

Designing Device-less Interaction – A Tracking Framework for Media Art and Design

Michaela Honauer

Human-Computer Interaction Group, Faculty of Media, Bauhaus University Weimar

Abstract

This paper presents *KinectA*, a tracking application that employs depth-sensing technologies such as the Kinect Sensor. It supports receiving the basic information necessary for interaction without input devices and the interrelated process of, for example, designing gesture-based interfaces. The software offers simultaneous hand, skeleton and object tracking. Therefore, media artists and designers can focus on their creative work due to the availability of these basic tracking functions. KinectA is available for Mac and Windows, and communicates via *OSC* to other software or hardware.

1 Introduction

Interactive systems are often device-less and do not depend on input devices like mouse or keyboard. Thus, the demand of designing traditional *GUIs* (Graphical User Interface) seems to disappear from some computational niches (Seow et al., 2010). In particular, media designers and media artists are faced with new challenges regarding the creation of interactive applications, installations or performances that go beyond the desktop metaphor (Norman, 2010). Their field of work is always in flux and the need to make the computational world available for amateurs requires more technical skills than ever before.

The author was faced with similar problems during her work for an interactive shadow dance performance in 2011. We aimed at using the *Kinect Sensor* (abbreviated Kinect) as input device for dancers. But assessing the depth data requires some programming knowledge about the *SDKs* (Software Development Kit) that are available for the Kinect (cf. Goth, 2011). Therefore, we have developed *KinectA* as a tracking application that assists media artist and designers with their creative work. It enables them to easily access the basic depth information sensed through the Kinect.

2 Motivation for this Project

When we started our research in the beginning of 2011, there was no tracking software available that met the requirements of media artist and designers who want to realize projects with the Kinect technology. Most of the existing projects that use depth sensors such as the Kinect incorporate their own tracking concept, where the tracking methods are integrated into the final applications and not available separately (e.g. DeVincenzi et al., 2011). That means, they do not use an extra tracking software to access the depth data as shown in the middle of figure 1. This is especially relevant for media artists and designers, who often do not have sufficient programming skills for such advanced technical problems. They normally also prefer to concentrate their efforts on the creative application which is illustrated on the right side of figure 1.

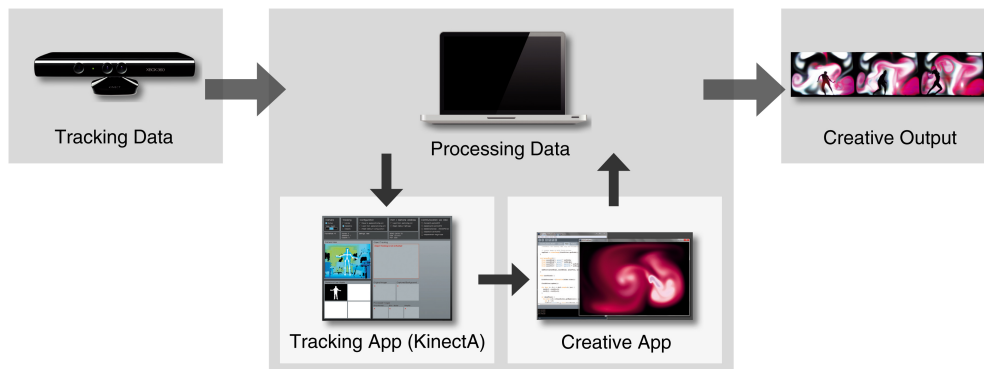


Figure 1: KinectA in the workflow of media artists and designers.

In contrast the main idea of KinectA is to provide a tracking application that is ready to run. This software is especially meant to meet the requirements of media artists or designers, and assists them in their creative work. For this user group it is important that they can choose between different tracking options (e.g. skeleton, hands or objects) depending on their individual project ideas. Furthermore, it is necessary for them to control the tracked data and to decide which information is involved in their creative processes.

Above all, we would like to encourage the discussion about device-less interaction modes and new device-less interfaces with our contribution. Terms like *Natural Interaction/ Natural User Interfaces* (cf. Goth, 2011 or Seow et al., 2010), *Multi-modal Interaction/ Multi-modal User Interfaces* (cf. Worsley et al., 2011), or *Gestural Interaction/ Gestural User Interfaces* (cf. Norman, 2010 or Saffer, 2009) are often used with reference to technologies that do not need any further equipment for the input. It is interesting for us what other researchers think about these ideas, how potential users perceive these interaction modes and how they handle the technology.

3 The Main Features

In order to connect the Kinect Sensor to a computer three major frameworks exist. These are the *Microsoft Kinect for Windows SDK*, the *libfreenect* wrapper of the OpenKinect Community and the *OpenNI* framework. KinectA is built on the OpenNI (Open Natural Interaction) framework because this driver offers hand and skeleton tracking. In addition, it is focused on the hardware access to the main operating systems Mac OSX, Linux and Windows. In contrast, Microsoft's framework runs only on Windows-based systems and the open source solution of the OpenKinect Community does not contain higher-level solutions like skeleton tracking.

