Towards explicit physical object referencing with Virtual Characters

Michael Kruppa, AI-Lab Professor Wahlster, Saarland University

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- Object references in physical worlds

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  - Different technologies to support different referencing methods
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Motivation

Object references in virtual worlds

- Virt...

- It is ... focus in a ... be cons...

- In v... a real ... obje... ...ally)

Character taken from: Lester et. al., Cosmo: A Life-like Animated Pedagogical Agent with Deictic Believability, In Proc. of the IJCAI- 97 Workshop on Animated Interface Agents: Making them Intelligent, Nagoya, 1997
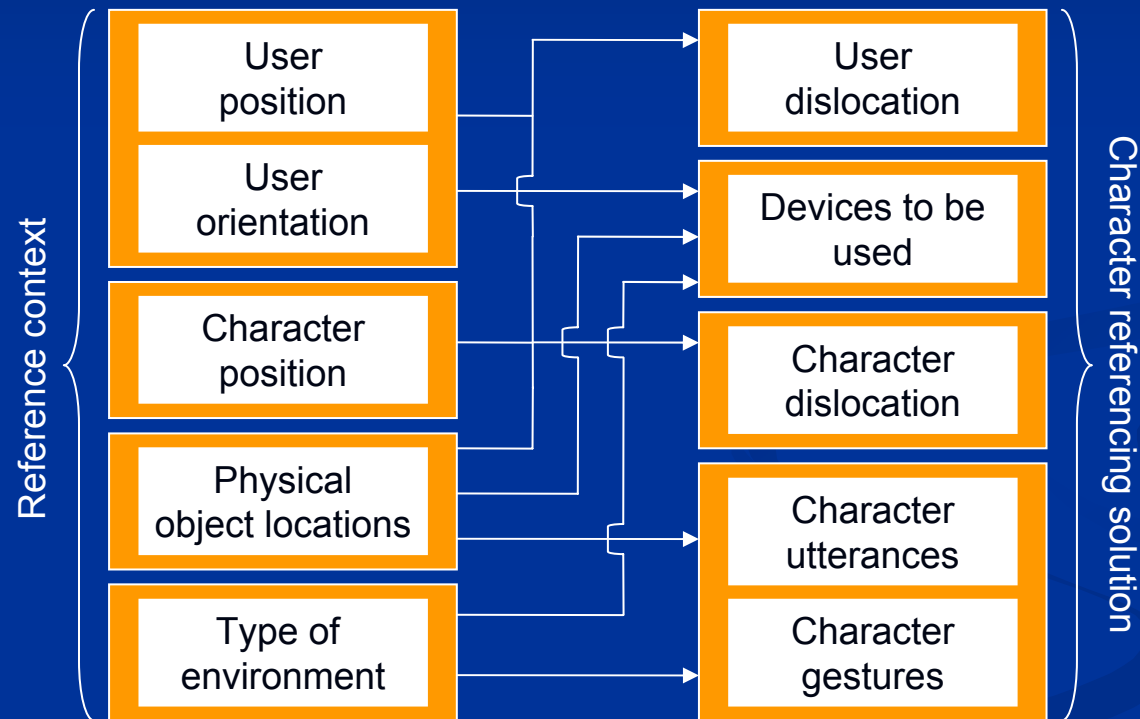
Object references in physical worlds

- Physical objects may be highlighted with spotlights
- Physical objects may be equipped with unique numbers for identification
- Physical objects may be referenced verbally

- Problems and limitations:
  - sometimes, a particular technology may not be available or may not be used for some reason
  - the spatial location of objects may limit the number of technologies to highlight the object
  - depending on the relative positions of different objects to each other, verbal references may be ambiguous

Physical object references with virtual characters

- Virtual characters have proven to succesfully disambiguate references to objects in virtual 3D worlds (e.g. Cosmo)

- Virtual characters may refer to objects the same way, humans refer to objects (i.e. moving towards the object, pointing at it or describing ist features and location)

- Depending on the given situation, a virtual character may perform many different actions in order to disambiguate a reference to a physical object

