the two rightmost staples).

3.2 Arguments and reasons for character preferences

We now leave the ranking preference data and move to the participants' arguments and reasons for their character rankings. The issues focused on in analyzing these are: (i) participants' referring to the *gender of the characters* in arguing for its ranking, (ii) comments and arguments about the *attractiveness of characters*, and (iii) *the nerd* as appearing in arguments and comments. These issues are presented below in due order.

3.3 Referring to the gender of characters in arguing for preferences

There were 316 opportunities to use gender related arguments, since each of the 158 participants were asked to motivate both their first and last choice of presenter. On 35 occasions the gender of characters were brought up: by female participants in 22 cases and by male participants in 13. This difference in number may reflect a more pronounced gender consciousness in women compared to men (e.g. Hirdman, 2003). Furthermore, half of these comments were, not surprisingly, made by participants who chose characters of the same gender for their first and second choice of presenter – even though these participants made up less than 25% of all participants. A further pattern that emerged was the following: Female participants with same-gender-of-character preferences were more likely to reason in gender terms about their choices (i.e. their most and least preferred characters) if they had put the *two female* characters first, than if they had put the *two male* characters first, whereas the opposite was the case for male participants: They were more likely to argue in gender terms about their most and least preferred characters if they had put the *two male* characters first than if they had put the *two female* characters first.

Now let us look in more detail at participants' comments when they referred to the characters' gender. This material gives indications both of the participants' reasoning, and of how the different characters afford or mediate – or perhaps even trigger – different types of gender related arguments.

3.3.1 MM: Gender related arguments

The character that was least – five times – referred to in gender terms in choice/non-choice arguments was MM. One male and one female student chose him since:

"it is suitable for a boy to talk about technical things"

"this is a guy, and I think that this [the computer engineering programme] is for guys"

Another female student put MM in the fourth place:

"because he is a man, it is always nicer to see a woman, particularly when it is an education that is probably mostly taken by males".

A male student commented, upon having listened to MM, that:

"well, this was fine, but it would probably have been a little better with a woman"

A third male student said that "he looks a bit 'lad-dish' and that makes him less charming"

3.3.2 MA: Gender related arguments

Nine participants raised gender related arguments concerning MA. Three male students and two female students chose MA as presenter since:

"he seems more like a guy with computer experience"

"it is a guy, and it is a computer education" [This male student put FF in fourth place since: "she was a woman on a computer education and she did not seem to belong there".]

"he looks like a *computer-guy*"

"he looked nice; and in many contexts, many people find it more reliable when it is a man speaking"

"he looked like a handsome computer-guy"

Three female students used gender related arguments to motivate their ranking MA in the *fourth place*:

"since he is a guy, and 'the typical kind of guy' for this kind of education" [In this female student's further reasoning it was clear that she thought it would be good to break with the "usual" associations.]

"I don't know, I think it would be better with a woman" [This female student ranked FA first, and FF second.]

"I have no real reason for this, I just thought that a female is better" [This female student ranked FA first, and FF second.]

Finally one female student argued for choosing MA in a way that might be interpreted as a wish to avoid gender typicality:

"Because he did not have typical short 'boy's hair'"

3.3.3 FA: Gender related arguments

Turning to the female characters, eight female and two male students came up with gender related arguments concerning FA. All argued *for* their choosing FA in terms of her being female. The eight females said:

"I think it is good that women are more visible"

"I think it is important that it is a women speaking since that can make more girls realize this can be for them"

"she seems young and looks nice, and I think she would make more girls interested"

"I like to see that also girls can be profiles for an engineering education, in particular one involving computers, which has many male students"

"Because she was good – and a girl"

"I think women too ought to have influence in speaking for such educational programmes, so that girls can see that there are also female students here"

"It is fun to have a female presenter, since the education probably has more male students"

"because that would make the programme more open for other people; one thinks that only total nerds study there, but this is a woman" [It can be noted that even though this participants expressed that she wanted a female and to open up the programme more, she ranked FF in last place, arguing that she did not look serious enough and that she was too alternative and thus not suitable for presenting a university education.]

Similarly one of the two male students who explained his choice of FA with her being a female, placed FF last, writing that:

"a woman feels more welcoming, but the other woman looks so styled, which I don't like"

Finally, the other of the two male student explained his choice of FA with:

"because it is a woman, and then it's much easier to be interested in listening" [He ranked FF as number two.]

3.3.4 FF: Gender related arguments

The more androgynous looking female character FA was, thus, entirely described in positive gender related terms: she was *chosen/preferred as a girl/woman*. The gender related arguments about FF, by eight female and five male students, were in contrast more split and ambiguous. Three of the females argued in positive terms about their choice of FF:

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”when one thinks about computer educations one thinks, at least I do, mostly of males. To hear a woman present is really a good thing” [She ranked FF first and FA second.]

”because she was the best-looking and seems more conscious of what women want”

”she looks like a focused woman, who knows what she wants =) ha-ha” [She ranked FF first and FA as number 3.]

The other five females as well as the five males put FF in last place, and several of them seemed to defend this by saying that they *do* want women presenters in this context, but not this woman; not FF. The female students commented:

”it could perhaps be good to have a female presenter, but perhaps not her” [She ranked FF last but FA as number 2.]

”I cannot say straight on that she would not be good as presenter but she just does not seem competent” [She ranked FF last but FA first, with the motivation that she finds it important to have a woman as presenter.]

”she is a kind of woman I don’t like” [She ranked FF last but FA first.]

”I am not against her really but I think it should be mixed between women and men when it comes to influencing” [She ranked FF last but FA first, with the motivation that girls too ought to have influence in speaking about such educational programmes.]

”males are usually good at presenting these things” [She argued like this for putting FF last, but nevertheless ranked FA first, saying that she was good.]

The five males reasoned:

”women are, on the whole, less interested in computers, and this one looked less motivated than the other woman” [He ranked FF last and FA as number 3.]

”she looked the least like someone dealing with technology” [He ranked FF last but FA second.]

“she was a woman on a computer education and she did not seem to belong there”

”she doesn’t give the feeling of being as serious as the man, doesn’t seem to have the same working experience as the man” [He ranked FF last and FA as number 3.]

”as I said, a woman feels more welcoming than a man, but she looked so styled, which I don’t like” [He put FF last but FA first.]

