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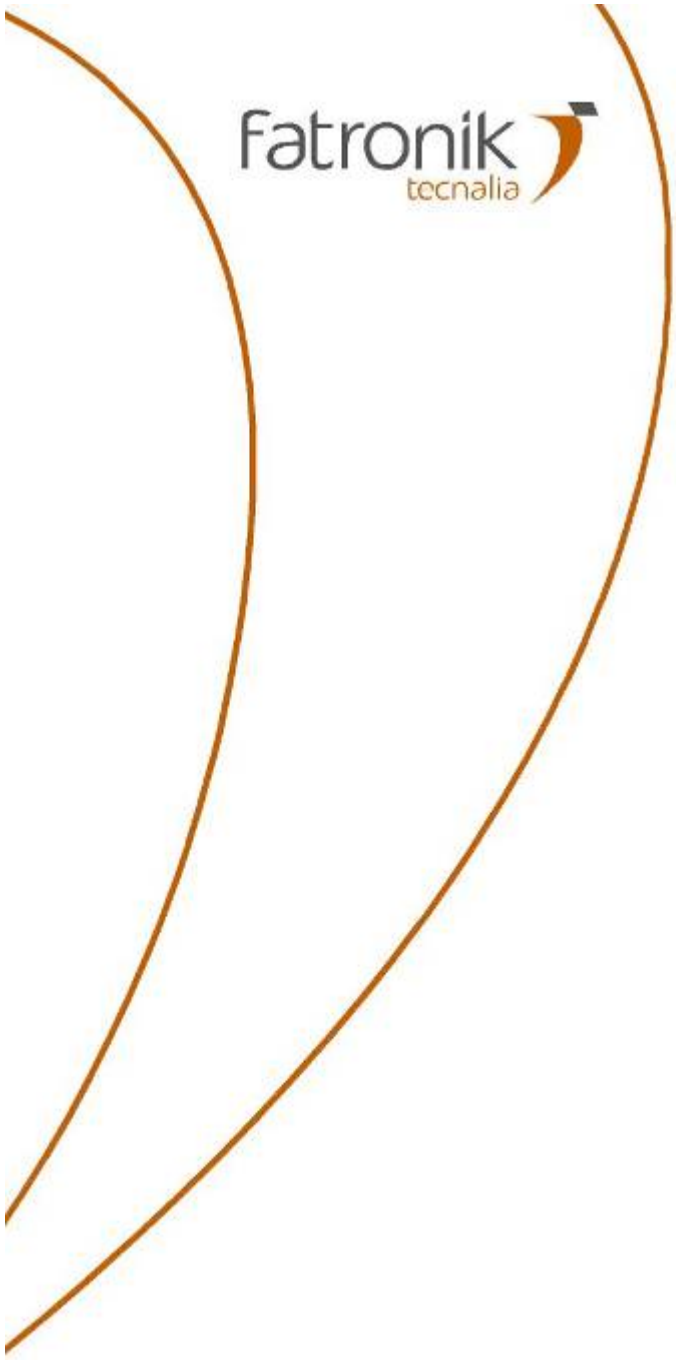

Content personalization

some theory and the real world

Dr. Stefan Carmien
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UAM Spain

Adaptive Personalization

End user programming of task support systems and E-learning for people with disabilities are special cases of the general problem of adaptive systems which present two interesting issues:

- Mechanisms of deep and relevant adaptation (i.e. non-trivial adaptation)
- The chasm between research and integration into daily life

Overview of talk

Some theoretical perspectives

- Universe of one
- Distributed cognition
- Metadesign

MAPS

EU4ALL

A discussion of adoption and abandonment if there is time

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A Note About This Talk

You have a lot of experience in (or at least thought a lot about):

- Design and evaluation of Adaptive Systems
- Capturing, inferring and representing user models
- Authoring and visualization tools
- Supporting collaboration (especially collaborative learning)
- Usability of intelligent systems and user interfaces

Please interrupt me with observations, criticism and questions

I am not the ‘sage on the stage’