- Virtual character may perform references to both virtual and physical objects in a consistent manner
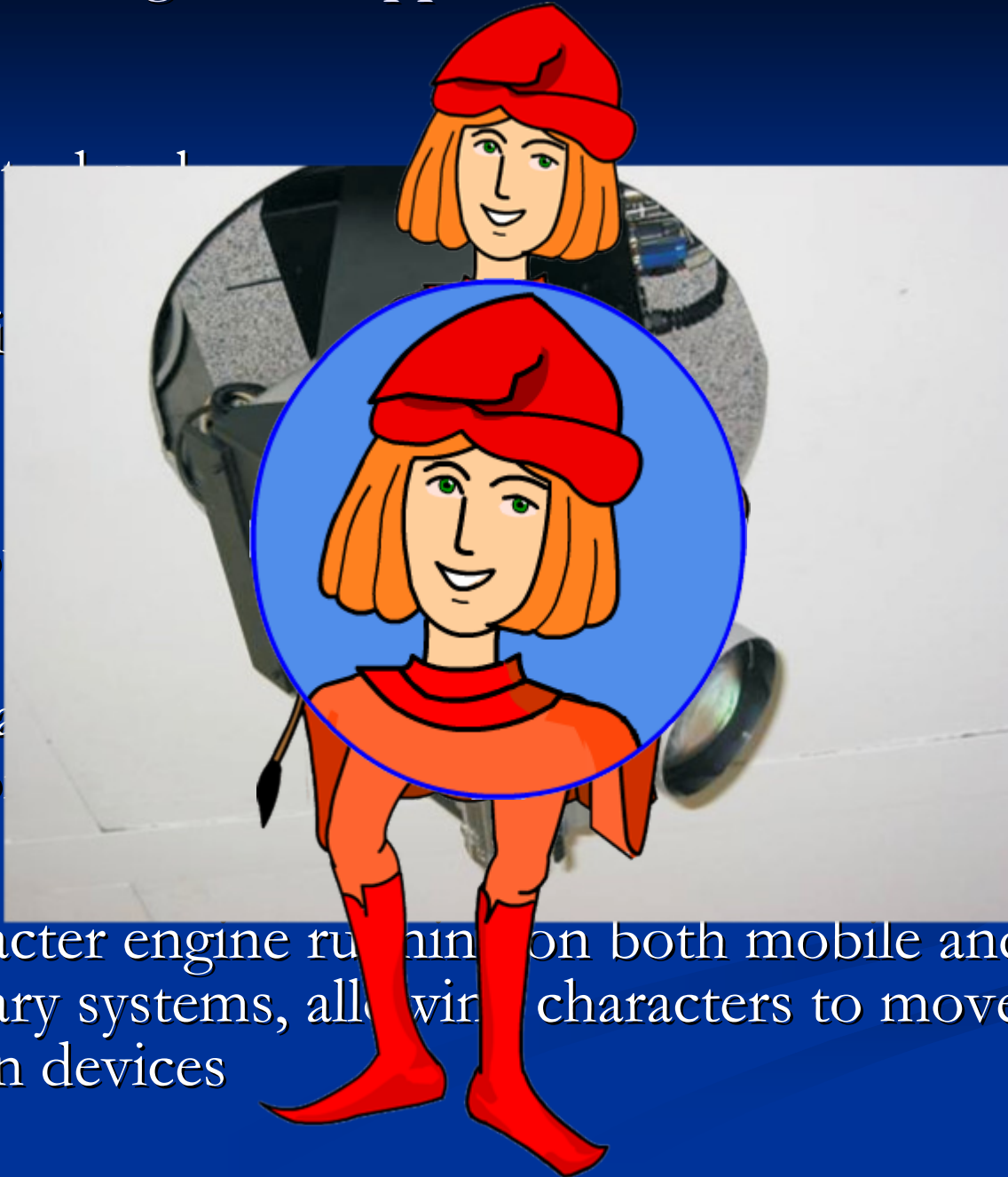
What may influence the way a character performs a reference?

Different technologies to support different referencing methods

Available t...

- A mobi...

- Several ... large scale to ... ...)

- A steer... undisto...

- A character engine ru...in...on both mobile and stationary systems, all...wir...characters to move between devices

Different technologies to support different referencing methods

Limitations:

- Spoken references may be ambiguous

- It is probably impossible to support each method at each location

- Different social setups may demand a different referencing solution

- Personal preferences may limit the use of specfic technology in certain situations
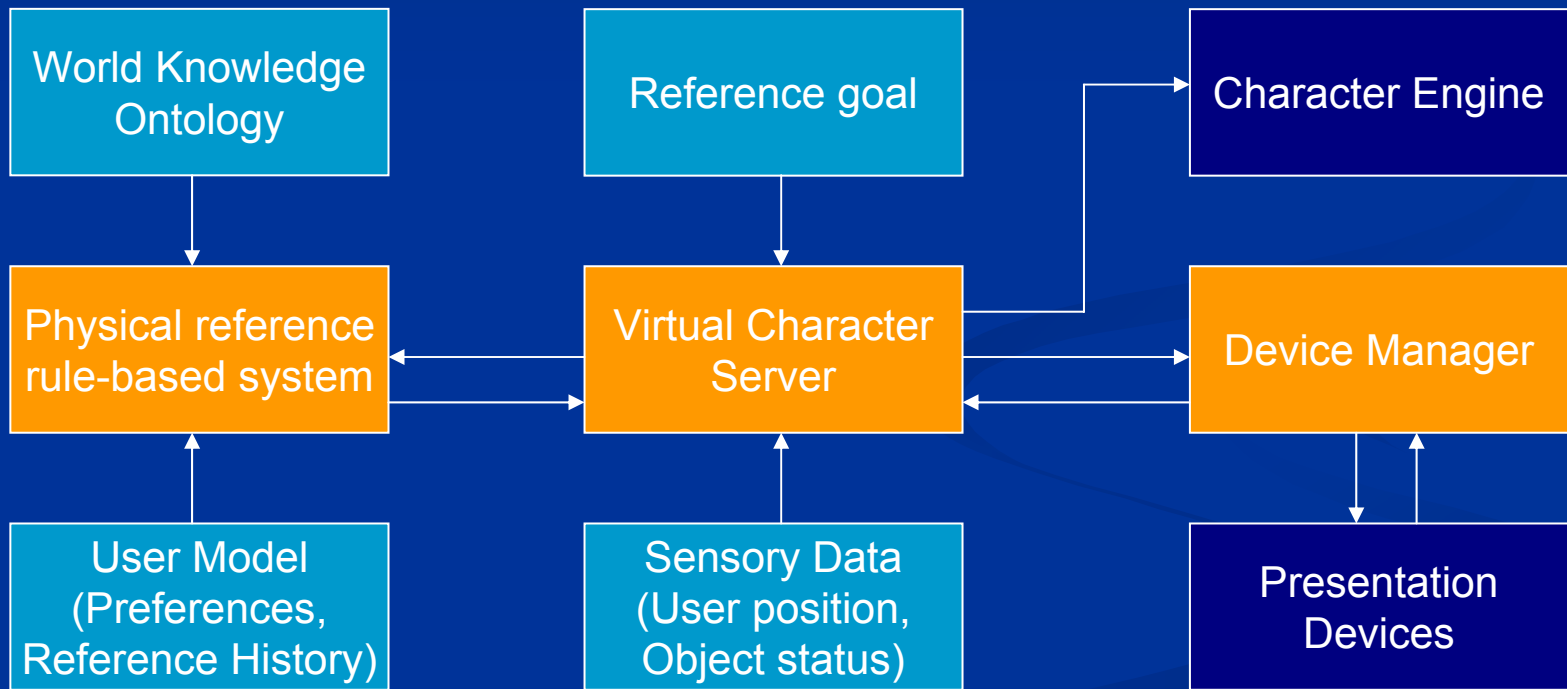
A rule based system to determine the best referencing solution

The idea:

- For each situation determine the best referencing solution by taking into account:

  - the calculated probability of a certain reference to be ambiguous
  - the spatial context of the user (i.e. position, location, environment)
  - the available technology at the given location
  - the status of the available technology
  - the social setup of the situation
  - the personal user preferences

A rule based system to determine the best referencing solution

System setup:

A rule based system to determine the best referencing solution

* Virtual Character

Reali

```
(defrule us
  (object
  ?user <-

  =>
  (bind ?te
  (if (> ?1
    (print
    (print
    (print
    (print
    (print

    (print
  else
    (modify
  )
)
```

```
;;Intelligent Environment with Spatial Audio, BeamMover and LCD_Panel

(object (name Spatial_Audio_IE)
        (hasType spatial_Audio)
        (isInRoom Torre_Aquila)
        (isOnWall undefined))
(object (name BeamMover_IE)
        (hasType beamMover)
        (isInRoom Torre_Aquila)
        (isOnWall ceiling))
(object (name LCD_Panel_IE)
        (hasType LCD_Panel)
        (isInRoom Instrumented_Environment)
        (isOnWall 2)
        (isUnique TRUE))

;;The Torre Aquila Room with 11 Frescoes                              -----" crlf)

(object (name January_Frescoe)
        (hasType frescoe)
        (isInRoom Torre_Aquila)
        (isOnWall 2)
        (physProp 1 0 4 1))
(object (name February_Frescoe)
        (hasType frescoe)
        (isInRoom Torre_Aquila)
        (isOnWall 2)
        (physProp 4 0 1 1)
        (hasVRI left)
        (hasPicture TRUE))
```

W   are
th

A rule based system to determine the best referencing solution

```
C:\WINDOWS\system32\cmd.exe                                         _ □ ×

C:\findReferenceMethod>del output.txt

C:\findReferenceMethod>java findReferenceMethod
Actual user data:

name             = Michael
devicePreference = big
isInRoom         = Torre_Aquila
looksAtWall      = 4
wallDistance     = 20
focus1           = February_Frescoe
focus2           = focus2
focus3           = focus3
-----------------------------------------------------------------------
Started the refFinder Engine
-----------------------------------------------------------------------
<decision user=Michael action=mustTurn direction=left>
-----------------------------------------------------------------------
(change x x) or (exit)?:
```

Conclusions and outlook

The presented solution…

- …allows virtual characters to disambiguate physical object references in many different situations

- …is very flexible, allowing for easy integration of new hardware

- …is very robust against constant setup changes and uncooperative users

Next steps:

- improve the way in which the world is described in the database

- integrate new hardware(simple audio devices, wall mounted tvs)

- test the implemented system with multiple users simultaneous