Designing for MDE:s

Designing for Collaborative Co-Located Multi-Display Environments

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Summary & Learning goals

The students are introduced to using the taxonomy for MDE: in practice.

Learning goals:

- Recognize Topology, Coupling and Interaction as aspects for design of collaborative technology in MDE:s
- Analyze Topology, Coupling and Interaction as aspects for design of collaborative technology in MDE contexts.
- Reflect on Topology, Coupling and Interaction as aspects for design of MDE:s and the framework's potential as a tool for ideation.

Recommended readings

- F. Garcia-Sanjuan, J. Jaen and V. Nacher, Toward a General Conceptualization of Multi-Display Environments, Frontiers in ICT 2016 Vol. 3, https://www.frontiersin.org/article/10.3389/fict.2016.00020

Exercise

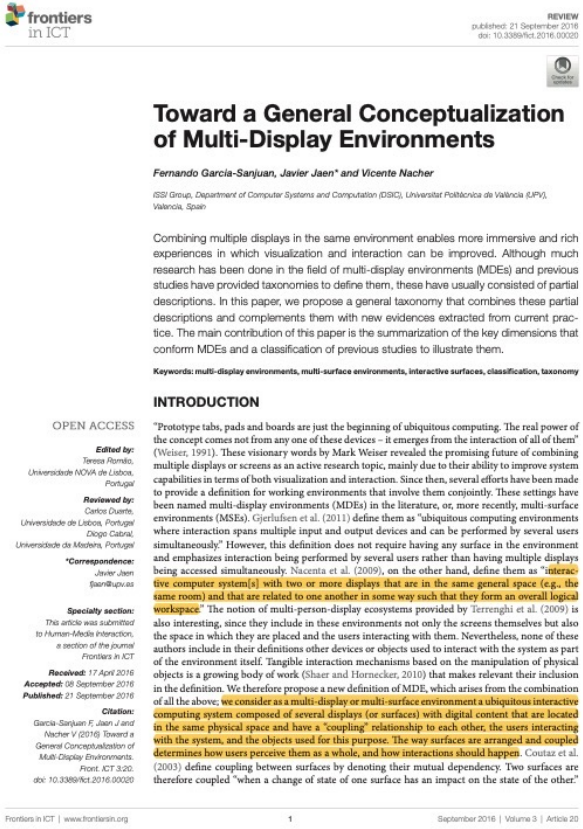
- Select an application you are working on or some other collaborative software you find interesting.
- Think of what a multi-display version of the system could be like and in what situations it would be useful
  - Try to come up with several ideas!
- Make sketches of your solutions and try to come up with a usage scenario

Exercise

- Go back to the taxonomy for Multi-Display Environments and try to describe your solution using the terms from the taxonomy.
  - E.g., is it homogenous or heterogenous?,
  - Foot or yard sized?
  - etc
- If there's time left, pick some other dimensions from the taxonomy and try to come up with a solution that fits those.
  - E.g., if your first solution is yard-sized make a foot version
  - If it was regular, make an irregular design
  - etc

Mapping out Multi-Display Environments (MDE:s)

- General description of MDE:s along 3 perspectives
- Topology
- Coupling
- Interaction



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Toward a General Conceptualization of Multi-Display Environments

Fernando García-Sanjuan, Javier Jaen and Vicente Nacher*

iSSI Group, Department of Computer Systems and Computation (DSIC), Universitat Politècnica de València (UPV), Valencia, Spain

Combining multiple displays in the same environment enables more immersive and rich experiences in which visualization and interaction can be improved. Although much research has been done in the field of multi-display environments (MDEs) and previous studies have provided taxonomies to define them, these have usually consisted of partial descriptions. In this paper, we propose a general taxonomy that combines these partial descriptions and complements them with new evidences extracted from current practice. The main contribution of this paper is the summarization of the key dimensions that conform MDEs and a classification of previous studies to illustrate them.