Why accessibility and disabilities are a good entry to adaptive systems

Like using neurological pathologies to study neurological function

- Extreme problems of accessibility provide highlights into problem
- A single disability is a well bounded problem

There has been a lot of work in this area that might be useful to creating general adaptive systems

- WCAG & WAI lead to ARIA
- Extensions of LOM and ISO 24751

Overview of universe of one

Disabilities are often complex mixtures (comorbidity)

- Reduced intellectual ability combined with
  - Sensory impairments
  - Motoric impairments
  - Psychological / developmental impairments

Because of lack of ability to abstract representations interface elements have to be specific and concrete

- Pictures not icons
- Specific human not synthetic voice

End-users comprise a set of one

Universe of One

This population often has variation in ability

- Over time
  - Gradual decrease of ability in geriatric population
  - Gradual increase of ability in developmental population
  - Daily variation (bad day, bad time of this day)
  - Weekly variation
- Over tasks

Ser user model

- Essential characteristics
- Static user model
- Changes slowly over time
- Typically independent of context

Estar user model

- Condition of user
- Dynamic user model
- May change over time
- Often context dependent

Distributed Cognition

Knowledge about world contained in external artefacts, internal mental structures, and social roles

The cognitive act is distributed across them

Examples:

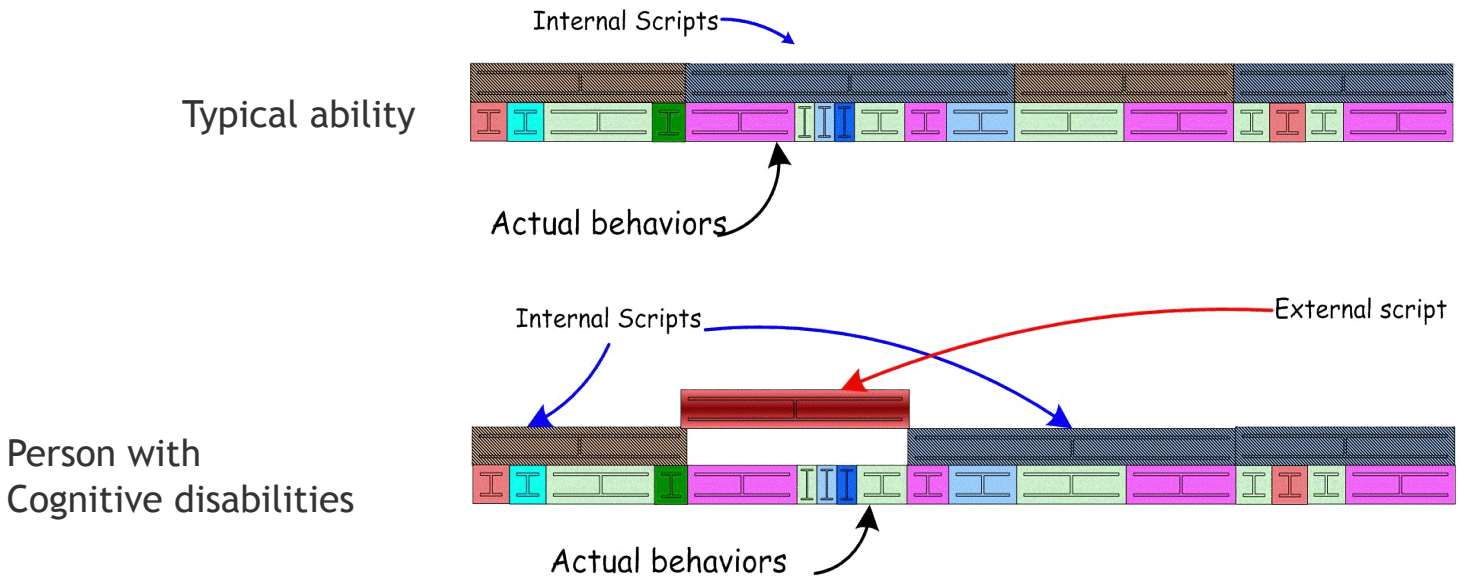
- Memorization ➔ books & reading
- Flying a modern plane ➔ pilot & instruments
- Ikea or Lego assembly instructions

