

USING VIDEO FOR ANALYZING DAYLIGHT SIMULATION TOOLS

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Motivation

- Are simulation tools unmediated sources of information?
- Tools get combined with people, workflow + organizations
- People, workflow + organizations are highly variable
- Video of use can capture performance (tool + people)

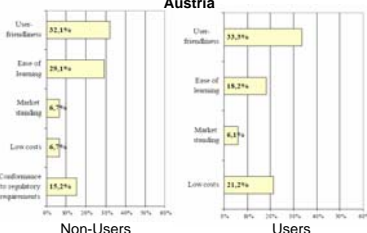


Heliodon as described to the public, Pacific Energy Center, San Francisco

Related Work

- Surveys are good places to start understanding what people want from tools

Austria



Non-Users Users

Mahdavi, Feurer, Redlein, Suter 2003

U.S.




Figure 2 USA Survey: Ease of use of Simulation Program

Donn 1997

Related Work

- Cooperative work between industry + IBPSA Scotland
 - Different organizations need different solutions
 - E.g ad-hoc versus highly structured

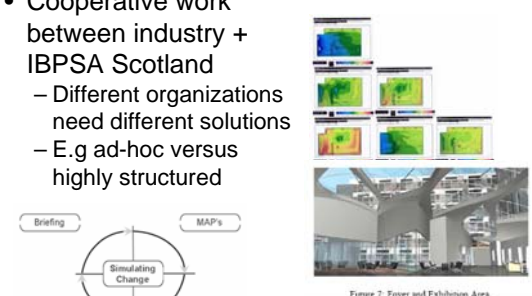



Figure 7: Foyer and Exhibition Area

McElroy, Eirick, Grant, Telfer, Elliot 2003

This Paper: Study Tools *In Situ*


- Potential gulf between tool specs + use
- Examine micro-interactions of people working with tools

"Dated?" heliodon




Physical

Software (Glaser 2001)



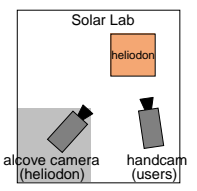
Future?



Hybrid (Underkoffler + Ishii 1999)

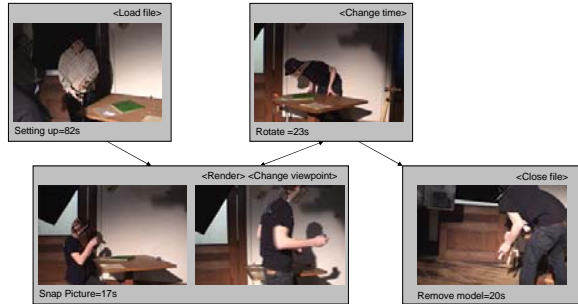
Physical Model: Setting

- Undergraduate Building Science Class
 - ½ hour training session
 - Sun study exercise- take at least 12 pictures of your model
 - Instructors and TA work with student
 - Heliodon needed sun path diagram
- Method
 - 2-4 observers taking notes
 - 2 video-cameras
 - Alcove for timing
 - Handcam for users
 - 5 hours of data
 - 7 users analyzed



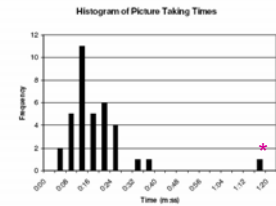
Physical Models: Basic Usability

- Time operations + tasks



Physical Models: Basic Usability

- These #'s can be used for benchmarking
- Caution has to be taken since not all operations and functionality are comparable
- Are today's computer programs as good as the heliodon at taking pictures?



* Outlier when teaching assistant discussed problem with student

Basic Usability- Errors

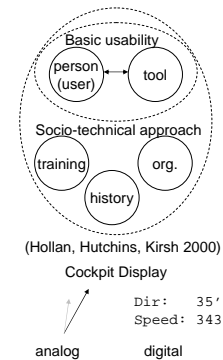
- Table falls to floor
 - Every other user!
 - Hazard to feet & model
 - 17 seconds to recover (avg)
- Accidental movement
 - 5 of 7
 - many unnoticed
- Just making things computerized does not automatically solve problem:



Enter latitude: +95N

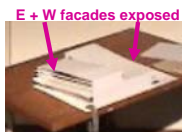
Socio-technical systems

- Usability metrics focus on person/tool
- Socio-technical systems examine larger networks
- Method: Observe Constructive interaction
- Conclusions are not automatic, they depend on context and interpretation

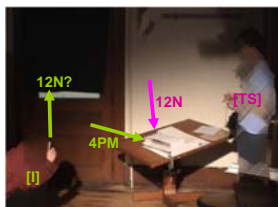


Socio-technical system: Instructor [I] + Student [TS]

- [TS]'s model has exposed facades
- [TS] thinks 12N is critical time
- [I] Suggests exploring other times



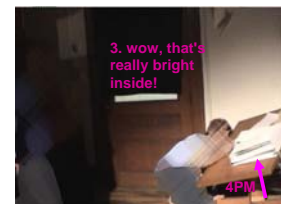
2. think about the east and west exposure, which is going to be 3-4 o'clock in the afternoon for the west, and for the east its going to be about 10 o'clock



1. actually [the sun does not] goes east and west as much as I thought it would go... because now it is at noon on June 21st