3.3.5 Summing up

In summary there is a considerable difference between *ten* arguments (five by female students and five by male students) *against FF* as presenter in terms of her being a woman – or as being “this kind of woman”, and *no* argument *against FA* as presenter in terms of her being a woman. On the other hand, *ten* participants (eight female and two male students) argue *for FA* as presenter since she is a woman, but only *three* (three females) argue *for FF* as presenter since she is a woman. A tentative conclusion is that the more androgynous female character has more positive affordances in gender terms. FA is more frequently and more consistently used in positive reasoning and arguments concerning women in this computer technological context. One hypothesis is that students who already have thoughts about a positive role for women in the computer engineering domain, or technical domains in general are more satisfied with picking the FA-character rather than the FF-character. The FF-character, on the other hand, seems to mediate or to lend herself more frequently to arguments about women not fitting in this context. But the topic is complex, and we will return to it in more detail later in the paper.

3.4 Comments and arguments about the attractiveness of characters

As related above, it appears to be crucial for young peoples’ educational choices, such as subject domain choices or educational programme choice, that they can find adequate role models (Hannover & Kessels, 2004; Rommes et al., 2007).

Among the parameters known to influence the strength of a role model, attractiveness is one. Role models that are found more attractive tend to be imitated more frequently (Rommes et al., 2007). Attractiveness is unquestionably a complex and manifold concept that cannot be dealt with in detail in the present article. We have analysed the material from the study, though, to see the extent to which attractiveness and non-attractiveness in the looks of the characters was brought up in the evaluation of them as presenters of a computer education.

It was strongly expected that *the look* of characters *would* be referred to, in particular in connection to the ranking of the four characters since there is not much apart from their looks to compare. Out from looks one can estimate and project various characteristics such as gender, age, education, profession, etc., and one may comment on whether a person looks like oneself, looks smart, happy, sad, etc. But what we are focusing on here are comments on looks that regard attractiveness and non-attractiveness.

Overall there were no large differences in the number of comments on attractiveness aspects made by

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male students (52) and female students (67)[7]. Furthermore, the female students commented on the attractiveness/non-attractiveness of the female characters as much as on the male characters. The male students commented 32 times on the attractiveness/non-attractiveness of the female characters and 20 times on the attractiveness/non-attractiveness of the male characters. The number of comments was relatively evenly distributed among the four characters with the exception of FF who received one third of the attractiveness/non-attractiveness comments.

3.4.1 Attractiveness comments on MM

The MM-character received comments about his attractiveness as well as his non-attractiveness, with some overweight towards the latter. One female student wrote that: "he is cute", and one male that: "he has an attractive face". Another male wrote that: "ha-ha, he looks like a brat, and that makes him look less charming", and two females wrote that "he looks a bit corny" and "he looks least attractive".

Some participants commented on MM's look in terms of 'niceness': "He looks nice and honest" and 'he looks young, humorous and reliable in a down-to-earth way". But MM also received quite a number of comments – by as many as 10 females and 7 males – about his look in terms of being dull, gloomy, uninteresting, and the like (e.g. "he looks a little dull and stiff", "he looks dull, simply", "he looks so dreary and expressionless", "he looks so dull and plain").

3.4.2 Attractiveness comments on MA

Turning to MA, one male and eight female students wrote that he was cute, good-looking, handsome, or the like. One male commented that "he is king", and one male and one female wrote that he looks cool. But three females and four males wrote that he is *not* good-looking (e.g. "he does not look good", "he does not look nice", "he is 'smug' in his look").

MA received more comments than MM on his look as being nice, decent plain, and the like (by three females and two males).

3.4.3 Attractiveness comments on FA

For FA, as well, there was a distribution in positive and negative comments as to her look. Whereas five male students and one female student found her attractive ("she is attractive", "she is damned good-looking", "she is pretty", "she is cool", "she is beautiful", "she has charisma"), one male and one female found her clearly non-attractive ("she is ugly", "she looks so pale and disgusting"). The FA-character also received many comments on her looks in terms of 'looking nice' – from five males and four females (e.g. "she looks nice", "she looks sympathetic").

Likewise there were many comments along the line that she looked natural, plain and neutral (in a positive sense). Five females and one male wrote that FA looked: kind, commonplace and reliable; most neutral; (most) natural; nice and normal. On the other hand there were about as many comments (five by females and two by males) in negative terms about dullness. (E.g.: "there is something in her face that seems dull", "she looks a little dull, a little colourless and not so inspiring", "she looks dull and nerdy", "she looks tired and non-engaging, she makes me think of rainy Monday mornings, the colour of her hair".)

3.4.4 Attractiveness comments on FF

FF, finally, was the character that received the most comments on her looks in terms of attractiveness/non-attractiveness, and also with most variety in content and details of the comments. FF was commented upon as being attractive by seven female students (e.g. "she was cute – ha-ha!", "she looks good", "I think she is the most beautiful", "because she is the most good-looking and that she seems conscious of what girls want also", "because she has a chic look"), and four males (e.g. "she was cute =)", "she is hot!", "because she's hot").

There were about as many comments on her looks in negative terms. One male and five female students claimed that she had too much make-up (e.g. "she is too heavily made-up", "she has too much make-up, she looks like a party babe"). One male student wrote that: "she has no attractive face", and another that: "she looks like an orange".

Four male students wrote that she: "looks too plastic", "does not look natural", "looks too styled", "looks shady". But the "non-natural" and "plastic" comments are *contrasted* with three positive comments on her looking plain: "she looks plain and normal", "she looks most common", "she looks neutral".

Two males and one female commented on her looks in terms of niceness (e.g. "because she looks nicest", "because she looks positive and nice with an inviting face".) On the other hand two male and two female students wrote that she did not look nice: "she looks wicked", "she looks unsympathetic", "her eyes and gaze feels a bit angry – she gives no

[7] Also remember that 14 more girls than boys were among the participants.

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pleasant impression", "she looks nasty, she looks sour".

Finally, three females and one male found her look interesting: "she looks like a focused woman who knows what she wants =) ha-ha", "because she looks different, maybe she is more interesting than the others", "she looks more lively and more interesting", "she looks more fun and interesting than the other girl". But two males found her looks uninteresting: "she doesn't look interesting, looks quite dull and not tempting", "she looks less motivated than the other girl".

3.4.5. Summing up

First of all, it should be observed that comments on attractiveness were indeed quite frequently involved as arguments for choosing a character as first place presenter, while comments on non-attractiveness were quite frequently involved as argument for placing a character in fourth place. There was one exception, where a participant ranked FF last with the argument that one should not try to market an education with "a beautiful person".