KinectA supports skeleton tracking (see figure 2), three-dimensional object tracking (see figure 3), and it provides a simple hand tracking feature (see figure 2). It is possible to run all tracking modes simultaneously. For instance, skeleton and hand tracking are both activated in figure 2. The number of simultaneously tracked items is limited for reasons of computer performance: KinectA can track in sum eight hands, four skeletons and 20 objects at the same time. The basic settings contain options such as activating the camera and changing between depth, infrared and no view. By default the depth view is on.

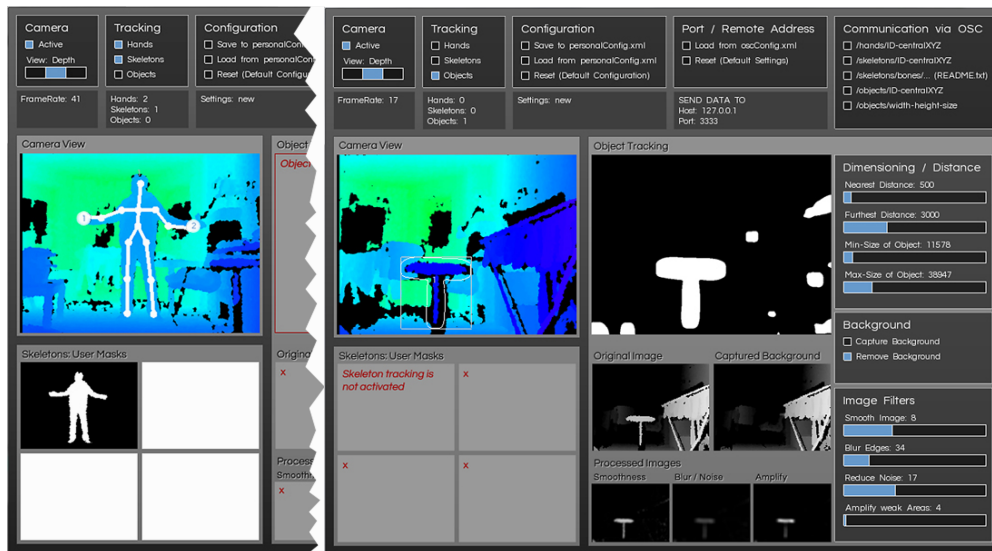


Figure 2: Skeleton and hand tracking are combined. (Note - Besides the settings for OSC communication, no additional information are provided on the cropped side of this screenshot.)

Figure 3: Object tracking enables to define the optimal distance and size of objects for a specific scenario. Background subtraction is shown in the middle. Afterwards only new objects are considered. In addition, this tracking mode provides image filters for smoothing, blurring, and noise-reduction.

4 Gestural Interaction Scenarios

The following examples are realized with KinectA as a proxy for the Kinect depth data:

- The first application is for kids and shows cute forest animals walking through a scene. It is based on the hand tracking feature. If children hold their hand up quietly, the animals walk towards them as a kind of gratification.
- The second scenario shows a puppet if a user enters the tracking area. It is implemented via skeleton tracking that can easily be used for displaying avatars.
- The final example is an extract of an interactive shadow dance performance that creates a spotlight around the dancer. It is based on object tracking, simply using the dimensions (width and height) of the dancer's silhouette. The final output draws an ellipse that dynamically changes its dimensions.

