

Setting the Creative “Temperature”: Amplifying Exploratory Thinking in Creative Learning

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Cognitive Science | UC San Diego
CSSA Talk Series 2.13.20

UC San Diego
The Design Lab



About me



NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

16

32

64

Obeys the rule

NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

10

9

8

NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

10

9

8

Does not obey
the rule

NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

9

12

15

NYTimes game

We've chosen a rule that some sequences of three numbers obey — and some do not. Your job is to guess what the rule is.

2

4

8

Obeys the rule

9

12

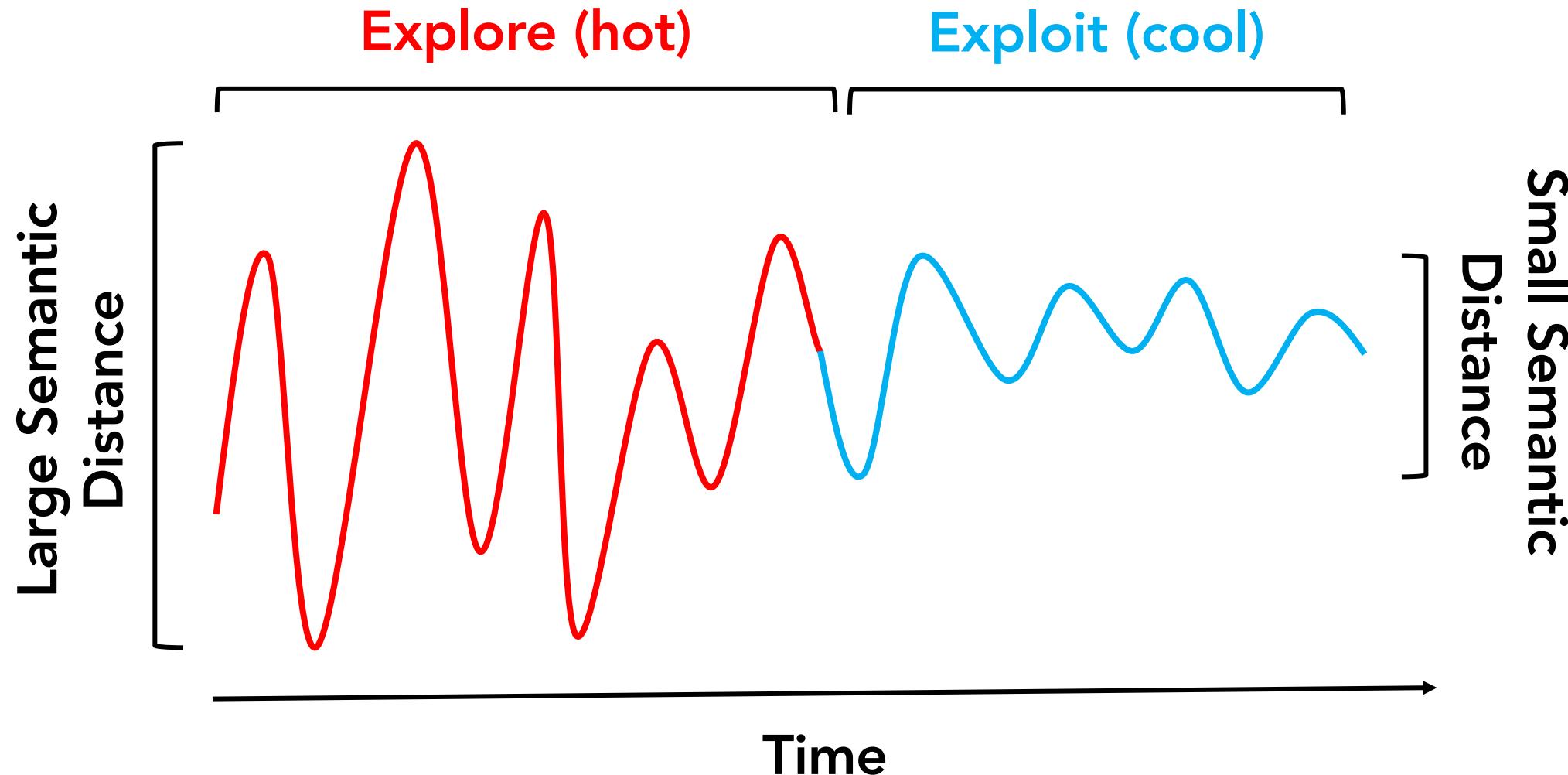
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Obeys the rule

What's the rule?

