Proposition de thèse de doctorat

Début : 2016-2017

Titre de la thèse : UndARstanding

Laboratoire : UMR 1563 AAU

Equipe : informatique - ECN

Localisation de la thèse : ECN et/ou ensa Nantes

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Description du sujet

The principle of augmented reality (AR) consists of inserting digital information (virtual images) onto real images (captured in real time from direct or indirect viewpoint). Adding this synthetic digital information must be made in a way that virtual images are registered with the real ones (it means that both the position and the orientation of the virtual camera must the same as for the real camera).
AR is generally divided between:

- Video see-through AR: where real images are shot by the camera of a device (tablet, phone, etc.) before being visualized through the screen of this device;
- Optical see-through AR: where digital information is directly displayed in front of the user's eyes onto a semi transparent screen (as in Google Glasses);
- SAR (Spatially Augmented Reality): digital information is projected onto the real environment.

When considering both Video see-through and Optical see-though AR questions arise as to how users "understand" or "perceive" the digital information that are being displayed. This subject has been relatively scarcely addressed in the literature, and mainly to study how distances are perceived in AR [SSE15].

The goal of this thesis is to study different perceptive biases induced by the display of 3D digital objects in AR applications:

- Depth perception (distance evaluation, spatial relations between real and virtual objects, etc.),
- Scale perception (relative size of objects),
- Importance of display fidelity (is photorealism important?),
- Are realistic lighting, shadowing etc. really important for AR applications?

All those aspects raise fundamental questions that relate to the way 3D digital objects are displayed in AR applications. Since those perceptive biases may have important impacts on AR applications, we propose to focus on a specific AR application which will serve as our benchmark to study the aforementioned phenomena: AR 3D labeling [MTM+].
A typical example of 3D AR labeling consists of displaying precisely located 3D information in an AR context (e.g. showing prices of flats in a building, etc.). This target application also provides the benefit of raising additional unsolved questions in terms of:

- Number of information to display in an AR context,
- Spatial and temporal coherence of the labels,
- Label density,
- Label positioning,

[MTM+] Madsen, J. ; Tatzgern, M. ; Madsen, C. ; Schmalstieg, D. & Kalkofen, D. (2016) Temporal coherence strategies for augmented reality labeling. To appear in Transactions on Visualization and Computer Graphics.
[SSE15] Swan, J.E ; Singh, G. & Ellis, S.R. (2015) Matching and Reaching Depth Judgments with Real and Augmented Reality Targets. Proc. ACM ISMAR, published in IEEE Transactions on Visualization and Computer Graphics 21(11) 1289-1298.

Compétences requises
MsC in computer science, computer vision