Socio-technical system: Instructor [I] + Student [TS]

- Instructor leaves TS to investigate himself
- TS finds problem
- TS returns to solar lab multiple times on his own initiative
- TS's design significantly improves



Socio-technical system: Teaching Assistant [TA] + Student [JP]

[TA] The professor wants you to be doing four different times of year and three different times of day-- morning, noon, evening, **but not too evening.**

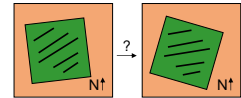
[TA] **So why are you doing October?** Think about what times are **most useful for you**

[JP] <inaudible> [hurriedly gets tape with new month on it, changes table position]



Result

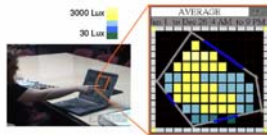
- JP is trained to use canonical times to investigate his non-standard ribbon-like design
- He did not investigate orientation!
- In later interview JP said that he put in too much work into heliodon for what he received
- No iterative design with solar tool



Did not reposition model to investigate other orientations

New Setting: Software

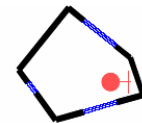
- Test with "Brina" and Dan.
- Hypothetical pentagonal room with 3 windows
- 'Average' daylight plot discussed
- How to incorporate this information into electric light planning
- Single camera on tripod recording session



Initial Use of Daylight Plot

- Brina starts a design with sconces

- 1 [B] =uhm, there we are always trying to get a balance with
- 2 that type of lighting, so even though you get a lot of
- 3 daylight, in this pattern, and we are looking kind of
- 4 dim over here so we want to get a **wall sconce** or
- 5 something happening.



Points to location of wall sconce
In hypothetical design

Organizational Breakdown and Individual Recovery

- 6 [B] uh- there, we are always trying to design for a good
- 7 balance, uhm and good work light, no matter what's
- 8 happening with daylight, because **we are assuming** a
- 9 **cloudy day** or
- 10 ok, [aha]
- 11 [or **bad**] **circumstances** (short laughter)
- 12 =ok [great]
- 13 or **evening circumstances**- so there is this
- 14 sort of general **assumption** that which is probably not a
- 15 very good idea, that, you know, **lighting is for when it is**
- 16 **dark** and=
- 17 [D] =aha
- 18 [B] when you don't have a lot of daylight,



clear day?

evening circumstance

Integrated Design

- 19 [B] so, uhm but I think, I think it would be a useful tool to
- 20 know where the daylight is coming in,
- 21 so that maybe, maybe there is a **general lighting system that can be turned off** and we **add wall sconce**
- 22 **over here and wall sconce over here**
- 23 **then we have the person at the desk, be willing to get up, which is [the whole problem]**
- 24 [D] [Right]
- 25 [B] with those sensors, so that people don't have to get up
- 26 from their desks to change the light,
- 27 [D] aha



General lighting system



add sconces



how to switch?

Final Refinement

108 [B] [like] I now understand that this side of this room
 109 could be the wall sconce and this side of the room.=

110 [D] =ok.

111 [uh huh.]

112 [B] [ok] and that, you know, if I put a fixture in
 113 the middle, and I give the daylight
 114 sensor here and there, near the, you know,
 115 ok, I've [got it]


116 [D] [uh huh]

117 [B] sort of solved in my mind, and


118 [D] [aha]

119 [B] [so I] can move onto the next [thing].


120 [D] [aha]



Add sconces



More precise specification of
daylight system



Sensor Specification

Video

- (show video)
- Feel free to propose alternative interpretations during Q/A session

Software Summary

- Brina identifies an organizational norm that interferes with using information from a daylight simulation tool
- Brina increased her design capacity through iterations
 - Brina refines a “general” lighting system that can be switched with daylight
 - Brina talks about occupant control
- Chart just showed “average daylight”, yet informed sensor placement

Conclusions

- Video can provide practical benchmarking metrics for how people use tools
- Training greatly affects tool use
- Users can use tools to extrapolate on relevant issues outside their scope of work
- Understanding socio-technical systems can improve tool training, adoption, and use

Future Work

- Finish task and operational analysis for daylight tools
- Longitudinal studies, questionnaires, interviews
- Test other tools
- Looking for collaborators to investigate other contexts (e.g. design practice)

Acknowledgements

- Fantastic help with filming, observation, and interviewing:
 - Edward Davis Jr. (IT, undergrad student)
 - Matthew Fickett (Architecture, graduate)
 - Mark Cabrinha (Architecture, PhD student)
- Alastair Iles (Energy Resources, UCB) for substantial discussions on early versions of this work



Acknowledgements

- The Web for presentation images

- <http://i6.photobucket.com/albums/y245/Pennsuedo/SunnyDay.jpg>
- <http://www.pitt.edu/~ciddeweb/PICS/taping.gif>
- <http://melrosemirror.media.mit.edu/servlet/pluto?state=3030347061676530303757656250616765303032696430303438383738>
- http://azores.free.fr/Sao_Jorge-4.htm
- <http://www.mech.pku.edu.cn/robot/teacher/wanglong/photo/always%20cloudy.jpg>
- <http://static.wiredfool.com/wiredfool/twilight.jpg>
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