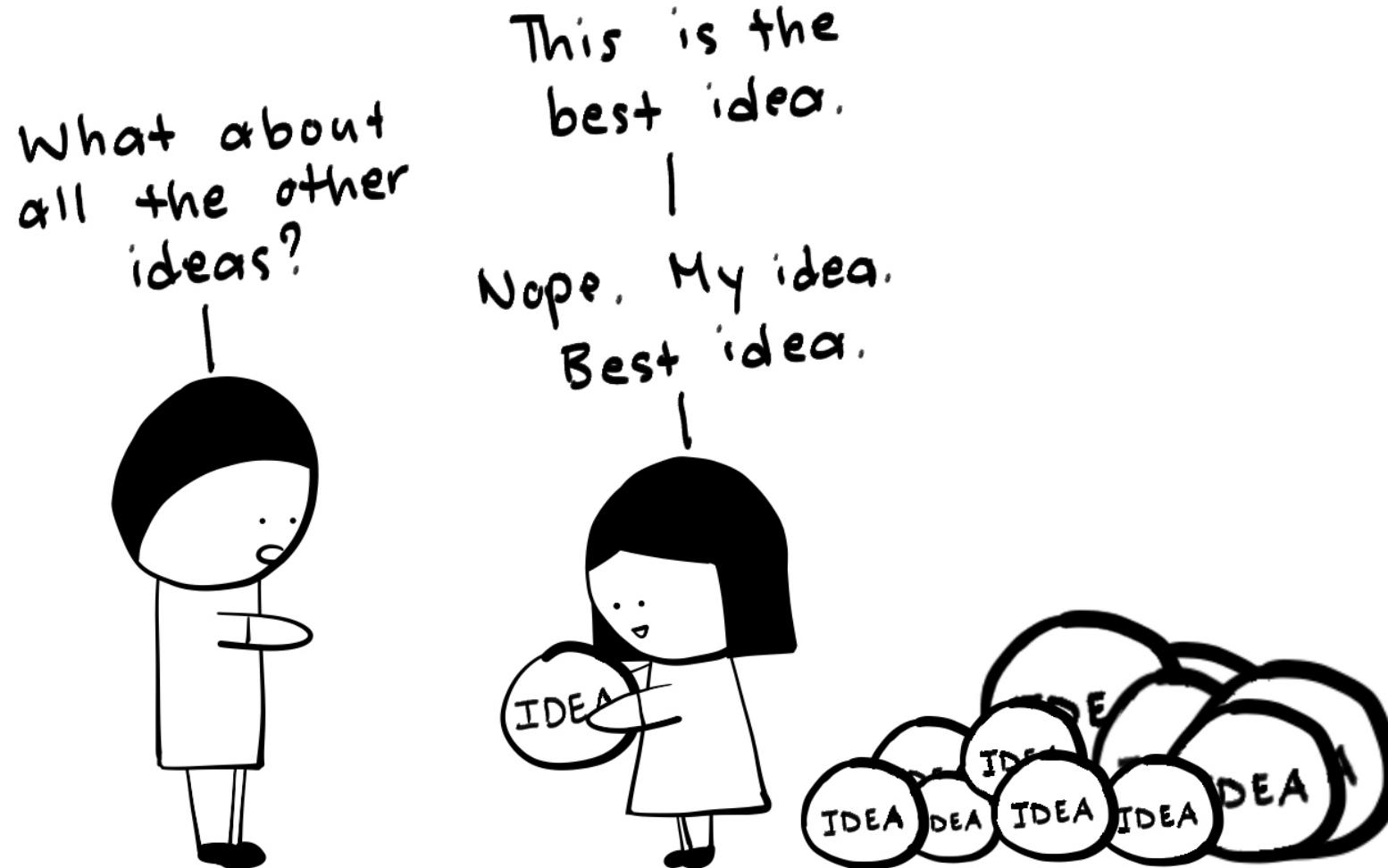
Each subsequent number is larger than the previous

Creative Thinking as a function of “Temperature”



[Kirkpatrick, Gelatt, & Vecchi, 1983; Lucas et al, 2014]