The considerable divergence in opinions for *all four* characters in terms of their attractiveness is positive in view of the study design. One or some particularly attractive or non-attractive characters would take focus away from and interfere with the factor we intended to study, namely gender stereotypicality in visual appearance. Another conclusion from the divergence in opinions is, of course, that taste differs. (The strongest divergence was found with the more gender stereotypical characters and most of all with FF, which was the character that received the highest number of and most divergent comments related to attractiveness and non-attractiveness.)

A further relevant observation concerns the perception of 'plain and common', which can play a role in an identification process (in the sense of someone familiar to recognize and to identify with)[8]. Even though FA was commented on far more frequently as looking 'plain', 'common', or 'normal', than FF, FF also received these sorts of comments. MA and MM, likewise, were both commented on by some participants as looking 'normal'/'plain'.

That the perception and evaluation both of attractiveness/non-attractiveness and of who looks 'normal' and 'common' differ among participants fuels the idea of exploiting the potential of virtual environments to have *more than one character* – such as in this case perhaps two interacting presenters.

3.5 The Nerd in arguments and comments

The topic of attractiveness/non-attractiveness leads us to the topic of *the nerd*. Rommes et al. (2007) provide an elaborate analysis of this issue based on a rich empirical material from the Netherlands. By means of a combination of methods, including focus group analyses and pictures drawn by young students, they pinpoint the Dutch cultural image of a computer scientist: male, unsociable, 'married to his computer', wearing unfashionable clothes and glasses, has a bad haircut, is overall unattractive and basically asexual – that is, *a nerd*.

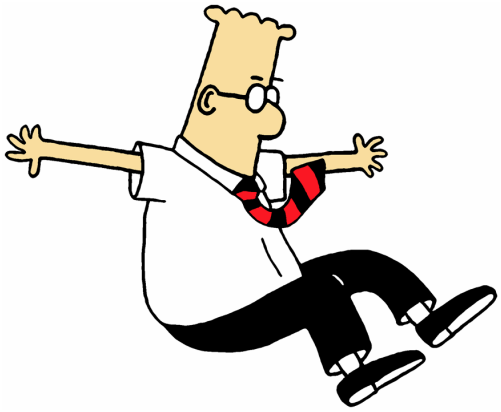

Figure 9. The world famous office engineer nerd Dilbert.

Also organizers of computer engineering programmes in Sweden sometimes mention as problematic a distorted image of 'the computer engineer student' as: a male student, constantly in front of his computer, drinking large amounts of coca-cola (Kihl, 2003).

Given that the image or prototype of a person studying at a certain education and/or belonging to a certain professional group is important for young peoples' choices of education (Kessels, 2005), a nerd image associated to computer engineering is a considerable obstacle for young people applying to such programmes. *The nerd* is not somebody to identify with or aspire to be, but someone extremely non-attractive and non-glamorous: in other words, a dysfunctional role model.

Furthermore, identity, relationships and sexuality are important during adolescence, and thus the risk of being associated with the 'asexual' 'nerd' image can be extremely threatening (Lippa, 1991; Rommes et al., 2007). Baylor and collaborators as well (Baylor & Plant, 2005; Baylor et al., 2006) touch upon these issues, in holding up virtual role models, that are interested in and knowledgeable in engi-

[8] The kind of use that dominated in the interview material and is referred to here is 'plain'/'common' in contrast to 'strange' and associated with 'someone familiar' and 'someone to identify with'. (There is also, on the other hand, the more negative notion 'plain' /'common' in contrast to 'exciting', 'special' and 'attractive', that can be associated with uninteresting, 'someone not to seek identification with as a role model'.)

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neering and simultaneously stand out as attractive and as affirmative in their sexuality.

Rommes et al. (2007) make likely in their analysis that it is such the *nerd* prototype of the computer scientist, rather than ideas of what it means to study and work in the field, that makes many young Dutch females – and males – refrain from applying to computer related educational programmes. Thus, not least given the 'student recruitment' context that our study took place in, we wanted to see whether we would find "the nerd" in our material, explicitly or implicitly, when subjects reasoned about and motivated why they chose or did not choose a certain presenter.

3.5.1"The nörd" in the participants' arguments

The Swedish language has the word *nörd*, pronounced very similar to *nerd*, along with the more specific *datornörd* (*computer nerd*).

In the material, the word *nörd*[9] was used twelve times, whereof six in arguments about MM, three in arguments about MA, two in arguments about FA and one in arguments about FF. It was primarily female participants that used the word *nörd*, namely ten out of the twelve times. Additionally there were fifteen occasions of reasoning or arguments, eight by females and seven by males, that can be associated with the "nerd" concept, even though the word *nörd* was not used.

Starting out with MM, three females and one male explicitly ranked him last as a presenter because he was a *nörd*. The male: "because he looks most nerdy (*nördig*)". MA was his first choice since: "MA looks cool". The females: "because I think he looked like a computer-nerd (*datornörd*) with his very ugly hair"; "because he looks a bit nerdy (*nördig*)" and "he looks a little dull, and a little nerdy (*nördig*)". Two other female students argued for putting MM last in a way associated with a 'nerd'-concept: "because he looks like a proper computer-person (*äkta datamänniska*), no one you can recognize yourself in"[10]; "he looks a bit dull and stiff, a typical computer-guy". MA was the latter participant's first choice since: "he is cool, and I got the impression that cool people study this educational programme".

One female instead wrote that she put MM first "since he looks a bit computer-nerdy (*datanördig*)". It is likely that she also thought that MM *fits in* and looks like a *computer student* since she ranked FF in last place with the argument that: "she looks like a business student". It was not clear, however, to which extent attractiveness/non-attractiveness judgements were involved here, but it seems likely that by "looking computer-nerdy (*datanördig*)" this female student was implying non-attractiveness to some extent.

Actually there seems to be some ambiguity in the valour of the Swedish word *nörd* with respect to attractiveness/un-attractiveness. One male student who expressed a very positive attitude towards the educational programme in question argued for MM as his presenter choice by writing that: "he looks nerdy (*nördig*) ☺" (note the smiley). Another male student wrote that he chose MM: "because he looks like a genuine computer-guy". (The word *äkta* (genuine) used here has a positive valour in Swedish in general.)

