A robotic head using projected animated faces.

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Abstract

This paper presents a setup which employs virtual animated agents for robotic heads. The system uses a laser projector to project animated faces onto a three dimensional face mask. This approach of projecting animated faces onto a three dimensional head surface as an alternative to using flat, two dimensional surfaces, eliminates several deteriorating effects and illusions that come with flat surfaces for interaction purposes, such as exclusive mutual gaze and situated and multi-partner dialogues. In addition to that, it provides robotic heads with a flexible solution for facial animation which takes into advantage the advancements of facial animation using computer graphics over mechanically controlled heads.
Index Terms: 3D facial projection, facial animation, gaze direction, situated interaction

1. The Head

As an alternative to using flat projection surfaces as as a medium to communicate with a facially animated agent, this project proposes the use of a three dimensional head-model as a projection surface. This approach, which is sometimes referred as *Shader Lamps* [1], gives the effect of an animated surface, by projecting an animated picture on a static model, when the projection picture matches in structure the projection surface. To do this, we use a hand-held, micro laser project (SHOWWX Pico Laser Projector). This projector is always in focus, even on curved surfaces. The projector is used to project the animated face on a 3D, translucent plastic face mask. Figure 1 shows the methodological setup. The face mask is printed using a 3D printer to of a matching design of the animated face. Figure 2 shows a snapshot of the design of the mask before printing, and after printing with an animated agents back-projected on it.

The main interactional advantages of acquiring a physical three dimensional model is avoiding the undesirable effects that come with flat surfaces such as the Mona Lisa effect where the gaze of the projected model looks at the same direction relative to the observer no matter where the observer moves around the room. Hence, if the gaze looks forward, every observer will establish a mutual gaze with it, while if the gaze looks sideways, it will be perceived looking sideways to all the observers. In earlier studies in [2] and [3], we have found that this projection eliminated this effect and can deliver absolute perceived direction into the physical environment of the observer, in a similar way a human head does.

2. Applications

These interactional abilities using the projected head opens the possibility for several applications such as situated and multi-party dialogue, where the animated head can establish mutual gaze with one observer but not with the others, or can point into physical objects in the environment of the interaction partners.

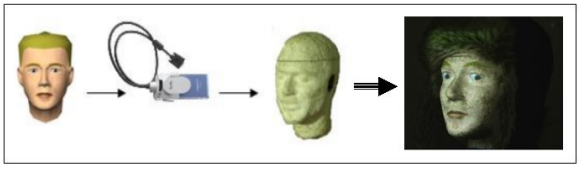

Figure 1: *The animated head on the left, projected using the Pico laser projector in the middle, on a static physical head model. The resulted projected face is shown on the right.*

Figure 2: *A snapshot of the animated agent back-projected on a three dimensional head model.*

These interactional abilities have been possible before with the use of physical robotics heads. However, mechanically controlled robotic faces are limited in design and control compared to virtual faces animated using computer graphics, where articulation, texture, size and design are flexible and easy to control. This paradigm, hence, gives an advantage over mechanically controlled heads in terms of design, perceived animation, maintenance, weight, and noise level, to count a few.

3. Acknowledgements

This work is carried out at KTH and supported by the European Commission project IURO (Interactive Urban Robot), grant agreement no. 248314.

4. References

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