Using a distributed cognition design approach often changes the users task

Distributed Cognition and Plans/ Tasks

Internal & external scripts

- External Scripts - external artifact cueing internals scripts
- Internal scripts - internalized sequences of behavior
- Interplay between internal & external



Distributed cognition

Using a distributed cognition design approach often changes the users task

This can lead to de-skilling

Deciding to use a distributed cognition approach depends on

- Cost to access
- Importance of reliability
- Frequency of use

"I won the spell-check bee."

Metadesign

There is not enough knowledge of *use time* specifics at *design time*

Tool designers can't know all the tacit knowledge about a domain that has to be embedded in the application

We can address this by underbuilding

Metadesign is a approach to doing this

Metadesign is active user modelling

Metadesign & Situated Action

Situated use of computationally supported artefacts

- Use at runtime always diverges from the envisioned use at design time
- Lucy Suchman's work on situated action.

Meta-design considers the design of tools that are to be evolving cognitive artefacts supporting human endeavours while evolving themselves as users needs and context changes.

Much of this research involves thinking about (in the form of scenarios), and experimenting with systems to determine where the most leverage can be extracted for the user.

Often the tradeoffs are spanning the continuum:

- Generalized tool (e.g. compilers)
- Toasterized devices (e.g. fax machine)

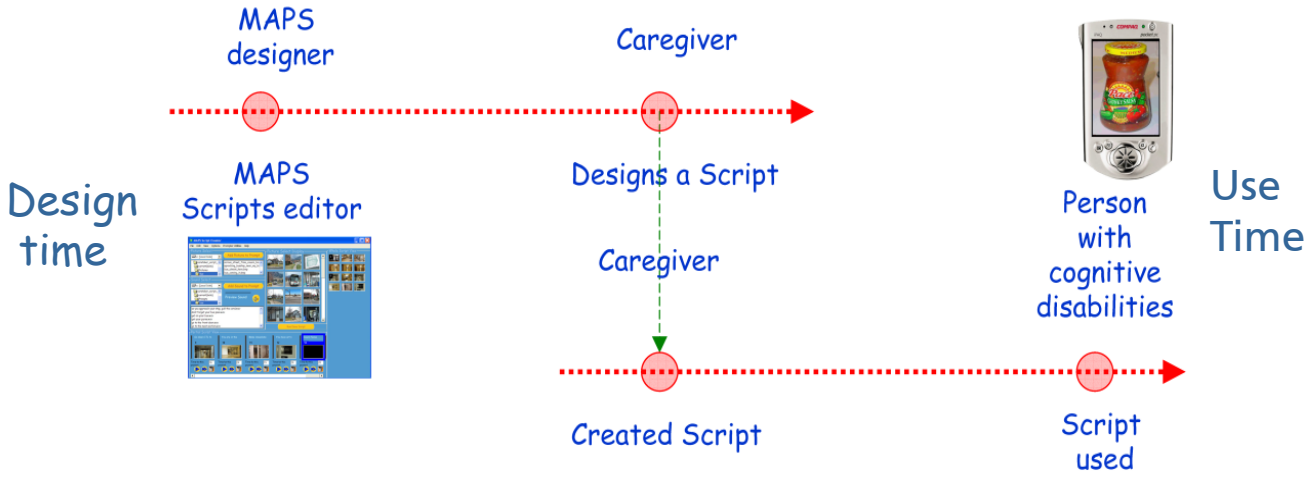
Metadesign

Design for designers / Design over time

- Design approach to making artifacts that can be used to design further artifacts

End-users use metadesign tool to do design thus changing the tool

- Design at tool design time
- Design at metadesign tool use time



Metadesign tools are typically under-designed

Metadesign examples

High level scripting languages

Blogs / Wikis / Social Networking Apps.

Web based Collaborative tools

Buildings

More examples…..

OK, but what about user modeling?