Also, three females, who chose MA as their number one presenter commented on MA's look, the look of 'computer-people' and of 'the nörd' in positive terms: "he looks like a handsome computer-guy" [She put MM last since: "he looks a bit corny"], "one gets the impression that cool people study at the programme", "he looks good, and looks like a computer-nerd (*datanörd)*". [This female student put FA in fourth place with the argument that she is "ugly" which indicates that her argument for putting MA first involves his looks in positive terms, as 'good-looking'.]

On the other hand, a fourth female who ranked MA as her number one presenter, wrote that she does so since MA does *not* seem to be a nerd: "because he looks good, and not too nerdy *(nördig*)". [She put MM in fourth place as being "dull and dry".]

Five other female students, who put MA first, argued that he looks like someone belonging to that educational domain: "he looks like someone from that education", "he looks like a computer engineer", "he fits best with that programme", "it seems like a good person for that programme, he looks like someone who would study there". In all these cases it is relatively open whether this *fitting look* of MA is a good look, a neutral look or an ugly look – as well as if and how it is a *nerd* look. One young man also wrote "he looks like a computer guy", and two more males motivated their choice of MA in quite positive terms: "he looks as if he fits well in computer engineering, and he looks a bit like me", "he looks like a guy with computer experience".

Then, one male and one female ranked MA in *fourth* place "because he looked as he really was a student in the programme, like some 'rag-tag' person" and "since he is a guy, and 'the typical guy' for this kind of education".

[9] We are using both the Swedish and the English words. The reason, that will come forth, is that it is not obvious to what extent they are similar in meaning.

[10] FF was this girl's first choice, since she wants things to "open up, and wants a girl here since she thinks mostly of boys when she thinks about computer education."

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Summing up the arguments about the two male characters with respect to the *nerd/nörd* topic, a first observation is that none of the characters closely fits with the description of the nerd above, as wearing glasses, having a bad hair-cut, being very unattractive, etc. Both MA and MM were held to be *good-looking* by at least some participants. Nevertheless, both were on some occasions considered to be, or were associated with, a *nörd* – MM relatively more than MA, perhaps related to the fact that MM was more frequently said to look dull and boring than MA? However, MA received many more comments than MM of the sort: 'he fits in with this education'. Together this does not support the idea that it is *the nörd* that fits in with this education.

Finally, *nörd* comments occurred more rarely in connection with the female characters. Yet one female student put FA in fourth place "because she looks dull and nerdy (*nördig*)", and put FF first, "because she is no nerd (*nörd)"*. Another female student brought up the *nörd* concept when explaining her choice of FA: "because she does not seem nerdy (*nördig*)".

3.5.2 The Swedish "nörd"

What emerges from our material so far appears not to be an equally strong cultural image as the one that emerged from Rommes' material (Rommes et al., 2007), of *the nerd* as the typical computer scientists/engineer.

It seems that *nörd* has in part a different meaning and use than the English *nerd*, in that it is being used in a more varied way and not always with a negative connotation. Furthermore, the associations to an unattractive appearance do not seem that strong.[11] We intend to continue to explore this topic when we analyze the material from the focus group interviews, where we ask who the typical computer engineer is.

3.6 Attitude influences

We have come to the part of the analysis that is not based on participants' explicit ranking of characters and their arguments about them, but instead on changes in participants' attitudes towards the computer engineering programme after they had listened to the presentation by one of the four virtual presenters.

On the screen participants were asked, before the presentation of the computer engineering programme, about their interest for different educations and to what extent they could imagine themselves as a student in the different educations (Figure 5b).

[11] One anecdotic observation in the context is that the Swedish 'James Bond like' master spy Carl Hamilton (from books and films) has an alias as a computer expert.

After the presentation they were asked to mark on a Likert scale the extent to which their attitude towards the computer engineering programme had been influenced: very negatively, negatively, a little negatively, a little positively, positively, or very positively (Figure 5d).

The largest group of participants, 86, i.e. a little more than half, answered: "a little positively". Four participants answered: "a little negatively". In our analysis we did not include these two middle positions but only 'negatively' and 'very negatively', that were given the values 2- and 3-; and 'positively' and 'very positively', that were given the values value 2+ and 3+. In Table 1 the added values, character by character, are presented.

Table 1. Attitude influences from the multimedia presentation.

Added positive (+) influences only

	FF	*FA*	*MA*	*MM*
Males	54 +	38 +	21 +	58 +
Females	31 +	36 +	36 +	36 +

Added negative (–) influences only

	FF	*FA*	*MA*	*MM*
Males	8 –	11 –	14 –	0 –
Females	0 –	4 –	15 –	5 –

Added total (positive and negative) influences

	FF	*FA*	*MA*	*MM*
Males	46 +	27 +	7 +	58 +
Females	31 +	32 +	21 +	30 +

Overall more male than female participants reported a clearly positive influence from the presentation. The total sum of positive values for the male participants was 171 (+) and for the females 139 (+) even though there were 14 more female than male participants. However, both for male and female participants the positive influence values were relatively high. The negative influence, measured in negative values, was considerably smaller, with 33 (-) for males and 24 (-) for females (Table 1).

When it comes to the presenters involved in the cases where participants reported a strong positive change in attitude towards the education, the results were as follows. For female students, the positive influence was very evenly distributed over the characters. This is not in line with Baylor's results (Baylor et. al, 2006) where female students' attitudes towards engineering classes were considerably more positive if the virtual coach was *female*. What must be borne in mind is, however, the difference in contexts. Baylor investigated students' en-

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counters *over some time* with a pedagogical coach, directing a tutorial. In our study there was *one brief* encounter with a presenter.

The only character that was somewhat over-represented as involved in negative influence on female characters was MA. This, as well as the very evenly distributed positive influences from the characters on the female participants, does not concord with the strong preferences in the female participant group for the two androgynous characters as apparent in their explicit ranking and reasoning about the characters.

With the male participants the contrast between their explicit ranking and reasoning about characters, and the positive and negative influences from characters, was more striking. In explicit rankings and reasoning, the androgynous characters were preferred – but looking at the positive influence values, these were low for these characters which were instead most involved in negative influences on male participants. Furthermore, the character the male participants ranked lowest and argued most negatively about was MM. But the *positive* influence on attitudes on male participants was clearly strongest from MM, followed by likewise strong positive influences from FF.

3.7 Analyses in the pipeline

There is a lot more data from the study that we would – given time and funding – want to analyze and make use of. Not the least, there is the material from the focus group interviews, where the participants were, among other things, asked to mention masculine as well as feminine professions. It would be interesting to compare this material with that of (Rommes et al., 2007). There is also material on how participants talk about androgyny.

