

Multi-Device Interaction

Pierre Dragicevic

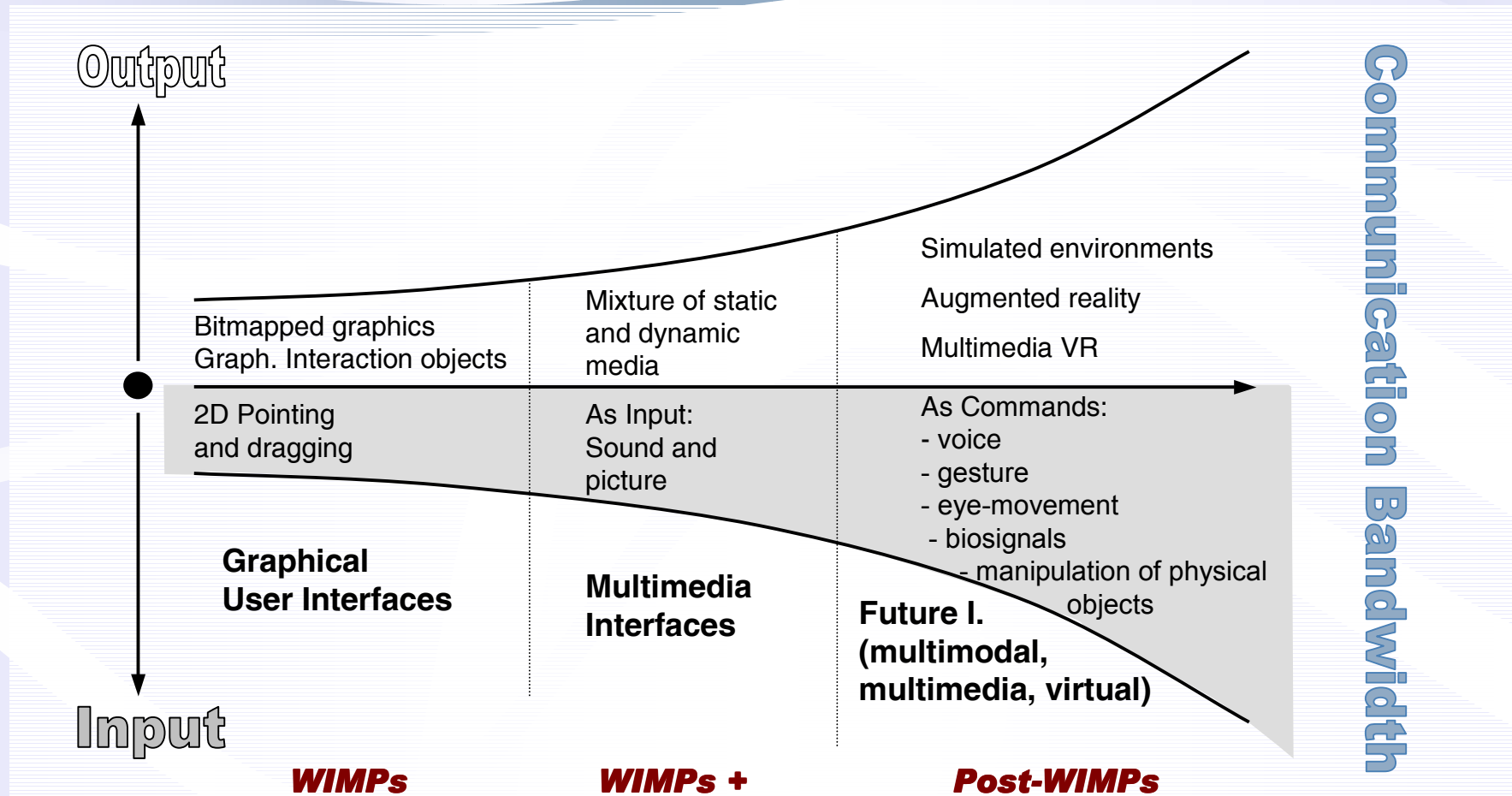
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***Ecole des Mines of
Nantes***

Generations of User Interfaces



Adapted from Jürgen Ziegler

Input Device Integration

- **There is no easy way to integrate**
 - New devices
 - New interaction styles
- **...Into existing**
 - Applications
 - Toolkits
 - Systems

Why Is Easy Device Integration So Important ?