Theoretic underpinnings

By combining the perspectives of

- Distributed cognition
- Metadesign

We have a framework to design computational supports for persons with cognitive disabilities and in other domains

And maybe, another way of thinking about user modelling

Two approaches to deep customization

End user programming

- Support the end user becoming a co-designer of the system

User (and Device and Content) modelling

- Model the user and other components and base delivery on the models
- Make user model dynamic and scrutible

MAPS

Memory **A**iding **P**rompting **S**ystem

End-users:

- Young Adults with Cognitive Disabilities
- Caregivers working with them

An aid to performing Activities of Daily Living tasks

MAPS

Prompting as task support

- Scripts of prompts (prompt = image voice)
- Internal scripts / traditional use
- External scripts & hand he computers

Environment Home
Activity Making a Sandwich
Student_____ **Please note kind of sandwich**

1-Independent
2-Model
3-Indirect Verbal
4-Gestural

	A	B	C	D	E	F
1		Modifications				
2	Gets bread package					
3	Opens bread package					
4	Takes out two slices					
5	Closes bread package					
6	Opens jar					
7	Gets knife					

–Computationally based prompting
  - Importance of specifics (image, voice)

–End user programming problem

Editor

Caregiver as programmer

Putting the right amount of domain in it

Changeable scaffolding

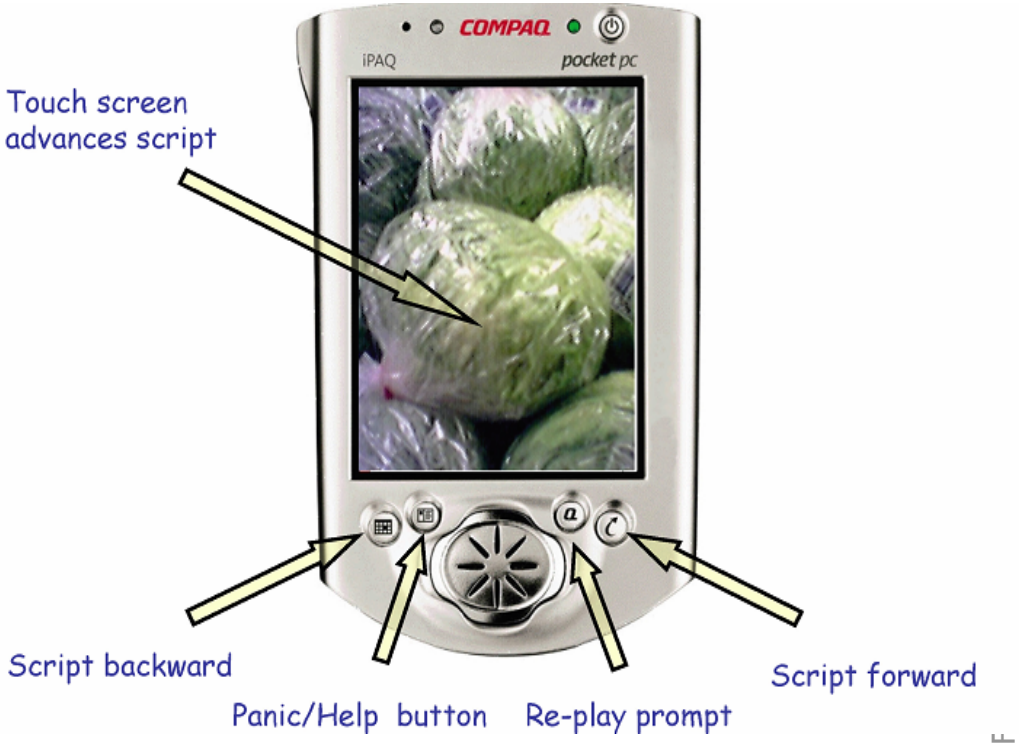
Prompter

Toasterize PDA

5 controls

Stored on sd memory

Mp3 player



MAPS users

Persons with cognitive disabilities & Caregivers

Dyad:

- Same data different interface
- End-user=
  - person with cognitive disabilities

and

  - caregiver

Task changes

- From: memorization of steps and sequence
- To: using a prompter

Leslie and Her Mom - High school

Leslie 16yrs, 3rd grade level

Stay-at-home mom made scripts

Tasks-

1. Sweep kitchen
2. Cook dinner
3. Shop by self

A European Unified Approach for Assisted Lifelong Learning

A EC project 2006-2009

EU4ALL

Content personalization

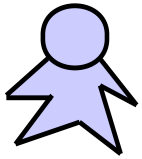
Repositories of pedagogial content

Content replacement not adaptation approach

User requests a unit of educational content as part of a class

EU4ALL provides the user personalized content

Deep personalization is dependent on three things:



The user

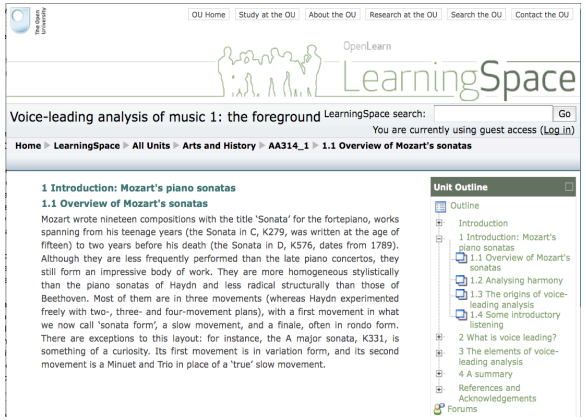
- Specific abilities
- Specific needs (I.e. sensory..)
- Preferences in adaptation

The context

- The user agent
- The environment (network accessibility, temperature, light)
- Local availability of resources (I.e. printers, Java, browser)

The content material or task

- Accessibility qualities
- Display specifics I.e. mime type
- Network requirements



EU4ALL

The designers of the EU4ALL system can't predict what every use might need

Using user and device modelling and matching it with content modelling

Dynamically providing the right content

User Modelling: PNP
Device modelling: CC/PP
Content Metadata: DRD
Content Personalization: CP
PNP + CC/PP + DRD = CP

Distance learning and standards

- LOM
- Dublin Core
- IMS
  - ACCLip
  - ACCm-the document one
- ISO
  - DRD, PNP

The User and the Environment

All of the previous standards assume that the information about the users device belongs with the user model

- This is not flexible enough
- What about UbiComp & AmI environments?

A better approach:

User agent & environment & hardware = DM

Eu4all overview

By making the delivery context independent to user model we provide deep customization

This solution assumes we know enough about

- User agent (mime types & assistive technology)
- User model (domain experts lists of functional needs)
- Content - availability and display requirements (I.e. network bandwidth greater than XX and java)

Several Examples

#	Missing ability	Example	Example	Orig. access mode (s)	Adaptation type	Content media requirements
1a	Auditory	Tape of talk	Tape of talk	Audio	Transcription	Mime text type
1b	Visual	Text of lesson	Text of lesson	Text	Audio tape	Mp3 mime type Streaming
2	Visual	Physics lecture on video tape	Physics lecture on video tape	Visual and Auditory Two entries in metadata pointing at the same original content object: Visual and Auditory - See below		
2 visual	Visual		Demonstration part of above	Visual part	Audio Description	Mp3 mime type Streaming
2 auditory	Visual		Lecture part of video	Auditory part	<none> NOTE: this is an *.avi	AVI Mime type Streaming
3	Visual	Text as part of a photo	Text as part of a photo	Visual	OCR?	Mp3
4	Visual	Text (a book etc.)	Text (a book etc.)	Visual	Text to audio DM transformation	Mp3

ISO 24751-1 - PNP

Attribute	Allowed Occurrences	Datatype
adaptation preference	Zero or more per *Content*	Adaptation_Preference