Furthermore, we would like to pursue a more focused analysis from the perspective of recruitment. Here those participants that are qualified to apply for computer engineering programmes are central, and in particular those participants that were interested – or became interested after the presentation – in the computer engineering programme. With respect to these groups there is much to scrutinize, such as students' attitudes in terms of whether the presentation, and the presenters, should be 'serious', 'fun', 'trustworthy', etc. It would be interesting to look in more detail into conceptions on 'who fits on this educational programme'. How do more and less interested students reason about this, respectively? Under what circumstances and with which participants does it occur that someone who at first marks the computer engineering programme as very uninteresting for him/her, ends up being very positively influenced by the presentation and vice versa?

4 TENTATIVE CONCLUSIONS

It has long been acknowledged that there are close symbolic associations between technology and masculinities and femininities (Cockburn & Ormod, 1993; Faulkner, 2003). In this context, we suggest, virtual agents or characters with their properties of human-likeness and interactivity, constitute a particular form of (information) technology with a particular constructive power with respect to gender. In our study virtual characters are used for presenting a university programme on computer engineering, but such characters can be used to present all kinds of educational domains, and may be of particular interest when attempting to provide alternative cultural images and aiming for less gendered occupational choices.

The work by Baylor and her collaborators (Baylor & Plant, 2005; Baylor et al., 2006; Baylor, 2005) provided important background and was a point of departure for our study in highlighting the importance of images and alternative cultural role models for engineering students. This research group has (among other things) put forth and evaluated pronouncedly *feminine-looking* and *attractive* female characters as alternative cultural role models.

Other researchers, as well, have suggested that more physically attractive and glamorous female role models might change the negative prototypes of computer scientists (Coltrane & Adams 1997).

But Baylor and collaborators also pointed out problems of *stereotype reproduction* in using such characters and such images. We, thus, became interested in looking for ways to reconcile the short-term pedagogical goal of recruitment and boosted self-efficacy in female students, and the long-term pedagogical goal of changing rather than reproducing gender prejudices and stereotypes. In the study that we have just presented, we explored motivational and cognitive effects of *more androgynous or neutral-looking* characters. More specifically, we compared the effects of such characters with those of more typically feminine-looking female and masculine-looking male characters.

4.1. Manifold suggested

Our results were, when looking at the students' *explicit* orderings and arguments, that the two androgynous characters were clearly preferred to the two more gender stereotypical characters. There was a clear tendency in the participant group, significantly above what is expected by chance, to place the two androgynous characters as their two first choices of presenter. The result was most pronounced for the female participants.

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As to the participants' *arguments* for their rankings, opinions on *attractiveness* seemed to play a significant role. In arguments about all four characters, attractiveness was often used as an argument for choosing the character. Correspondingly, non-attractiveness was often used as an argument for putting the character in fourth place[12]. However, opinions on *whether* a certain character was attractive or non-attractive were divergent with respect to all four characters.

The FF character, which is the one that most correspond in appearance to the "sexy, attractive, young female engineers" that Baylor used in her studies (Figure 10), received the highest number of comments as to attractiveness/non-attractiveness. Looking at the female participants, there was, on the one hand, some participants for whom this type of character appears to be valuable, as reflected in arguments for choosing her such as: "she looks as if she also knows what a woman wants", "she has a chic look", "she looks like a focused woman who knows what she wants".

Figure 10. Left: the "more feminine-looking female character" from our study; Right: the "sexy, attractive, young female engineer" of Baylor and colleagues (Baylor et al., 2006).

Looking at the explicit rankings and arguments of the group of female participants as a whole, though, FA was clearly preferred to FF as presenter. (Yet this was not reflected in the attitude influences that were more implicitly measured as changes in attitudes towards the presented educational programme. On this measure, FA and FF were equivalent.)

But the most central result, when comparing effects of FA and FF, comes from the analysis of arguments that refer to the *gender of the character*. Here we found that a whole group of ten participants argued *against FF* as presenter in terms of her being a woman – or as being "this kind of woman" – whereas non one did so *against FA*. And vice versa, a considerably larger group of participants argued *for FA* as presenter *as being a woman* than correspondingly *for FF*. Our interpretation is that the more androgynous female character has more positive affordances in gender terms. The FA character is more frequently and more consistently used in positive reasoning and arguments about women in this computer technological context. Female students who already have thoughts about a positive role for women in the computer science domain, or in technical domains in general, seem more satisfied with picking the FA-character than the FF-character. The FF-character, on the other hand, seems to mediate or afford, or lend herself more easily, to arguments about women not fitting in this context.

Nevertheless, we want to emphasize the divergence between participants. One should not neglect that FF seems to have positive affordances for one group of participants. This points towards the possibility of not having to be bound to one virtual character, in this case one presenter, but use two or several characters that take turns and interact with one another.

Furthermore, it is important to situate the results of the present study in a cultural context. The virtual characters, which might function well and be adequate in Sweden, are not necessarily the ones that ought to be chosen in another country. For instance, we observed that *the nörd* seems to have less impact and be more modulated than *the nerd* in some other cultures – which could decrease a need to introduce attractive, sexy female and/or male characters as a counter balance.

4.2. Potentials in the use of virtual characters with respect to gender issues

On a broader scale the results from this and other studies indicate that it is possible to exploit virtual characters to support identification and formation of identities in young women and men while avoiding the reproduction of undesired gender stereotypes. Smartly used this form of information technology could, to borrow from Rommes (2007), be developed into tools that may increase the freedom for (young) people to create their personal "gender identity cocktails". Even though there are forms of information technology that to the contrary are involved in the reproduction and even reinforcement of gender stereotypes (c.f. Figure 4, p. 5), there is all reason to focus on the likewise strong potential in the field for the *broadening* of cultural images.

For one thing, there is quite a different space in which to *manoeuvre* in virtual worlds than in the real world. As Brave & Nass (2005) reason about gender and information technology: "Rapidly increasing the number of female teachers in stereo-

[12] Which is in line with what is known on attractiveness as a significant parameter of the strength of a role model (Rommes et al., 2007).

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typically male disciplines (or vice versa) seems difficult. But technology provides a wonderful opportunity to […] 'staff' educational software to counter stereotypes." (p. 29).

Within computer game communities where members continually contribute to game development, one can see a growing diversity in characters, and in particular new kinds of female heroines.

