Visualization Creativity Workshops

Challenges in problem-drive vis

- Messy design process
  - Iterative and multilinear
- Wicked problem
  - Problem and solution co-discovered
- Varying levels of engagement
  - Champion vs tolerant
- Highly-specialized needs
  - Designed for handful of users

Creativity requirements workshops

- One (or two) day(s) of structured activities to deliberately stimulate creative thinking in order to generate software requirements
- Various forms and uses exist for software requirements analysis [Scholosser2008, Maiden2007, Maiden2004, Jones2008,…]
- Address challenges of visualization design…

Visualization creativity workshops

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Embrace messiness through loosely structured activities that encourage revisiting and revising

Explore the problem and solution space simultaneously

Engage collaborators with participatory methods

Expose shared needs to create more generalizable solutions

Our experience

- Three distinct projects:
  - Smart home energy use [Goodwin2013]
  - Neuroscience [Lauritzen2016]
  - Constraint programming [Goodwin2017]

- Previous work described workshop structure [Goodwin2013; 2017]
  - Focus: *what was done* and *specifics*
  - Missing: *why/how* and *generalization*

Contributions

- A practical and conceptual reflection on visualization creativity workshops. We draw on experience conducting three workshops and a review of creativity and visualization literature to:
  - Explain when and why to consider running creativity workshops
  - Evaluate one successful workshop structure used in our three projects
  - Examine the role of workshop output in the design process

Creativity workshops in vis design

- Evaluate fitness for design study
  - Winnow and cast [Sedlmair2012]
- Formulate initial abstraction and task analysis
  - Discover [Sedlmair2012]
  - Understand [McKenna2015]
- Our experience
  - Energy use – “a few months” of experience with smart home technology
  - Neuroscience – two months of interviews and contextual inquiry
  - Constraint programming – approx. six months learning about domain

Workshop motivation

- Messy design process
  - No clear path forward
- Wicked problem
  - Mental models shaped by current technology
- Varying levels of engagement
  - “Talk to my post doc…”
- Seemingly diverse user needs
  - “My problem is unique and harder than everyone else’s…”

Workshop structure

- Described in [Goodwin2013;2017]
  - What was done?
  - What was the outcome in our specific project?
- Generalized description of the structure and motivation
  - What was done? Why was that done?
  - How can the outcomes be generalized to other vis projects?
- Venue to foster creativity [Dul2011]
- Participant selection [Goodwin2017; Sanders2011]

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Vis awareness + analog.	Present and relate visualizations	Analogical reasoning [Goodwin2013] Engage users [Koh2010]
Storyboarding	Imagine “a day in the life”	Physical construction [Sanders2011] Combinational creativity [Boden1990]

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Storyboarding	Imagine “a day in the life”	Physical construction [Sanders2011] Combinational creativity [Boden1990]
Conclusion	Identify key themes	Verification and illumination [Wallas1926] Convergent creativity [Osborne1953]

Method	Goal	Design space
Introduction	Understand-focused More generative More divergent	
Wishful thinking		
Constraint removal		
Lunch and excursion		
Vis awareness + analog.		
Storyboarding		
Conclusion	Ideate-focused More evaluative More convergent	

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We'll dive into one of these activities today – the paper will have all of them covered in equal detail.

Wishful thinking

- Description**:** Elicited vis-focused ‘aspirations’ from participants
  - What would you like to **know**?
  - What would you like to be able to **see**?
  - What would you like to be able to **do**?

- Output: opportunity statements recorded on post-it notes

- Creativity purpose: A form of guided brainstorming, but with more formal prompts meant to challenge the existing thought paradigms [McFadzean2001; Osborne1957]

Wishful thinking

- Details and evaluation:
  - Duration: 50 – 70 minutes
  - Push past exhaustion:
    - Paradigm preserving: Screenshots of existing tools
    - Paradigm bending: “What next?”
  - All three workshops found this effective

- Modifications and alternatives:
  - Discussion strategy – partners vs groups
  - Persona analysis [Martin2010]

- Pitfalls
  - Wrong size post-it notes
  - Discussing feasibility of ideas (collaborators won’t know what is feasible)

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Workshop output to requirements

- Generates a few hundred discrete artifacts—post-it notes, photographs, and drawings
- Analysis involves an open coding of ideas into key themes and tasks
  - Three projects identified ~10 – 25 themes and ~5 – 10 tasks each
- DAF vocab: opportunities, constraints, considerations [McKenna2015]
- Evaluation: “ease of development” and “impact value” [Goodwin2017]

Workshops in the design process

- Opportunities are input to prototyping:
  - Design workshops [Goodwin2013]
  - Visualization exploration [Goodwin2016]
  - Technology probes [Lauritzen2016]

- Constraints and considerations are heuristics for evaluating designs:
  - “everything in three clicks” [Goodwin2013]
  - “connect with existing tools” [Lauritzen2016]

Discussion

- Messy design process
  - Workshop structure supports iteration and revisiting of ideas
  - Output influences future design iterations

- Wicked problem
  - Co-discovery of problem and solution space – everyone is learning
  - Activities with diverging output are ideal for satisficing (vs solving)

