Adaptation at the Human Level

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A Clinical Model of Adaptation



The Email Client

- In the summer of 2001, we ran a pilot study to determine the range of email clients (and features) that made sense for the TBI audience.
- Closed buddy list.
- Minimize access to OS interface.
- Control of process
- Gradual emergence of "service model"
- configurable email client.

Harrison no mail	Date: April 24 (Sat) yes and no. Steve decided that I wa everyone. It was one of the posters	as being unfair, so he told you brought from TR.	ſ
McKay no mail	-Jim	, , , , , , , , , , , , , , , , , , ,	
Steve no mail	On Fri Apr 23 15:20:24 GMT-08:00 2 Hi Jim.	2004 Laurie wrote:	
Bonnie no mail	Did we EVER correctly guess what t	the green thing was in the TAL	<u>1</u>
Con Don	Type your email to Jim, then click send		
No mail	Unfair about what? I don't get it :)		☆
Jim 1 mail			
Andrew 4 ^{ta} no mail			
			Ŷ
Shut Down	Send	Cancel	

A Skills-Study of Emailing



Configuration Space



3. The composition space: freeform
 vs guided
 Roughly 10x10x10 configurations.



Goal-Attainment Scale



Goal-Attainment Scale (GAS) implies a decomposition of the domain into measurable sub-goals or levels of attainment.

People are encouraged to set long-range goals. Goals/levels that are not immediately applicable are deferred.

Deferred goals have some metric that allows them to be monitored for applicability.

Monitoring is goal-based. The goals of an <u>individual</u> are used to prune the entire monitoring space.

Weekly Evaluation





Configuration changes



Harrison no mail	Da y. April 24 (Sat) yes and no. Steve decided that I was being unfair, so he told every yone. It was one of the posters you brought from TR.
McKay no mail	-Jin
Steve no mail	On Fri Apr 23 15:20:24 GMT-08:00 2004 Laurie wrote:
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ndrew 4 ^{ta} o mail	
Shut Down	Canad Canad

Case Study: Yolanda

🚸 Yolar	nda is a 37-year old, Native American f	emale with cognitive	
disabilit	ties due to a traumatic brain injury fro	m a motor vehicle accider	nt
17 years	Yolanda's Impairments		
she (
for new	1. Memory		
planning	Short term memory	(moderate)	•
	Anterograde memory	(mild)	
She i	2. Executive functions		
* Staf	Initiation		
financa	Organization	(maile)	1
Induce	Organization	(mild)	4
counsel	Planning	(moderate)	
* She i	Self-monitoring	(severe)	
town.	Inhibition	(severe)	

She had no prior computer experience.



Yolanda's Timeline of Adaptation

Initial system:

0-3

- Controlled composition (size limit)
- Restricted process (reply required)
- Short buddy list (two relatives)

First letter published!

Toda /=24M

3-6 6-9 9-12 12-15 15-18 18-21

Adaptation within process space:

Change to: saved drafts

Linked-goal: letter-style content

Triggered-by: retain set across sessions

Adaptation within composition space:

Change to: freeform composition Linked-goal: letter-style content Triggered-by: meeting size constraints Adaptation within social space:

Change to: added editor to buddy list Linked-goal: submit to newsletter Triggered-by: consistent performance

A Small Case Study: Ron's Buddy List

Data Mining

Test: rational-reconstruction of adaptations seen on project.

Goal monitored: Ron wanted to eventually have lots of buddies.

Data collected: Ron's daily activity in correspondence.

Adaptation looking for: add new buddy to Ron's list.

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no mail	es and no. Steve decided that I wa veryone. It was one of the posters	as being unfair, so he told 4 you brought from TR.	î
McKay no mail	Jim		
Steve no mail	On Fri Apr 23 15:20:24 GMT-08:00 : i Jim.	2004 Laurie wrote:	
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Don	ype your email to Jim, then click send		
no mail	Unfair about what? I don't get it :)	1	î
Jim 1 mail			
Andrew			
no mail			
		4	ŗ,
Shut Down	Send	Cancel	
	•	1.	

Kon's email client

Read/reply within a session.

Number of *different* buddies sent to in a session.

Total number of sends in a session (could be all to same buddy).

Results

- ✓ Placed monitored data in Excel.
- ✓ Plotted using various curve fitting and running average techniques.
- Potential correlation between down-trend in activity and adding buddy.

Future

 Use data-miner to analyze, rather than Excel
 Use regression, neural net, & statistical correlation techniques



Summary to Date

Ten participants in study: 4 have been emailing two years or longer, 6 have been emailing at least 1 year.

They range in living environments: 3 live in their own homes, 4 live in a minimal-care facility, and 3 live in a full-care facility.

All reported an inability to use a computer when entering the study.

