Model-based Design of Multimodal Interaction for Augmented Reality Web Applications

The Augmented “Drag-and-Drop”

Sebastian Feuerstack, Állan C. M. de Oliveira, Mauro dos Santos Anjo, Regina B. Araujo, and Ednaldo B. Pizzolato
2 Overall Research Question

How to model interactions that span Modes and Media?

http://www.multi-access.de
3 Multimodal Interfaces

Which **Media** ?

Which **Modes** ?

http://flic.kr/p/6eeLwg

http://flic.kr/p/7sZ6ho

http://flic.kr/p/6eeLwg
4 Interaction Resources

How?

Interaction Resources
Why modeling?

- One specification that
  - is declarative and exact
    - discuss & execute & store & share
  - add new forms of interaction
    - no code but model changes
6 Related Work

![Diagram showing related work in AR/3DUI and Multimodal]

- **Authoring for End-Users**
  - BuildAR
  - Kharma

- **Authoring for Developers**
  - APRIL
  - DART
  - Open Interface
  - Morgan

- **Modeling**
  - MINT

- **Components**
  - Frameworks
    - Studierstube
  - Toolkit
    - ARToolkit - Flartoollkit

- **Abstraction**

- **Code**

---

OFFIS-Institute for Information Technology

22.06.2015
7 Use Case: Augmented Drag and Drop

- Buying Furniture
- Shopping Cart
- Drag and Drop
- Into my environment
8 How to model?

- Cameleon Reference Framework
- W3C MBUI
  - Task Model
  - Abstract UI
- Custom
  - Interaction Resources
  - Mappings
9 Abstract User Interface Model
10 Abstract User Interface Model

Structure: AUI

- **Interactor**
  - prev
  - next
  - context

- **AIO**
  - label
  - parent
  - child
  - 0..n

- **AIIN**
- **AINDiscrete**
- **AIC**

- **AIOUT**
- **AIOUTDiscrete**
- **AIOUTContinuous**

- **AIReference**
- **AIChoice Element**
- **AICommand**
- **AIChoice**
- **AIRealityFrame**

- **AISingleChoiceElement**
- **AIMultiChoiceElement**
- **AISingleChoice**
- **AIMultiChoice**

Select your products:
- **Coffee Maker**  Price: $800 Reais
- **Vacuum Flask**  Price: $100 Reais
- **Palm Tree**  Price: $50 Reais
- **Table Lamp**  Price: $300 Reais
11 Abstract Behavior Model

AUI:AIO:AIChoiceElement: AISingleChoiceElement

- **Presenting**
  - **listed**
  - **dragging**
  - **focused**

- **Selection**
  - **unchosen**
  - **chosen**

Reality Frame: Activate
Select your products

- **Coffee Maker**
  - Price: $800 Reais
- **Vacuum Flask**
  - Price: $100 Reais
- **Palm Tree**
  - Price: $50 Reais
- **Table Lamp**
  - Price: $300 Reais

Functionality:
- `aios=find(parent.childs.chosen)`
- `aios.all.unchoose`
- `next||prev||parent / aio=find(act); aio.focus`
- `[in(focused)] choose / aios=find(parent.childs.chosen); aios.all.unchoose`
12 Multimodal Mapping: The Mouse-based Drag-and-Drop

IR:IN:Mouse

Mouse

Wheel - z

Button

IR:IN:Pointer

Stopped

Pointed

Stop

Moving

IR:IN:Button

Released

Press

Pressed

C

T_w<0,3s

sc=SingleChoiceElement.focused

LeftButton.pressed

LeftButton.released

sc.drag

dst=SingleChoice.focused

dst.drop(aios)

c.parent.drop

Tw<0,3s

fail
Hand Gesture Resource Interactor

IR:IN:HandGesture:PointingSelect

NoLeftHand
left_hand_appeared
left_hand_disappeared

Left Hand

Pointing
stopped

moving

move

move

stop

NoRightHand
right_hand_appeared
right_hand_disappeared

Right Hand

Command

selected

released

thumb_up

thumb_down

BothHands

left_hand_appeared

right_hand_appeared

left_hand_disappeared

right_hand_disappeared

NoHands

left_hand_appeared

right_hand_appeared

right_hand_disappeared

left_hand_disappeared

C
RightHand.cmd.selected
sc=SingleChoice.focused

Tw<0,3s

C

dst=SingleChoice.focused

aois.drag

RightHand.cmd.released

Tw<0,3s

dst.drop(aios)
Video: Connecting the Web with AR
Conclusions & Future Work

- Detailed, declarative modeling of multimodal interactions
- We can combine modes and media by mappings and bridge realities
- All models are interpreted and can be changed while running
  - What`s still missing is a tool / editor
- We intend to contribute to
  - W3C-MMI WG
  - W3C Ubiquitous Application Design CG
Questions?

Thanks for your attention

Sebastian Feuerstack
feuerstack@offis.de