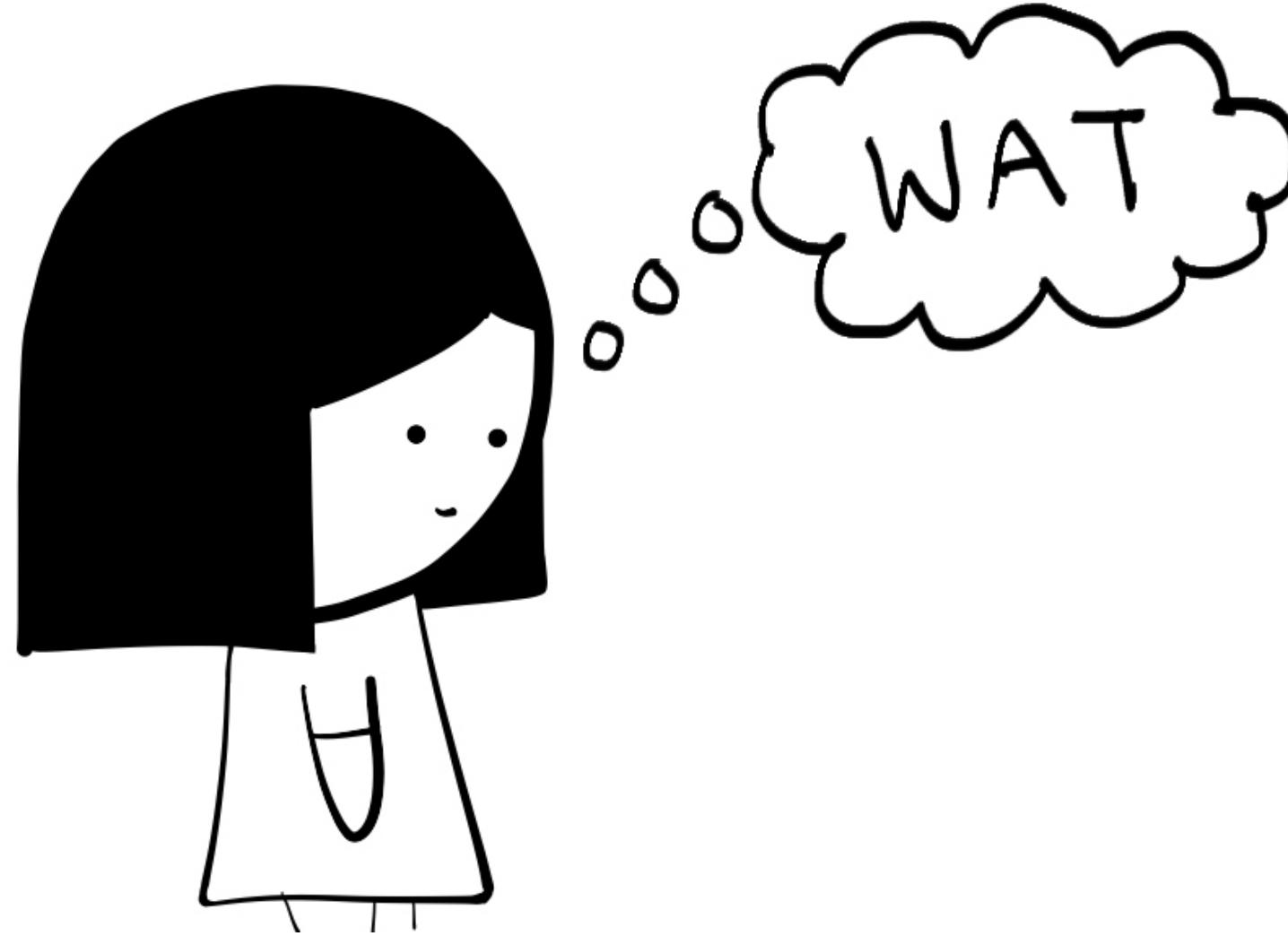
We have a bias towards *satisficing*



[Simon, 1979; Jansson, 1991]