Discussion

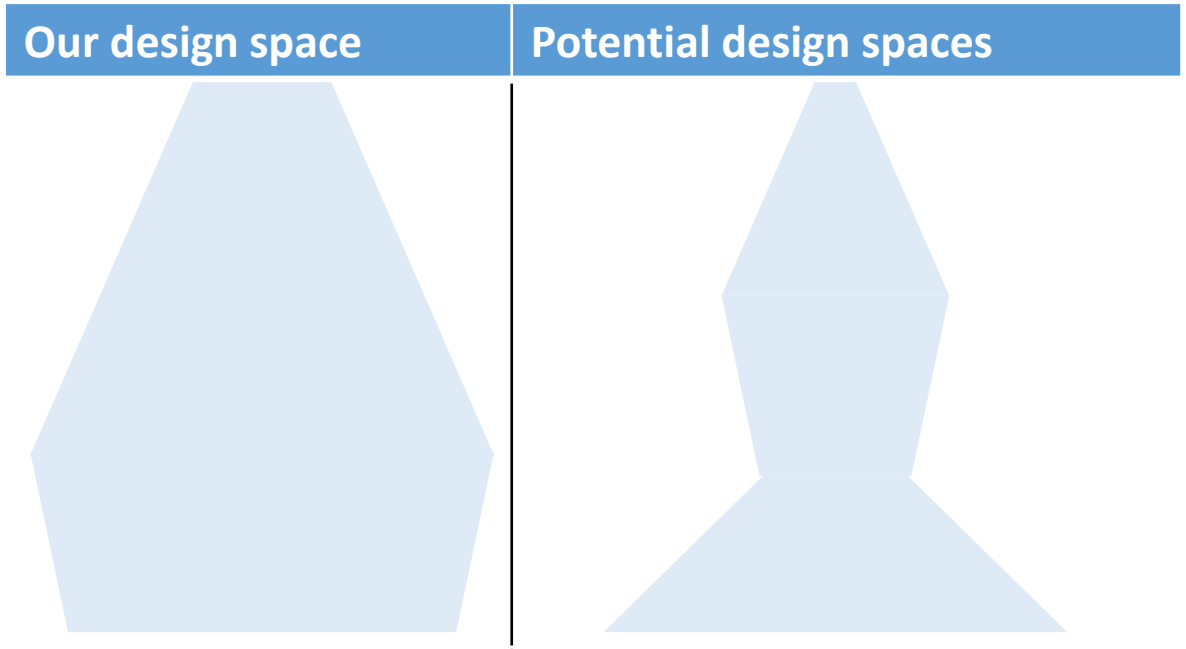
- Varying engagement
  - Participatory methods lead to buy-in
  - *“The visualizations opened our eyes to the data we have…we need to focus on visualization more!” – WS #1 participant*

- Highly-specialized needs
  - Discussions tend to build consensus and expose shared needs
  - *“I was surprised by how much overlap there was with the challenges I face in my own work and those faced by others” – WS #3 participant*

Discussion

- Not all feedback was positive
  - “Overall it was good, but a bit long and slightly repetitive” - WS #2 participant
  - “too much time expanding and not enough focus” – WS #3 participant

- Other workshop structures



Conclusion

- A practical and conceptual reflection on creativity requirements workshops in visualization design.
  - Connect creativity workshops to existing vis process models
  - Discuss workshop preparation and participant selection
  - Evaluate one successful workshop structure used in thee projects
  - Examine the role of workshop output in the design process

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Discussion

- Ideas generated are not necessarily novel or creative, but that's the point.

- Rapidly generate understanding of user needs
  - 6 participants * 8 hours workshop = 48 man hours of time with collaborators
  - Output is rich and descriptive set of needs – opportunities, constraints and considerations

- Workshops are mutually beneficial
  - "the interpersonal leveling and intense revisiting of concepts made more team progress in a day than we make in a year of lab meetings" – WS #2 participant

- *"[The workshop] provided a way to stop thinking about technical issues and try to see the big picture"*

- "the interpersonal leveling and intense revisiting of concepts made more team progress in a day than we make in a year of lab meetings"

Discussion

- Varying levels of excitement and participation: establish broad trust, rapport, and engagement with members at all of levels of collaborator's organization
  - *"The visualizations opened our eyes to the data we have…we need to focus on visualization more!" – WS #1 participant*

- Limited time: efficiently understand user needs
  - *"[The workshop] provided a way to stop thinking about technical issues and try to see the big picture" – WS #3 participant*

- Highly-specialized user needs: expose shared needs within collaborator's organization that can motivate more generalizable designs
  - *"I was surprised by how much overlap there was with the challenges I face in my own work and those faced by others" – WS #3 participant*

Activity – constraint removal

- Description**:** Identify constraints or barriers to the aspirations identified in the previous activity; remove these constraints and record new sets of aspirations

- Output: constraints identified on post-it notes; new aspirations recorded after the constraint is removed.

- Vis purpose: This is a *generative* method meant to identify *constraints* for visualization software, removing those constraints reveals new opportunities

- Creativity purpose: Inspire paradigm-breaking creativity [Boden1990, Jones2008]

Activity – constraint removal

- Details and evaluation:
  - Duration: 50 – 70 minutes
  - Effective in all three workshops
  - Push past exhaustion of previous activity
  - Varying levels of constraints identified -- some domain-specific, others limitations of vis

- Modifications and alternatives:
  - Forced association [McFadzean1998]
  - Force-field analysis [Lewin2008?]