Attribute	Allowed Occurrences	Datatype
usage	*Zero or one per Adaptation Preference*	usage_vocabulary
adaptation type	Zero or one per *Adaptation Preference*	adaptation_type_vocabulary
original access mode	One per *Adaptation Preference*	access_mode_vocabulary
Adaptaion_preference_ranking = not DM or DRD	Zero or more per *Adaptation Preference*	Integer – the preference rank of the possible adaptation (i.e. 2 adaptation types for the same original access mode could exist)

Vocab

The 5 basic "access mode" values are:

- Visual
- Textual
- Auditory
- Tactile
- Olfactory

The 9 basic "adaptation type" values are:

- Audio representation
- Visual representation
- Text representation
- Tactile representation
- Caption
- Audio description
- Braille
- Digital talking book
- Electronic book

UAProf

Attribute	Description	Resolution	Type	Sample Values
Mime_Type	List of the IANA mime type(s) that can be 'played' on this device	Append?	Literal (bag)	"Audio.MP3" See IANA mime type listings for vocabulary
AT-Transformation type	a bag of literals each literal represents a given transformation (scenarios)	This depends on a repository of transformation engines	Literal (bag)	Could be integers could be 'audio-to-text'

Some mime types:

- audio/mpeg: MP3 or other MPEG audio
- audio/x-ms-wma: Windows Media Audio
- image/jpeg: JPEG JFIF image;
- image/png: Portable Network Graphics
- image/svg+xml: SVG vector image;
- text/plain: Textual data;
- video/quicktime: QuickTime video;

DRD

Access mode

Attribute	Allowed Occurrences	Datatype
Media_Object _ID	*One time per Access For All Resource*	EU4ALL Identifier
access mode statement	*Zero or more per Access For All Resource*	*Access_Mode_Statement –*
has adaptation	*Zero or more per Access For All Resource*	EU4ALL Identifier
is adaptation	*Zero or one per Access For All Resource*	*Is_Adaptation –*
adaptation statement	*Zero or more per Access For All Resource*	Adaptation_Statement
Mime_type –	Zero or more per Access Mode Statement	Mime type vocabulary (iana)

Is adaptation

Attribute	Allowed Occurrences	Datatype
original access mode	*One per Access Mode Statement*	*access_mode_vocabulary*
access mode usage	*Zero or one per Access Mode Statement*	*access_mode_usage_vocabulary*

Attribute	Allowed Occurrences	Datatype
is adaptation of	*One per Is Adaptation*	EU4ALL Identifier
extent	*One per Is Adaptation –*	*extent_vocabulary*

Adaptation statment

Attribute	Allowed Occurrences	Datatype
adaptation type	*Zero or one per Adaptation Statement*	adaptation_type_vocabulary
original access mode	*One per Adaptation Statement*	access_mode_vocabulary
extent	*Zero or one per Adaptation Statement*	extent_vocabulary
Mime_type	*Zero or more per Adaptation Statement*	Mime type vocabulary (iana)

Why do this so crudely? Is this not the age of the Semantic Web?

Good question

- This would involve a lot of AI & inference making
- This implies a lot of semantic knowledge about content and is either:
  - A ***VERY HARD*** problem (general case)
  - A result of a lot of hand coded rules (we are back to where we started)

The standardization process

- Need for agreed upon standard vocabulary
- Changes are difficult
- On-demand adaptation is much bigger problem
- Part of design for all approach

What EU4ALL misses

Who does all the content and who keeps it up to date?

- This is the missing hard part that so many research projects gloss over

Sensory adaptations much easier than intellectual disability adaptations

- Similar to the problem of adapting web content
- Is this even a real (I.e. logically solvable) problem?

Further research topics

- Prompting
  - True context awareness
  - Parameterized scripts
  - Automatic scaffolding retractions / extension
- eLearning content personalization
  - Automatic adaptation (I.e. modifying existing content on the fly)
  - Standards - granularity & assistive technology
  - Authoring issues (who will bell the cat?)

End of part one - short break

Next, I will give a brief overview of

technology adoption and abandonment

Conclusion

Thanks for coming to my talk
and my thanks to Professor Carro for inviting me.

If you have any questions or comments later I'm at

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