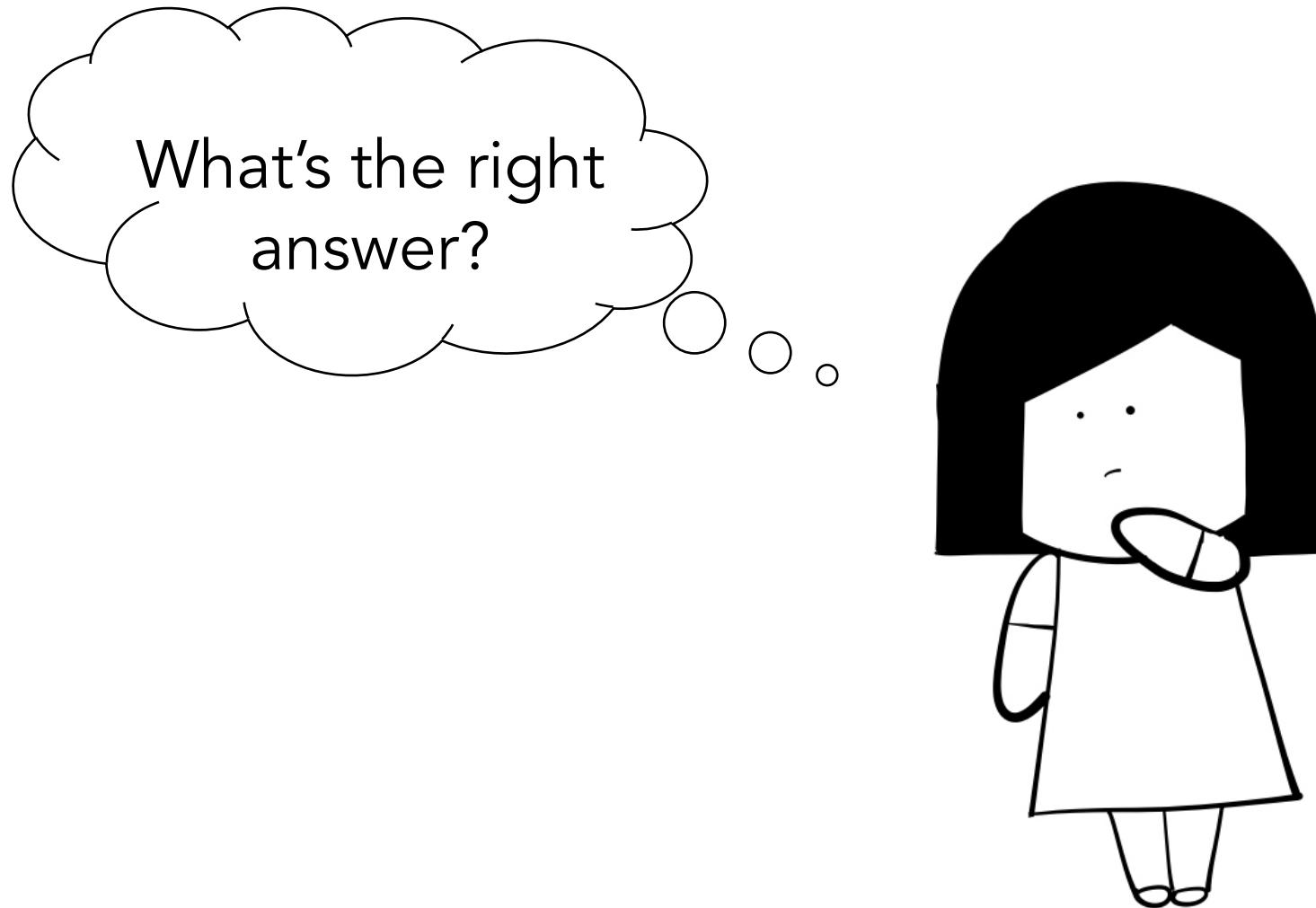
But exploration is hard because people often know *what* or *how* to explore