- **User's abilities**

- Common skills: *writing,...*
- Special skills: *cartoonist, puppet animator,...*

- **User's constraints**

- Disabilities: *hearing, motor,...*

- **Working environment opportunities**

- Input rich: *multimedia, multimodal,...*

- **Working environment constraints**

- Input limited: *noisy environment, small footprint, one-hand control,...*

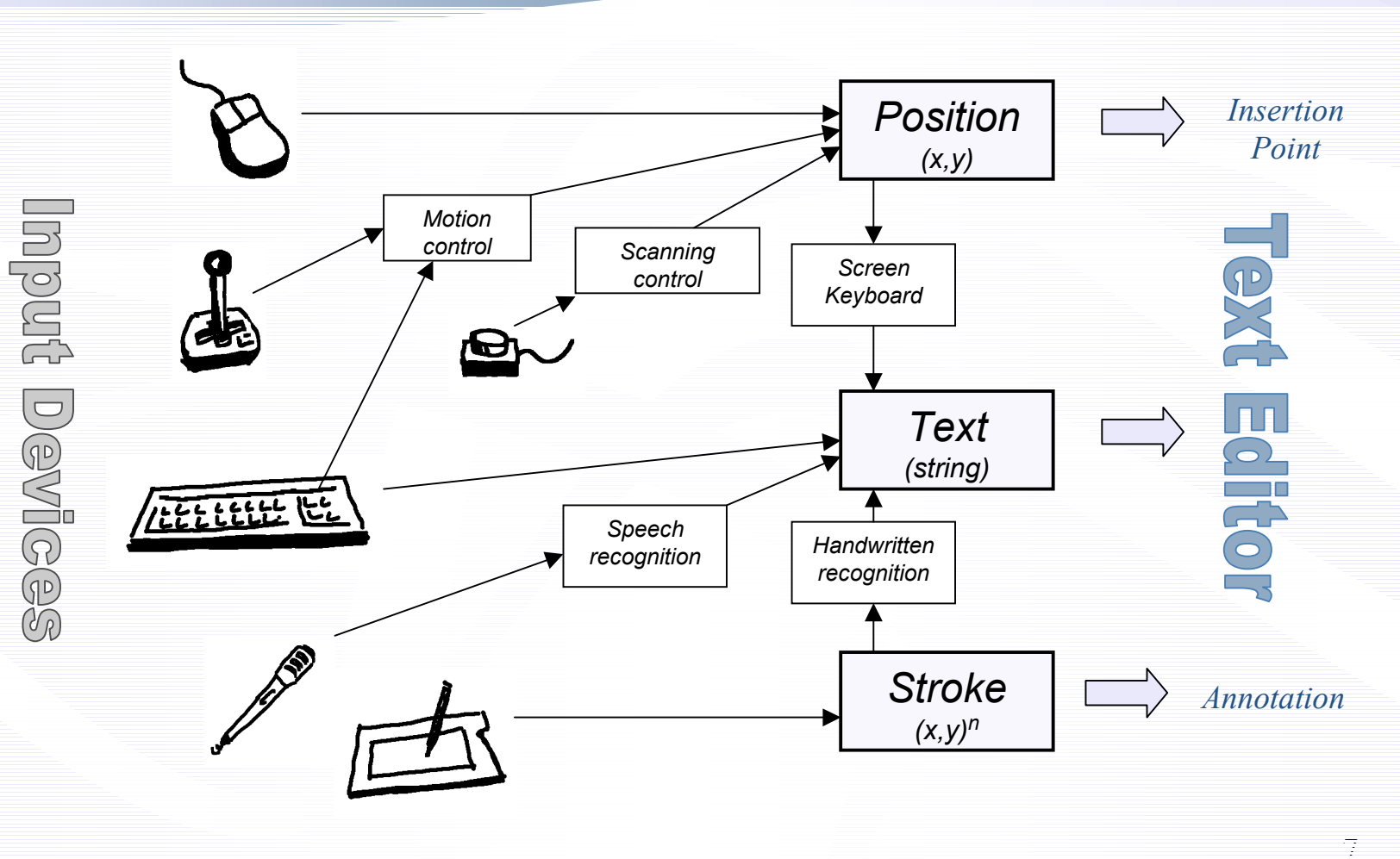
What We Currently Need

- **A good description of the application's demands**
- **A good description of what an input device is able to provide**
- **An efficient tool that helps to connect them together**