In the wordings of Pinckard (2003) "in MUDs and MOOs, one can often create a third sex and invent a pronoun and refer to oneself always with that pronoun (and insist others do that same). In these science-fiction and fantasy-themed online worlds, it's perfectly plausible that ungendered, ambiguously gendered, or bi-gendered races could exist". Also in pre-designed games examples of gender busting characters can be found, as in the following examples.

– *Nights into Dreams:* A fusion of boys' and girls' game genres where both the female and male characters may assume the identity of *Nights*, a magical, androgynous figure. This game has, furthermore, retained popularity through more than one decade.

– *Beyond Good and Evil:* Featuring the street-smart reporter/journalist character *Jade* who has been repeatedly prized by communities of female gamers. On the female gamers forum *ThumbBandits*, Jade is described as a progress with respect to *Lara Croft* – a very strong and positive female hero character, but without Lara Crofts pronounced sexualisation.

– *Metroid:* Featuring *Samus Aran*, an extremely strong, yet modest and sympathetic action heroine. Samus Aran is clad in cyborg garb through most of the games, and many jaws are dropped when *she* at the end removes her helmet and cyborg suit and reveals this strong woman and not the expected male bounty hunter.

– *The Legend of Zelda: Twilight Princess:* with gender ambiguity around both *Zelda* and *Link* as well as Zelda's alter ego *Sheik*.

5 SOME BROADER ISSUES & FUTURE RESEARCH

We regard the presented study as a first step in a larger project of exploring the pedagogical potential of virtual characters that challenge gender stereotypes, and pose the overall question: How can pedagogical tools that involve virtual characters help widening existing gender boundaries, by providing images, examples and experiences that are contrary to culturally dominant images?

There are several different paths to follow. In this section we will discuss some that have high priority on our agenda.

1. A pursued exploration of perceptions and attitudes towards androgyny and how androgyny can be used pedagogically in virtual characters.
2. Comparative cultural studies.
3. Education and gender with respect to educational programmes where men are in the minority.
4. Development of dedicated *gender pedagogical digital tools* involving virtual environments and characters.

5.1 More imaginative androgynities

One of the first things we would like to pursue is the exploration of perceptions and attitudes towards androgyny and how androgyny in virtual characters can be used pedagogically. The virtual characters used in the present study are, as discussed above, not *pronouncedly androgynous*. This is related to the fact that the visual characters in the present material are relatively naturalistic. In turn this constrains the possibilities of using more pronounced and ambiguous androgyny, since naturalistic androgyny is known to induce insecurity and unease in humans (Brave & Nass, 2005).

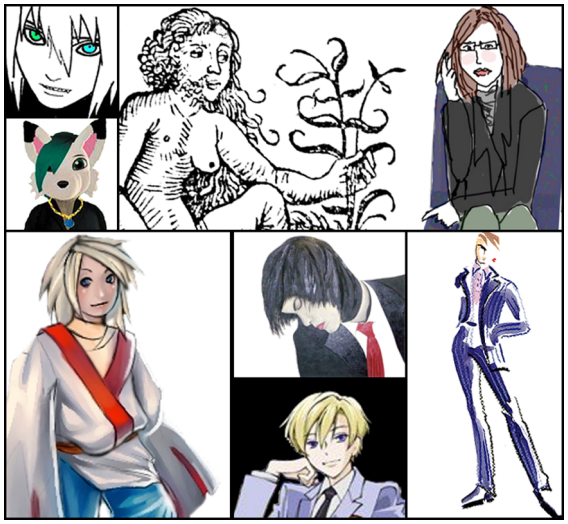

Figure 11. Examples of various androgynous depictions within a stylized, non-naturalistic design space.

But with less naturalistic, and more imaginative, characters, the design freedom and potentials may be wider (see Figure 11 above)[13] while there is still evidence that *identification processes* with respect to visually less naturalistic characters can function

[13] Also exemplified by the computer game characters mentioned previously in Section 4.2, page 18.

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well (GameGirlAdvance, 2003; Gulz& Haake, 2006; Haake & Gulz, 2007; McCloud, 1993).

For instance, we have made use of Manga-inspired characters in previous studies (see Figure 12 below). These seemed to function quite well with respect to identification, and were superior in this respect to the more naturalistic Sims2-like characters used (Haake & Gulz, 2007).

Figure 12. Sims2-inspired and Manga-inspired characters used in a previous study by the authors (reported in Gulz & Haake (2006)).

We would like to continue the exploration of the pedagogical potentials of androgyny in a follow-up study to the presented one. In this follow-up we would use less naturalistic, more imaginative, representations to se how one can approach more imaginative and ambiguous visual androgynities.[14]

Attractiveness that has been mentioned several times above would also be a core issue in a follow-up, being an important parameter in positive and well-functioning cultural images and role models. We will look for and explore *non-gendered*, *attractive* characters. An implication is a need to avoid androgyny in the sense of in-between (neither feminine nor masculine, neutral, greyish or average). Androgyny, or preferably *androgynities*, in our sense rather means various kinds of combinations of feminine as well as masculine characteristics. *Attractiveness* is certainly not unobtainable in such combinations.

We hold though that, in the context that we are dealing with, androgynous attractiveness is a considerable gain over gender-stereotypical attractiveness, and in particular over *feminine attractiveness* of the kind that Baylor and collaborators work with. The reason is a conception, at least in Western Society, of beauty or attractiveness as some kind of primary goal for a woman; that her primary role or function is to be good-looking and to attract. This in turn brings about liability that a beautiful woman appearing on the board of directors or as the chief engineer, may be perceived as being there in terms of her good looks or of 'bringing in some female beauty'. Her primary role is fulfilled – as everyone can see – and this role is not competence. It is possible that such unfortunate associations lie behind the attitude that Baylor and collaborators detected as involved in the increased self-efficacy of students: "Such a good-looking woman cannot be, or does not have to be, competent in order to be where she is. And so if she is able to do this, I can do it."

This kind of ballast of associations might be dispelled or disposed of, when turning towards androgynous attractiveness.

Our approach to androgyny is, thus, optimistic. We view it as a large space with many possibilities of combinations of characteristics – such that we classify as feminine and such that we classify as masculine. There are many other researchers who express an optimistic view on the boundary widening potential in digital world with respect to gender. Haraway (1991), Turkle (1995), Gilmore (2004) and Chess (2006) all in various ways argue that androgyny in the digital world is a rich continuum with many possibilities for femininity, masculinity, both or neither).[15]

5.2 *Cultural comparisons*

When it comes to cultural comparisons, it would be interesting to carry out more direct comparative studies in relation to the mentioned studies of Baylor in the US and/or of Rommes in the Netherlands.