12



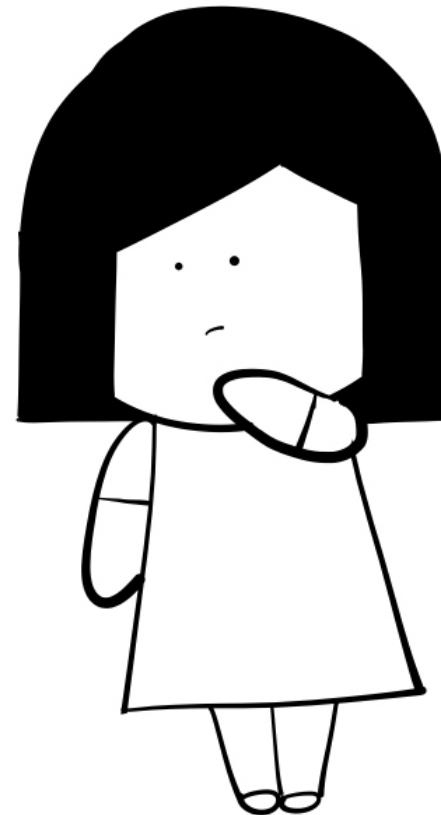
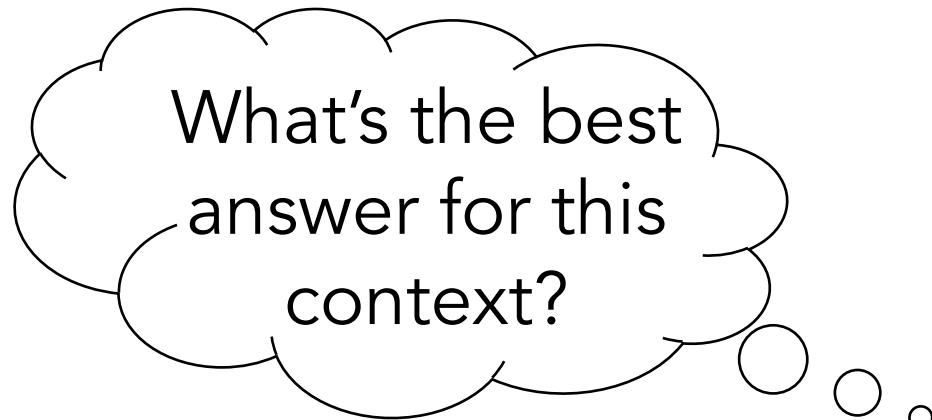
Exploration shifts how we approach problems

