Haptic Texture Authoring: A Demonstration

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Abstract. We present a haptic texture authoring algorithm for synthe-
sizing new virtual textures by manipulating affective properties of exist-
ing real textures. Two different spaces are established: "affective space"
built from a series of psychophysical experiments and "haptic model
space" built on features from tool-surface contact vibrations. Another
space, called "authoring space" is formed by merging the two spaces,
whereby, features of model space that were highly correlated with af-
fective space become axes of the space. Thus, new texture signal corre-
sponding to any point in authoring space can be synthesized by weighted
interpolation of nearest real surfaces in perceptually correct manner.

Keywords: Haptic Texture · Interpolation · Texture Perception · Tex-
ture Rendering · Psychophysics.

1 Introduction

In the field of texture perception, the relationship between visual perception and
physical characteristics of surfaces has received a high level of interest from the
research community, while, on the other hand, the relationship between tactile
perception and physical characteristics is a less trodden path. This can be ac-
credited to the difficulty in finding specific factors and characteristics of tactile
perception which can be controlled and manipulated independently. It is a well
known fact that vibrations originating from interaction with different surfaces
play a vital role in texture perception and identification. Various researchers
have successfully rendered virtual tactile sensations by reproducing vibrations
encountered during tactile interactions[3]. However, such studies did not succeed
in pointing out definitive characteristics that can be used to directly manipu-
late the perception or affective properties of textures. The process of directly
manipulating the affective properties is called as haptic texture authoring.

The main aim of haptic texture authoring is to provide a system where the
affective properties of textures are readily manipulated. This can be achieved if
a relationship is established between the physical properties of textures and its
affective properties. In this study, the physical properties are modelled using the
algorithm presented by Abdulali et al. in [1], whereas, the affective properties
are captured by following methods similar to [4]. In the current study, we strive
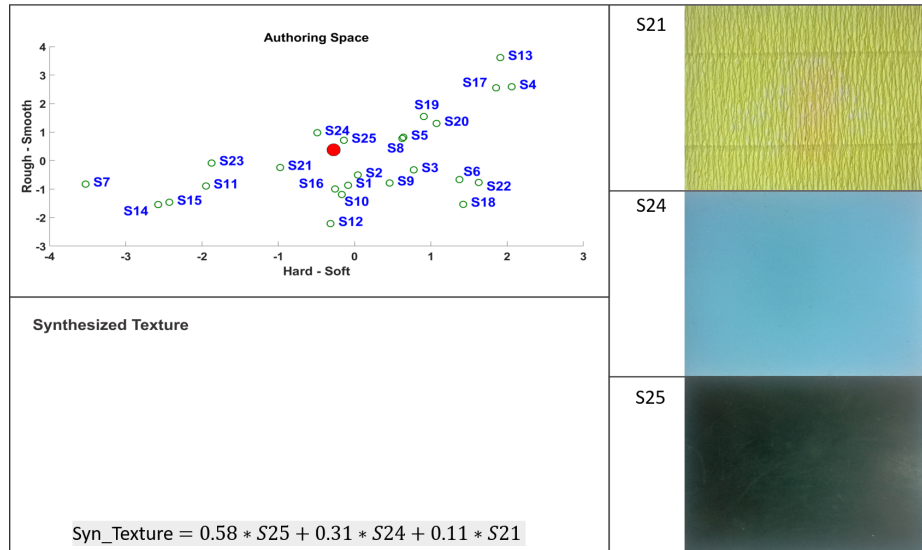
Fig. 1. A screen shot of the demonstration scenario for haptic texture authoring.

to find out this relationship, and then exploit it to alter the physical properties of surfaces by manipulating its affective properties.

In order to achieve haptic texture authoring, an affective space based on psychophysical experiments, and a haptic model space based on tool-surface interaction vibrations are established. Based on the relationship established between these two spaces an authoring space is established. Thus the authoring space inherits the physical properties and affective properties of textures. Creation of new haptic textures with user defined properties takes place by manipulating the affective properties which in turn changes the physical properties of surfaces. Rendering of the new virtual haptic textures is carried out using the method provided in [2].

2   Demonstration Scenario

The aim of this demonstration is to create various virtual textures with predefined affective properties. The user interface for the demonstration is shown in Fig.1. A user can select any value of the affective properties by clicking inside the authoring space (within the convex hull of the given textures). A new virtual texture having the specified affective properties will be generated on the screen by interpolating its neighbors. Users can also compare the newly created texture with its parent real textures. A video for this demonstration is available at `http://haptics.khu.ac.kr/Haptic_Texture_Authoring_AsiaHaptics2018.mp4` .

Acknowldegments

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