Non-photorealistic line-based rendering: A perceptual approach
Audrey Legeai, Gwenola Thomas, Joëlle Thollot

To cite this version:

HAL Id: inria-00526624
https://inria.hal.science/inria-00526624
Submitted on 20 Oct 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
We aim at rendering large 3D objects on mobile devices by means of strokes. Since mobile devices have small screens and limited resources, we should:

- prefer view-independent strokes to lower the C.P.U. load and to ensure temporal coherence.
- use a minimal set of relevant strokes to provide a legible depiction of the object.

1. WHAT KIND OF FEATURE LINES CAN WE EXTRACT FROM A 3D MODEL?

<table>
<thead>
<tr>
<th>Feature Lines</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silhouettes</td>
<td>Allow distinguishing the object from its environment.</td>
<td>View-dependent. Additional lines are needed.</td>
</tr>
<tr>
<td>Boundaries</td>
<td>Allow distinguishing the object from its environment.</td>
<td>View-independent. Additional lines are needed.</td>
</tr>
<tr>
<td>Crest Lines</td>
<td>Convey complementary information.</td>
<td>View-independent. Computation sensitive to noise.</td>
</tr>
</tbody>
</table>

Features conveyed by suggestive contours and crest lines are either redundant or complementary.
- We want to select among those lines the ones that are the most relevant.

2. WHAT DO WE PERCEIVE FROM SHAPES?

The response of linear neurons in early visual system may be modeled as the linear spatial summation of the intensity of light falling on their receptive field. [Petkov 97]

We can draw an analogy between the function of intensity on the receptive field and the intensities of a set of neighbour pixels within an image. Then, simulating the response of a grid of identical linear neurons to an image consists into convolving the receptive field function and the image function. The result is a response map. Response map resulting from different neurons simulation can be combined.

3. APPLICATIONS

We suggest to select the 3D lines whose location in image plane corresponds to the best perceived areas location. Our selection scheme:
- is independent on the type of lines and model representation,
- relies on very intuitive thresholds,
- allows preserving the 3D lines' connexity, which makes stylisation straightforward.

4. LIMITATIONS AND WORK IN PROGRESS

It is not clear yet what viewpoint, light model, or perception model we should use to proceed to the selection. In the future, we will investigate perceptual invariants under viewpoint change and light change so as to extract view-independent feature lines in accordance with perception.