13



Exploration shifts how we approach problems

14



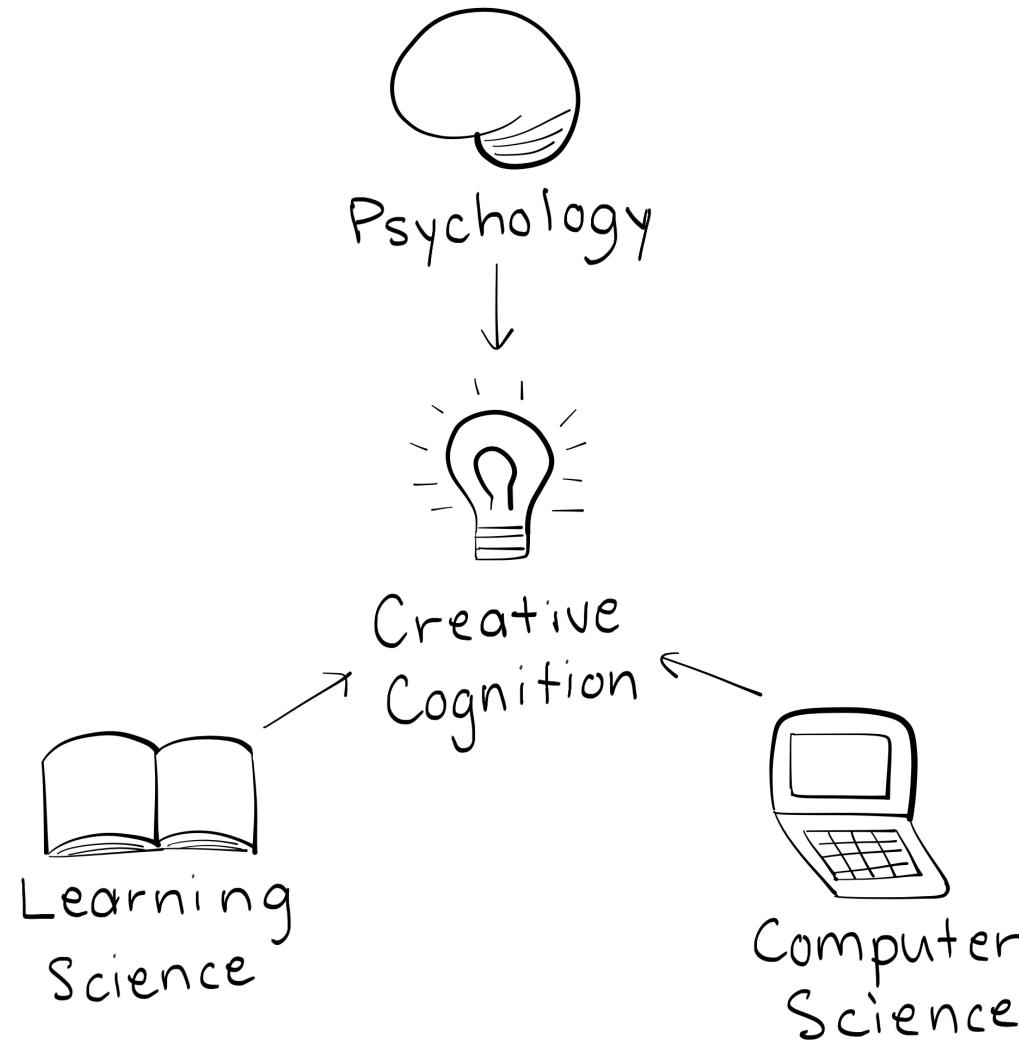
Thesis statement

Creative work involves multiple levels of concern and detail.

Novices are often unable to see the forest for the trees because lower-level details.

Attuning people to higher levels of abstraction and detail can amplify exploration for open-ended, creative tasks.

A combination of approaches



Addressing 3 important process skills

You're wearing the **Green Hat!**



The **Green Hat** focuses on creativity; the possibilities, alternatives, and new ideas. It's an opportunity to express new concepts and new perceptions. With this hat on, you want to think of diverse new ideas and approaches to the problem.

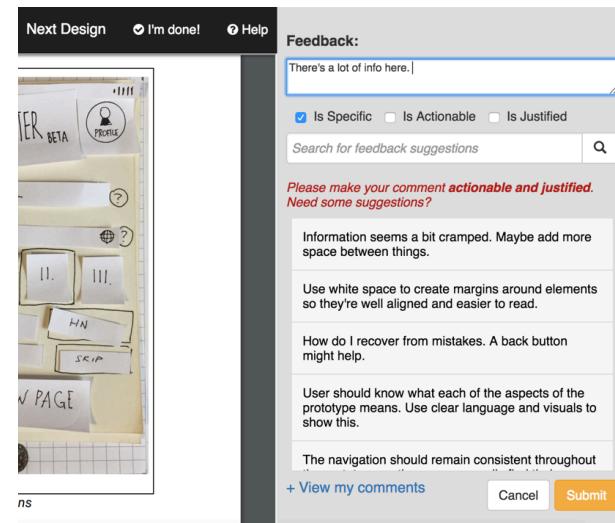
You're wearing the **Blue Hat!**



The **Blue Hat** focuses on process, focus, next steps, and action plans. It's an opportunity to be action-oriented in problem-solving. With this hat on, you want to come up with plans and ways to achieve those goals.

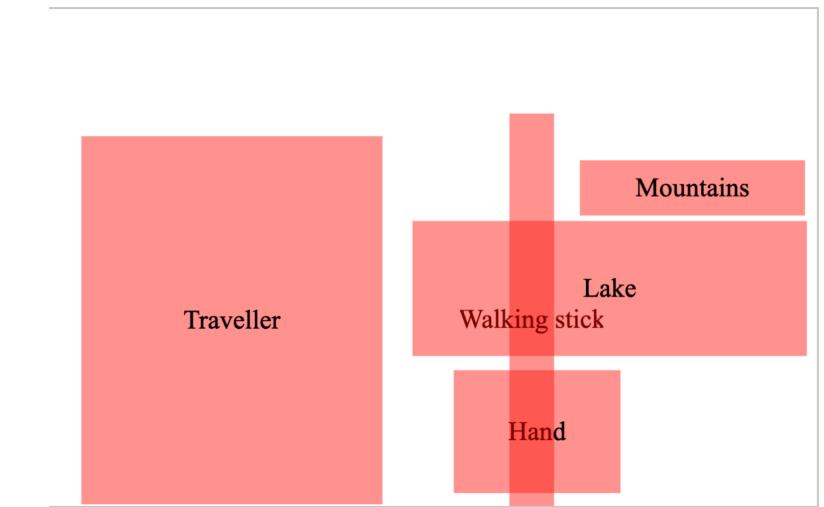
Framing

[Ngoon, Walker, & Klemmer, C&C 2019 Poster]



Critique

[Fraser et al, UIST 2018 Demo; Ngoon et al, CHI 2018]



Collaboration

[Ngoon, Kim, & Klemmer, CSCW 2020 (Under review)]

How do I frame creative problems?