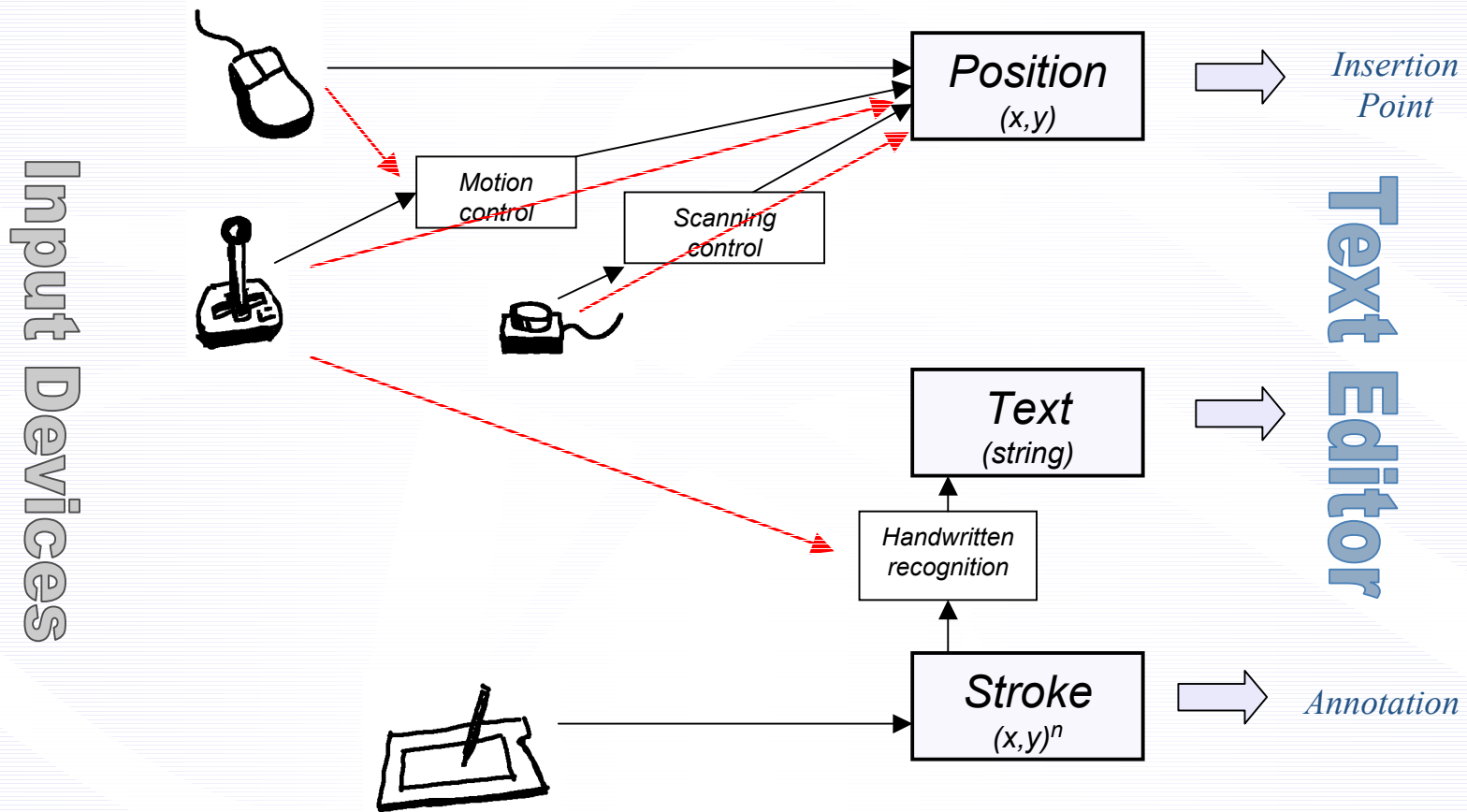
Our Work

- **Building an “input management toolkit” for multi-device interaction**
- **Designing interaction techniques that rely on this toolkit**
- **Integrating it in several systems to show its effectiveness**