Baylor has been conducting studies that involve interaction between students and virtual characters over time, e.g. as in a series of tutorials. This condition is more closely related to a role modelling and identity formation context than the briefer exposure that we have worked with in the present study. Furthermore, it would be interesting to compare the cultural images surrounding computer technology in the US and in Sweden.

Likewise, we would like to dig further into a comparison between Rommes' materials from the Netherlands. In what ways do the Netherlands and Sweden differ with respect to the cultural images of the computer engineer and of 'the nerd'? And to what extent can this be related to whether computer en-

[14] It would also be interesting to involve not only appearances but also ways of expressions and body language – and non-typical combinations of these with respect to gender.

[15] Other researchers are more pessimistic, for instance Biocca & Nowak (2002), who emphasize that the only thing that happens in cyber space is that the distinction between feminine and masculine will be amplified and exaggerated.

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gineering is perceived as an unattractive or attractive discipline in these countries?

5.3 Educations with male students in the minority

Continuing with the issue of gendered occupational and educational choices, we would also like to conduct a study targeted at a domain with underrepresentation of male students; this first study having focused on images of a profession where women are underrepresented. The underlying questions are the same: How can we use virtual worlds to offer a broader range of styles and identities than in the real world? How can we make use of these virtual worlds for countering dominating gendered cultural images?

5.4 Dedicated gender pedagogical tools

Virtual characters tend to populate digital materials to an increasing degree, in educational as well as in broader contexts. One finds virtual presenters, instructors, learning pals, coaches, mentors, alter egos, avatars, and other kinds of characters in virtual role plays, all from main characters to side kicks.

Is it then possible to construct *dedicated* gender pedagogical tools using virtual characters?

One possibility is that students themselves design virtual characters, in the sense that they decide on the ethnicity, gender, body shape, clothing style, voice, dialect, etc. for a virtual character inhabiting a certain digital learning environment: "What is the police character going to look like? And the character that is arrested? Which voice fits to this judge character?"

The situation as such is familiar for many young people used to games such as the Sims and to avatars in on-line-chats (e.g. www.imvu.com). For educational purposes the situation may be set up either via commercial educational systems that provide character design kits, or via digital learning materials put together by teachers and students themselves and using character tool-kits (which are becoming available, e.g. SitePal, PeoplePutty and Meez)[16]

For pedagogues with knowledge about the impact of role models and stereotypes there will be opportunities to initiate discussion and reflection: "Why did we/you choose this character in this role? What features did we/you combine with one another and which not? Whose appearance is exposed and how – in terms of gender, age, ethnicity, class, regional subgroup, etc?[17] Notably, *various* alternatives may be suggested and *tried out*. Such a visual and dynamic situation may provide a natural basis for reflection and discussion – probably more so than an otherwise more disconnected classroom discussion on stereotypes.

Furthermore, since humans are perceptual creatures and are powerfully affected by perceptual input and materials, this can be a vigorous complement to attempts at verbal reconstruction. This is perhaps particularly important in an academic context, where language and other abstractions often have a strong position compared to a more tangible visual tradition. Yet we know that visual, and other perceptual, stimuli and codes have a subtle but powerful influence on us all (McArthur, 1982; Schneider et al., 1979). Thus, it is unlikely that real success in reconstruction of for instance gender structures can be reached by focusing on language alone. Perhaps virtual characters can bring us one step further.

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[16] *SitePal*: www.sitepal.com; *PeoplePutty*: www.haptek.com; *Meez*: www.meez.com

[17] Additionally there is a possibility to conduct simple classroom exercises where different groups of students are to evaluate a role game and its characters, but with different castings in the different groups.

Figure 10. Left: *Presenter* © Magnus Haake (Dept. of Design Sciences, Lund University); Right: *Coach* © Baylor and colleagues at RITL (Center for Research of Innovative Technologies for Learning, Florida State University).

Figure 11. Top row: Weblog user icon for Hyuuga Harusame at www.catahya.net (download from: http://www.catahya.net/community/medlem.asp?id=3540); Avatar for Shaun Altman in secondlife.com (download from: http://images.businessweek.com/ss/06/04/avatar/index_01.htm); Illustration (cropped) of an androgynous figure from The Nuremberg Chronicle (Strange People: Androgyn (XIIr)), Morse Library, Beloit College, copyright © 2003 Beloit College (download from: http://www.beloit.edu:80/~nurember/index.htm); Illustration of an androgynous guy by Johnny Scharonne (download from: http://scharonne.wordpress.com/2007/10/17/the-face-of-dorian-gray/); Bottom row: Androgynous figure by unknown artist; Painting of an androgynous person by artist Klaus Hausmann (download from: http://www.arsvenida.de/html/klaus_hausmann.html); Cropped extract from a poster portraying androgynous young Japanese "host-boys" (*jap. shonen*) (download from: http://tokyolove.blogspot.com/2007_04_01_archive.html); Illustration by Mireille Schermer for an article about androgyny in fashion in NRC Webpagina's, © NRC Handelsblad (download from: http://www.nrc.nl/W2/Lab/Profiel/Mode/seksen.html).

Figure 12. *Avatars* © Magnus Haake (Dept. of Design Sciences, Lund University).

REFERENCES

Altmejd, A. & Vallinder, A. (2007). *Betydelsen av en virtuell agents sociala förmåga*. Student research paper. Lund, Sweden: Lund University. (*In Swedish*) [http://www.eat.lth.se/###]

Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (2000). *Self-efficacy: The Foundation of Agency*. Mahwah, NJ: Lawrence Erlbaum.

Bandura, A. & Schunk, D. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology*, 41(3), 586-598.

Baylor, A. (2005). The impact of pedagogical agent image on affective outcomes. In: *Proceedings on Workshop on Affective Interactions: Computers in the Affective Loop*, *International Conference on Intelligent User Interfaces (IUI 2005)*, San Diego, CA, 2005.

Baylor, A. & Plant, E. (2005). Pedagogical agents as social models for engineering: The influence of appearance on female choice. In: *Proceedings of Artificial Intelligence in Education (AIED'05)*, Amsterdam, the Netherlands, 2005.

Baylor, A., Rosenberg-Kima, R. & Plant, E. (2006). Interface agents as social models: The impact of appearance on females' attitude toward engineering. In: *CHI '06 Extended Abstracts on Human Factors in Computing Systems*, Montréal, Québec, Canada, 2006.