5 Closing Remarks

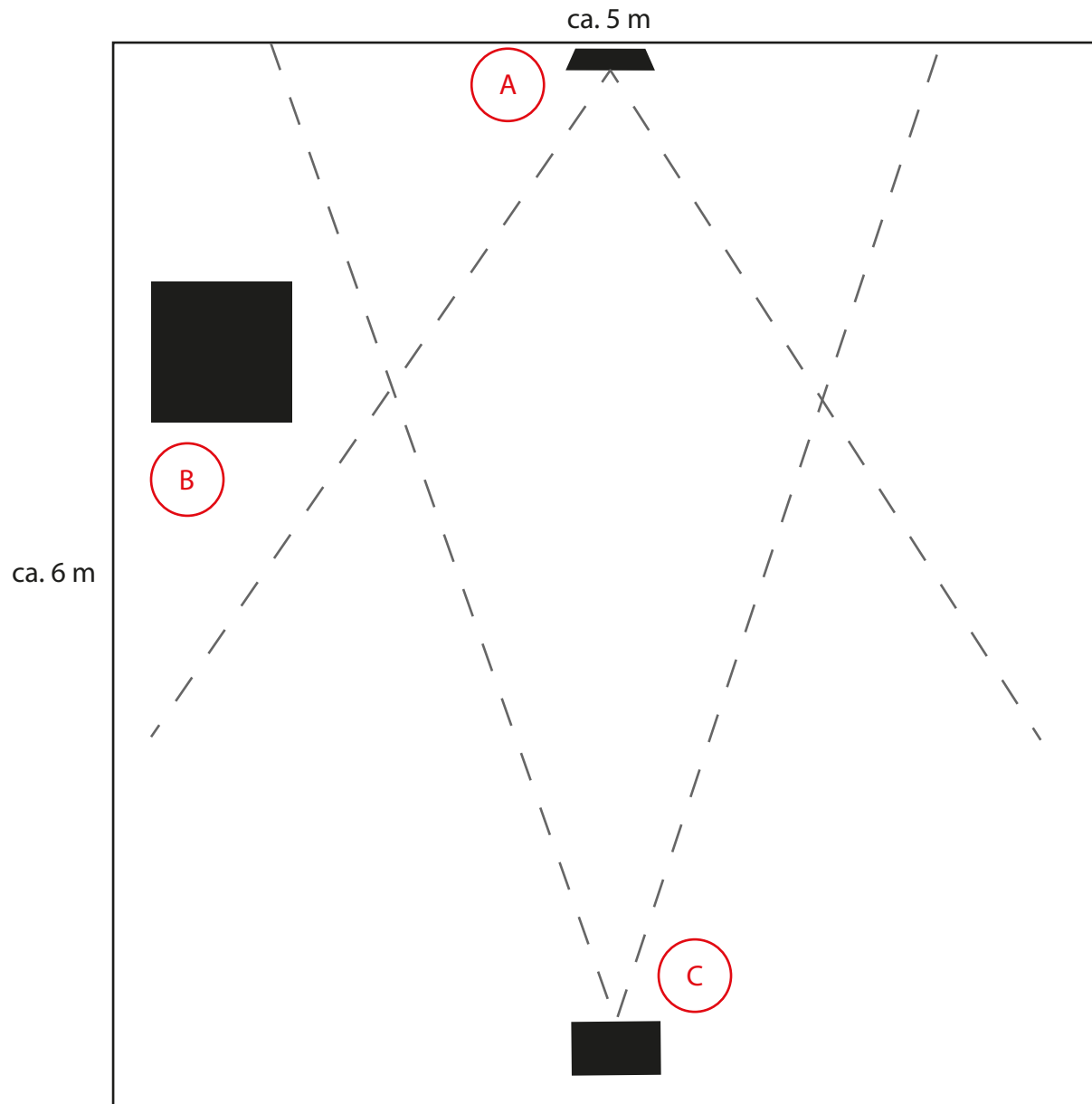
During the interactive demonstration at the conference, visitors get the opportunity to experience how KinectA is integrated in the creative process of media artist and designers. We run at least two of the described scenarios for testing purposes and explain in detail the main features of our tracking application.

Acknowledgements

Special thanks go to Jens Geelhaar and Michael Markert who supervised my master thesis.

References

- DeVincenzi, A. Yao, L., Ishii, H., Raskar, R. (2011). Kinected Conference: Augmenting Video Imaging with Calibrated Depth and Audio. *CSCW '11 Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work*, 621-624.
- Goth, Gregory (2011). Brave NUI World. *Communications of the ACM*, 54(12), 14-16.
- Norman, Donald A. (2010). Natural User Interfaces Are Not Natural. *Interactions*, 17(3), 6-10.
- Saffer, D. (2009). *Designing Gestural Interfaces*. Sebastopol: O'Reilly Media.
- Seow, S. C., Wixon, D., Morrison, A., Jacucci, G. (2010). Natural User Interfaces: The Prospect and Challenge of Touch and Gestural Computing. *CHI '10 Extended Abstracts on Human Factors in Computing Systems*, 4453-4456.
- Worsley, M., Johnston, M., Blikstein, P. (2011) OpenGesture: a Low-Cost Authoring Framework for Gesture and Speech Based Application Development and Learning Analytics. *IDC '11 Proceedings of the 10th International Conference on Interaction Design and Children*, 254-256.



„Designing Device-less Interaction – A Tracking Framework for Media Art and Design“

Demo-Datenblatt für die interaktive Demonstration von KinectA

an Punkt A wird benötigt

- Projektionsfläche/ weiße Wand
- 1 x Stromanschluss

an Punkt B wird benötigt

- Tisch, auf dem mindestens 2 Laptops gut Platz haben
- Sitzgelegenheiten, falls Tisch nicht zum Stehen geeignet
- kleine Lichtquelle/ Schreibtischlampe
- Pinnwand/ Möglichkeit Informationsmaterial anzubringen
- 2 x Stromanschluss

an Punkt C wird benötigt

- Beamer mit VGA- oder DVI-Kabel (mind. 5m lang) auf Stativ
- 1 x Stromanschluss

Außerdem wird benötigt

- Tape zum Fixieren von Kabeln
- Möglichkeit den Raum abzudunkeln
- 2 Stromverlängerungskabel (3-5m)
- 2 Stromverteilerdosen (3er)