Keywords: multi-display environments, multi-surface environments, interactive surfaces, classification, taxonomy

INTRODUCTION

"Prototype tabs, pads and boards are just the beginning of ubiquitous computing. The real power of the concept comes not from any one of these devices – it emerges from the interaction of all of them" (Weiser, 1991). These visionary words by Mark Weiser revealed the promising future of combining multiple displays or screens as an active research topic, mainly due to their ability to improve system capabilities in terms of both visualization and interaction. Since then, several efforts have been made to provide a definition for working environments that involve them conjointly. These settings have been named multi-display environments (MDEs) in the literature, or, more recently, multi-surface environments (MSEs). Gjerlufsen et al. (2011) define them as "ubiquitous computing environments where interaction spans multiple input and output devices and can be performed by several users simultaneously." However, this definition does not require having any surface in the environment and emphasizes interaction being performed by several users rather than having multiple displays being accessed simultaneously. Nacenta et al. (2009), on the other hand, define them as "interactive computer system[s] with two or more displays that are in the same general space (e.g., the same room) and that are related to one another in some way such that they form an overall logical workspace." The notion of multi-person-display ecosystems provided by Terrenghi et al. (2009) is also interesting, since they include in these environments not only the screens themselves but also the space in which they are placed and the users interacting with them. Nevertheless, none of these authors include in their definitions other devices or objects used to interact with the system as part of the environment itself. Tangible interaction mechanisms based on the manipulation of physical objects is a growing body of work (Shaer and Hornecker, 2010) that makes relevant their inclusion in the definition. We therefore propose a new definition of MDE, which arises from the combination of all the above; we consider as a multi-display or multi-surface environment a ubiquitous interactive computing system composed of several displays (or surfaces) with digital content that are located in the same physical space and have a "coupling" relationship to each other, the users interacting with the system, and the objects used for this purpose. The way surfaces are arranged and coupled determines how users perceive them as a whole, and how interactions should happen. Coutaz et al. (2003) define coupling between surfaces by denoting their mutual dependency. Two surfaces are therefore coupled "when a change of state of one surface has an impact on the state of the other."

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Edited by:
Teresa Romão,
Universidade NOVA de Lisboa, Portugal

Reviewed by:
Carlos Duarte,
Universidade de Lisboa, Portugal
Diogo Cabral,
Universidade da Madeira, Portugal

****Correspondence:***
Javier Jaen
fjaen@upv.es

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Topology Perspective

Describes the dimensions relative to the physical appearance of the MDE.

- HOMOGENEITY – *homogeneous*, *heterogeneous*
- *SPATIAL FORM – planar, volumetric*
- SHAPE REGULARITY – *regular, irregular*
- SIZE – *inch, foot, yard, perch, chain*
- MOBILITY – *fixed, mobile*
- SCALABILITY – *bounded, unbounded*

Coupling Perspective

- CREATION - *implicit, manual, assisted, automatic*
- MUTABILITY – *static, dynamic*
- LOGICAL VIEW – *discrete, redundant, extended-continuous, extended-discontinuous*
- PRIVACY - *private, personal, public*

Interaction Perspective

Describes the available interaction modes once the devices have been organized and couple together

- INTERACTION AVAILABILITY – *inexistent, partial, total*
- INPUT DIRECTNESS – *direct, indirect*
- INTERACTION MEDIUM – *on-device, around-device*
- INTERACTION INSTRUMENTS - *body-based, surface-based, tangible*
  - tangible includes e.g., mice and keyboards
- INPUT CONTINUITY – *punctual, gestural*

Examples

- homogeneous, planar, irregular, yard topology

- heterogeneous, volumetric, regular, and perch topology, with redundant logical view

References

- F. Garcia-Sanjuan, J. Jaen and V. Nacher, Toward a General Conceptualization of Multi-Display Environments, Frontiers in ICT 2016 Vol. 3, https://www.frontiersin.org/article/10.3389/fict.2016.00020

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