Bem, S. (1993). *Lenses of Gender: Transforming the Debate on Sexual Inequality*. New Haven, CT: Yale University Press.

Biocca, F. & Nowak, K. (2002). Plugging your body into the telecommunication system: Mediated embodiment, media interfaces, and social virtual environments. In: C. Lin & D. Atkin (Eds.), *Communication Technology and Society*, 407-447. Cresskill, NJ: Hampton Press.

Brave, S. & Nass, C. (2005). *Wired for Speech*. Cambridge, MA: MIT Press.

Brown, E. & Perrett, D. (1995). What gives a face its gender? *Perception*, 22, 829-840.

Chess, S. (2006). *Working with Sex, Playing with Gender: Locating Androgyny in Video Games*. Article published at author's homepage (www.shiraland.com). [Retrieved December 12, 2007 from: http://www.shiraland.com/Work/gender_media.pdf]

Cockburn, C. & Ormod, S. (1993). *Gender and Technology in the Making*. London, UK: Sage.

Coltrane, S. & Adams, M. (1997). Work-family imagery and gender stereotypes: Television and the reproduction of difference. *Journal of Vocational Behavior*, 50, 323-347.

Faulkner, W. (2003). Teknikfrågan i feminismen. In: B. Berner (Ed.), *Vem tillhör tekniken?*, Lund, Sweden: Arkiv förlag. (*In Swedish*)

GameGirlAdvance (2003). It's time for androgyny, it's just Vaan!, Weblog post, *GameGirlAdvance/Archives*, 2003/12/02. [Retrieved August 3, 2005 from: http://www.gamegirladvance.com/archives/2003/12/02/its_time_for_androgyny_its_just_vaan.html]

Gilmour, H. (2004). What girls want: The intersections of leisure and power in female computer game play. In: C. Carter & L. Steiner (Eds.), *Critical Readings: Media and Gender*, 328-352. Maidenhead, UK & New York, NY: Open University Press/McGraw-Hill.

Gulz, A. & Haake, M. (2006). Visual design of virtual pedagogical agents: Naturalism versus stylization in static appearance. In: *Proceedings of the 3rd International Design and Engagability Conference @ NordiChi 2006*, Oslo, Norway, 2006.

Gulz, A., Ahlner, F. & Haake, M. (2007). Visual femininity and masculinity in synthetic characters & patterns of affect. In: A. Paiva, R. Prada & R. Picard (Eds.), *Lecture Notes in Computer Science*, 4738/2007, 654-665, *Conference Proceedings of the Second International Conference on Affective Computing and Intelligent Interaction (ACII 2007)*, Lisbon, Portugal, 2007. Berlin/Heidelberg, Germany: Springer.

Haake, M. & Gulz, A. (2007). Virtual pedagogical agents: Stylisation for engagement. *Interfaces*, 70, 12-13.

Haake, M. & Gulz, A. (submitted). Visual stereotypes and virtual pedagogical agents. Submitted to: *Educational Technology & Society*.

Hannover, B. & Kessels, U. (2004). Self-to-prototype matching as a strategy for making academic choices. Why high school students do not like math and science. *Learning and Instruction*, 14, 51-67.

Lund University Cognitive Studies – LUCS 137 ISSN 1101 – 8453 © 2007 by the authors

Haraway, D. (1991). A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In: Haraway, D. (1991), *Simians, Cyborgs and Women: The Reinvention of Nature*, 149-181. New York, NY: Routledge.

Hirdman, Y. (2003). *Genus*. Stockholm, Sweden: Liber AB. (*In Swedish*)

Kessels, U. (2005). Fitting into the stereotype. How gender-stereotyped perceptions of prototypic peers relate to liking for school subjects. *European Journal of Psychology of Education*, 20(3), 309-323.

Kihl, M. (2003). *Välkommen i LTH? –En studie av D02:s och C02:s första år på Teknis*. Report. Lund, Sweden: Faculty of Engineering, Lund University. (*In Swedish*)

Lippa, R. (2001). On deconstructing and reconstructing masculinity-femininity. *Journal of Research in Personality*, 35, 168-207.

McArthur, L. (1982). Judging a book by its cover: A cognitive analysis of the relationship between physical appearance and stereotyping. In: A. Hastorf & A. Isen (Eds.), *Cognitive Social Psychology*, New York, NY: Elsevier, 149-209.

McCloud, S. (1993). *Understanding Comics: The Invisible Art*. New York, NY: Harper Perennial.

Morishima, Y., Nass, C., Bennett, C. & Lee, K. (2001). Effects of "gender" of computer-generated speech on credibility. *Technical Report of IEICE TL2001-16*, 31(8), 557-562.

Nass, C., Isbister, K. & Lee, E-J. (2000). Truth is beauty: Researching embodied conversational agents. In: J. Cassell, J. Sullivan, S. Prevost & E. Churchill (Eds.), *Embodied Conversational Agents*, 374-402. Cambridge, MA: MIT Press.

Pinckard, J. (2003). Genderplay: Successes and failures in character designs for videogames. Essay, *GameGirlAdvance/Archives*, 2003/04/16. [Retrieved December 3, 2007 from: http://www.gamegirladvance.com/archives/2003/04/16/genderplay_successes_and_failures_in_character_designs_for_videogames.html]

Reeves, B. & Nass, C. (1996). *The Media Equation: How People Treat Computers, Televisions and New Media like Real People and Places*. New York, NY: Cambridge University Press.

Rommes, E. (2007). Images and Identities; Sex, Sexuality and Soaps. Invited speaker manuscript: *The 3rd Christina Conference in conjunction with The 4th European Gender & ICT Symposium*, Helsinki, Finland, 2007. [Retrieved May 20, 2007 from: http://www.helsinki.fi/kristiina-instituutti/conference/pdf/rommes.pdf]

Rommes, E., Overbeek, G.., Engels, R., de Kemp, R. & Scholte, R. (2007). "I'm not interested in computers": Gender-based occupational choices of adolescents. *Information, Communication & Society*, 10(3), 299-319.

Schneider, D. (2003). *The Psychology of Stereotyping*. New York, NY: Guilford Press.

Turkle, S. (1995). *Life on the Screen: Identity in the Age of the Internet*. New York, NY: Simon & Scuster.

Voelker, D. (1994). *The Effects of Image Size and Voice Volume on the Evaluation of Represented Faces*. PhD Thesis. Palo Alto, CA: Stanford University.