None were able to use a COTS email client during the initial assessment. Same result at 6-month re-exams: none have been able to use COTS email without FTF staff support.

The good news: all participants continue to use email successfully. All have reached at least minimal attainment of their goals.

My Notes On Adaptation Experience

Adaptation management is a critical problem:

1. Missed adaptations.

A modification was needed and either (a) monitoring did not pick it up or (b) staff <u>evaluation</u> of monitored data did not pick it up.

2. Superfluous adaptations.

Typically, project staff inferred the need for an adaptation that was either (a) not supported by monitoring data, or (b) did not match with a user's goals. Example of the former: ADLs that are hard to monitor, e.g., changing meds.

Examples of the latter: lots \circledast . But it got better as we built up higher level concepts from raw monitoring data. And were better able to know <u>individual</u> behavior patterns.

Example of the former: attempts to use time as a measure, e.g., after 6 months, most should be ready for a less-intrusive system.

Examples of the latter: our good, but misguided intentions, e.g., changes to social space when not goal-directed.

New Project: Pedestrian Navigation Assistance



Theories of spatial abilities (1)

- Definition of spatial abilities (Golledge, 1997)
 - Geography definition

- the ability to think geometrically
- the ability to image complex spatial relations such as three-dimensional molecular structures or complex helices.
- b the ability to recognize spatial patterns of phenomena at a variety of different scales.
- the ability to perceive three-dimensional structures in two dimensions and the related ability to expand two-dimensional representations into three-dimensional structures.
- the ability to interpret macro spatial relations such as star patterns or world distributions of climates or vegetation and soils.
- the ability to give and comprehend directional and distance estimates as required in navigation and path integration activities used in wayfinding.
- the ability to understand network structures.
- b the ability to perform transformations of space and time.
- > the ability to uncover spatial associations within and between regions or cultures.
- b the ability to image spatial arrangements from verbal reports or writing.
- b the ability to image and organize spatial material hierarchically.
- the ability to orient oneself with respect to local, relational, or global frames of reference.
- the ability to perform rotation or other transformational tasks.
- the ability to recreate accurately a representation of scenes viewed from different perspectives or points of view.
- the ability to compose, overly, or decompose distributions, patterns, and arrangements of phenomena at different scales, densities, and dispersions.

Theories of spatial abilities (2)

Psychology definition of spatial abilities

- spatial visualization
 - ability to mentally manipulate, rotate, twist, or invert two- or threedimensional visual stimuli.
- spatial orientation
 - the ability to imagine how configurations of elements would appear from different perspectives.
- spatial relations
 - abilities that recognize spatial distribution and spatial patterns;
 - identifying shapes;
 - recalling distributed phenomena; comprehending and using spatial hierarchies;
 - regionalizing;
 - comprehending distance decay and nearest-neighbor effects in distributions; wayfinding in real-world environments;
 - Iandmark recognition;

Starting To Define Assessment Test Working with Amy Lobben to develop online tests:

- Interpreting symbol meaning
- Route planning
- Self-locating
- Mental rotation of text/image/geometry
- Visual memory tasks
- Path integration

Initial Assessment

Assistive Technology

Delivery

Prototype using CogBag system developed in Go-Outside project in UO Wearable lab.



GPS detects the bag's position, allowing it to guide the user and alert support staff if necessary.

An **RFID Reader** allows the bag to be aware of what items are in, or out, of the bag.

Wireless Sensors called Motes detect movement and environmental conditions. They also allow the bag to communicate with other computers in the area.

A SmartPhone[™] provides processing power as well as cell phone capability and internet connectivity.









Still Down the Road



The Devil's Advocate



iPod UI is not Personalizable

Personalization Through Preferences and Options



"Can be used for photography, publishing, web design, graphics, video games, movie production."

Key Points of a Clinical Style of Adaptation

 Personal process: assumes (a) one-size-fits-all solution will fail, and (b) problem changes over time in individualized ways.

Assessment implies a skills inventory. For optometry, a theory of vision under varying circumstances.

Treatments imply a solution-theory that maps assessed skills (e.g., unaided eyesight), combined with requirements, to solutions.

Process assumes that both humans and their environment can change over time. Hence, treatment comes in two sides of same coin: (a) what is delivered initially, and (b) what new/adapted solutions are delivered by monitoring over time.

First Attempts at Formalization

The KAOS Tool as a Means to Formalize GAS

- 1. A means to refine a goal into levels. Yes. Rich language of goal refinement.
- A means of attaching skill prerequisites to goals.
 We are extending the language to include this.
- A means of linking prerequisities to performance.
 We are extending the language to include this.
- 4. A means of reasoning about events in past, present and future.
 Yes. Use of LTL-style logic to reason temporally about events.

