Functional Analysis of Haptic Devices

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Introduction

Gesture is a very versatile phenomenon



• There are many different Haptic Devices



• There are many applications of Haptics / Haptic Devices











• The particularity of Haptics is the Mechanical Coupling between the Human and the (manipulated) Object

Natural situation



• The particularity of Haptics is the Mechanical Coupling between the Human and the (manipulated) Object





Object-based functional approach



Object-Based functional approach



- Observation of the Object as a separate object
- The Haptic Device is part of the Object in the mediated situation

Examples:

- Transparency [D. Lawrence et al.]
- Passivity [E. Colgate et al.]

Human-based functional approach



Human-based functional approach



- Symmetrical of the Object-based approach
- Related to the field of psychophysics
- Two complementary positions:
 - 1. The Haptic Device is a new mean to study the human sensorymotricity
 - 2. The mediated situation is a new situation for the Human

Interaction-based functional approach



Interaction-based functional approach





- Observation of the particular phenomena emerging from the coupling
- No dissociation of the connection H-O
- The approach the mostly related to Enaction Examples
- Instrumental playing
- Dynamics-based multisensory simulation



Task-based functional approach



Task-based functional approach



Task-based approach: Environment/Immersion



- The line of mobility is *between* H and E
- Mediated situation = immersive situation: a part of the Human body is situated inside the VE
- Need of a high transparency

Example: Exoskeletons, locomotion devices





Task-based approach: Tool / Command



- Vis-à-vis situations (no immersion)
- Involves an intermediate object between H and E
- A part of the Haptic Device is located in the Real World, while the other part is in the VE
- No need for high transparency

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Task-based approach: Object



- Line of Mobility situated between H and O
- Limit of the VE is concomitant with the limit of O → the Haptic device must present very particular properties
- Example: FEELEX, VOLFLEX, rheological devices





Conclusion

- Typology based on the functional properties of Haptic Devices and research works
- Four approaches:
 - Object
 - Human
 - Interaction
 - Task

•Environment / Immersion

- •Command
- Object manipulation

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SEPARATED TECHNOLOGICAL AREAS



Thanks for your attention!