Creative Diversity: Expanding Software for 3D Human Avatar Design

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INTRODUCTION
Creating detailed, high quality digital 3D models from scratch is known to be difficult for amateur users, and this is especially true of complex, mesh-based, physics-oriented human bodies (Bastioni et al., 2008). A range of software options are currently available for generating human avatars without requiring 3D modeling proficiency, including popular options such as Poser (SmithMicro Software 2016), Daz 3D (Daz Productions 2016), and MakeHuman (MakeHuman Team 2016), among others. However, each piece of software shares similar gaps in the ability to create avatars outside of normative anatomical frameworks. Acknowledging the limitations of current software models, our research aims to create software that expands the affordances and usability of human avatar software for creative purposes.

3D avatar modeling tools are routinely used in creating games, especially in independent games and other creative fields. That the gendered portrayals of women as avatars in mainstream games tend toward stereotypically sexualized body proportions, and that there are a lack of non-white playable character avatars outside of sports video games has been well documented (Mou and Peng 2009). Independent creators have an exciting opportunity to expand the kinds of games and creative content available beyond the mainstream; for example, Gewaltney describes the potential for challenge and empathetic experience in creating a game where the player navigates a city as a wheelchair user (2015). Yet the limitations of current human avatar modeling tools mean that challenges for users creating non-normative digital bodies are significant, particularly for those without 3D modeling experience.

Poser and Daz 3D rely on the user choosing a stock character to modify, while in MakeHuman, users modify the same basic avatar. In all instances, selecting a gender for the avatar is compulsory, and this choice determines the anatomical structure of the mesh avatar, restricting modifications to secondary sex characteristics and genital meshes. This

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artificial reliance on binary gendered anatomical stereotypes presents problems for creating a variety of appearances, including but not limited to transgender avatars. While it is possible to remove a limb's visibility in Poser, the 'bones' connected to the appendage remain, presenting problems when the avatar is exported, and no software we have encountered has the capability in program to represent a range of physically disabled bodies as avatars. MakeHuman includes race-specific sliders that modify not only the avatar's material coloring but also physical features, reinforcing racial stereotypes.

Though these features and restrictions may be indicative of an attempt to simplify the complex modification of a digital human form for users, they are also reflective of what Judith Butler describes as "the materialization of the regulatory norm", the idea that a human body must conform to norms of sex, race, and ability in order to be viewed as valid or whole (1993, xii). Our approach explores methods for implementing amateur-centered, creatively focused 3D human avatar generation software, without relying on normative categories to simplify user interaction or output.

Previous research into developing usable 3D modeling interfaces for novice users has focused largely on modeling objects, animals, or non-humanoid creatures, using frameworks of interchangeable, pre-determined segments or pieces from which the user can assemble an object (Funkhouser et al., 2004; Kreavoy et al., 2007). This would be a difficult framework to apply to highly detailed, variable humanoid modeling. AttribIt (Chaudhuri et al., 2013), in which sliders are used to control mesh morphing output based on descriptive adjectives (more to less dangerous being one such category), is an example of using expressive modification terminology to stimulate user creativity in 3D modeling. However, this approach is appropriate to objects and animals in ways that it might not be to human bodies, where classing bodies as dangerous carries racial connotations, for example.

We are focusing our research principally on expanding the range of possible bodies 3D human avatar generation software is able to generate accurately. Given the limitations of previous research and software, a crucial component of this research involves designing software interactions which increase usability for amateur users, without imposing normative constraints on the users' output possibilities. These goals will be achieved by direct manipulation techniques based on physical artistic interactions (e.g., sculpting, defining, smoothing), which modify adjustably detailed sections of the avatar on the on-screen display. We are also exploring the technical methods available to enable users to generate initial avatars from drawings and real world 3D objects, thus allowing multiple points of access to avatar creation (Murakawa et al., 2006; Tong et al., 2012).

In order to craft a useful software tool for a broad range of representative creative expression, we are engaging with artists and creative practitioners at multiple levels of expertise with the goal of designing, refining, and evaluating our software. This approach is based on interviews reviewing techniques used in personal practice and pedagogical settings, which we are currently conducting. Our design process is user centered, and participating users will have the opportunity to evaluate both the usability and the usefulness of the software as a creative tool in their process at various points during the research and development of the software. Our first round of user studies is expected to take place in April 2017.

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