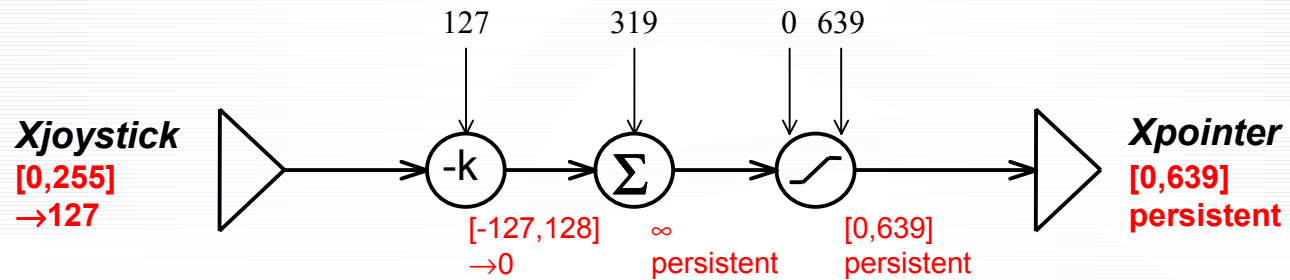
Choosing Interaction Techniques



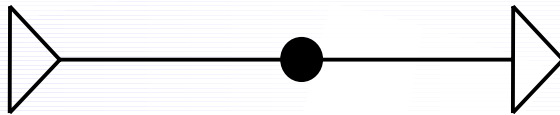
Choosing Interaction Techniques



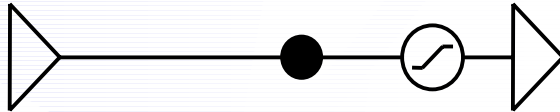
Matching Pre- and Post-Conditions



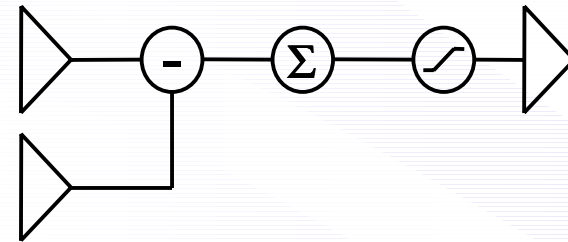
Xdigitizer
persistent



Xmouse
∞
persistent

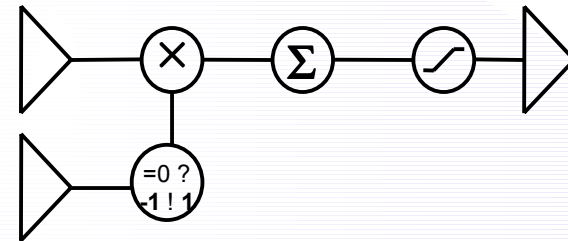


Button1
[0,1]
→0

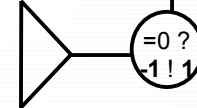


Button2
[0,1]
→0

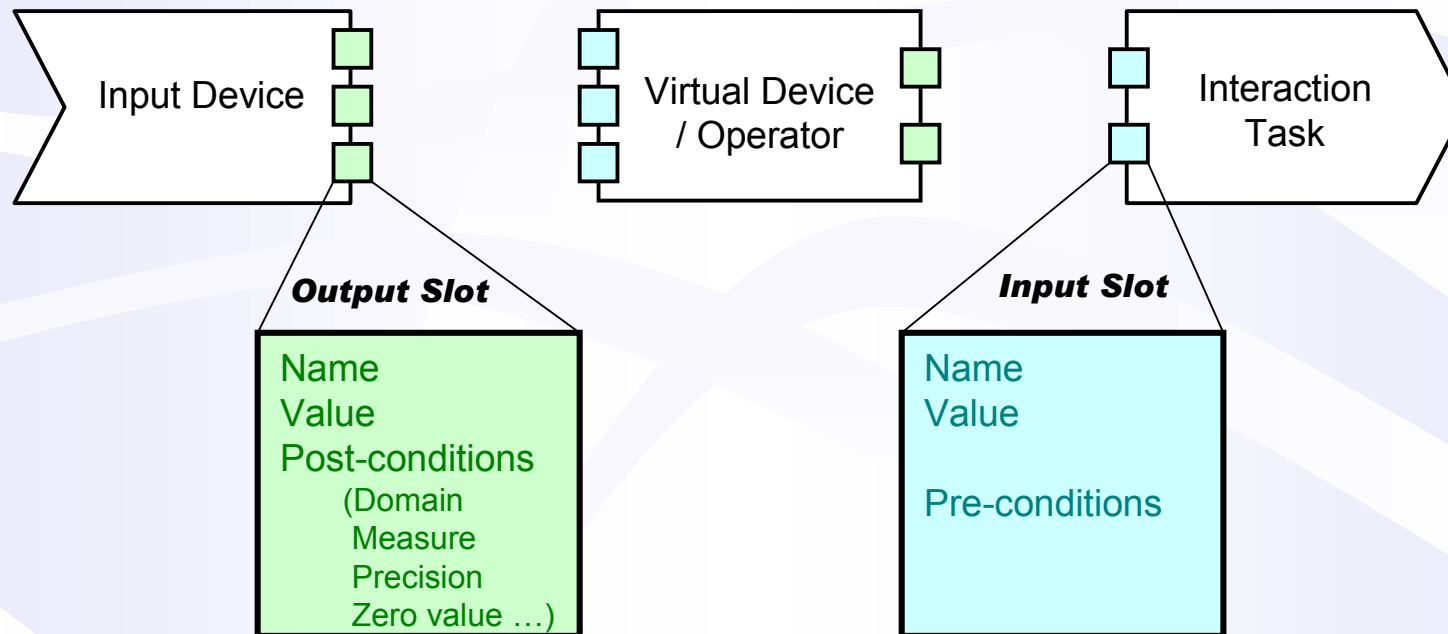
Pressure
[0,255]
→0



Button
[0,1]
→0



Building Blocks for Input Constructions



Building Blocks are Reactive Programs

- **Event-driven**
- **Deterministic**
- **Executable**
- **Verifiable (lots of support tools)**

Esterel / SugarCubes Implementation

- **Esterel**
 - Has the right semantics for describing concurrent reactive processes
 - Can be used to verify temporal and reachability properties
 - Can be compiled and executed
- **SugarCubes**
 - Provides a set of Java Classes for implementing threadless concurrent reactive systems
 - Has a semantics close to Esterel
 - Allows dynamic description of reactive modules
 - Is Interpreted

Performed Work

- **Study of a device model based on physical and transducer levels, with data/properties processing operators** [Dragicevic 98]
- **Study of reactive scripting of input behavior by using Esterel to implement interactors** [Fekete, Richard, Dragicevic 98]

Ongoing Work

- **Creation of input constructions with the SugarCubes toolkit**

Future Work

- **Write a first prototype of the “Input Management Toolkit” (January '99)**
 - Find a good device/interaction task description
 - Define & implement connection mechanisms
 - Provide a set of processing operators and customizable interaction techniques
- **Integrate it in several systems**
 - Multimodal CAD system
 - Musical score editor
 - Larger size applications