Explore (n=25)

You're wearing the **Green Hat!**

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Exploit (n=25)

You're wearing the **Blue Hat!**

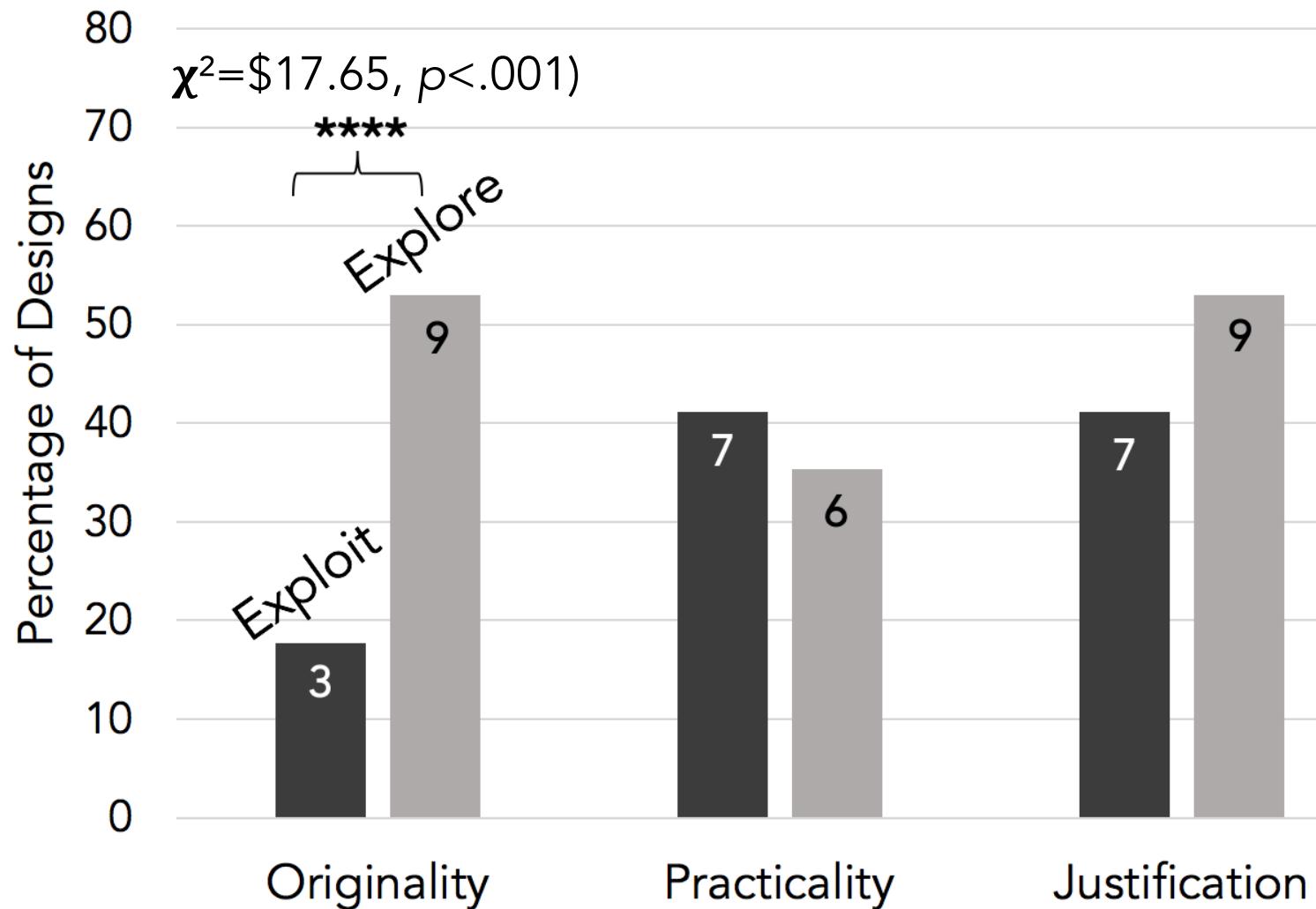
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Redesigning the student eating experience



Explore framing led to more original designs

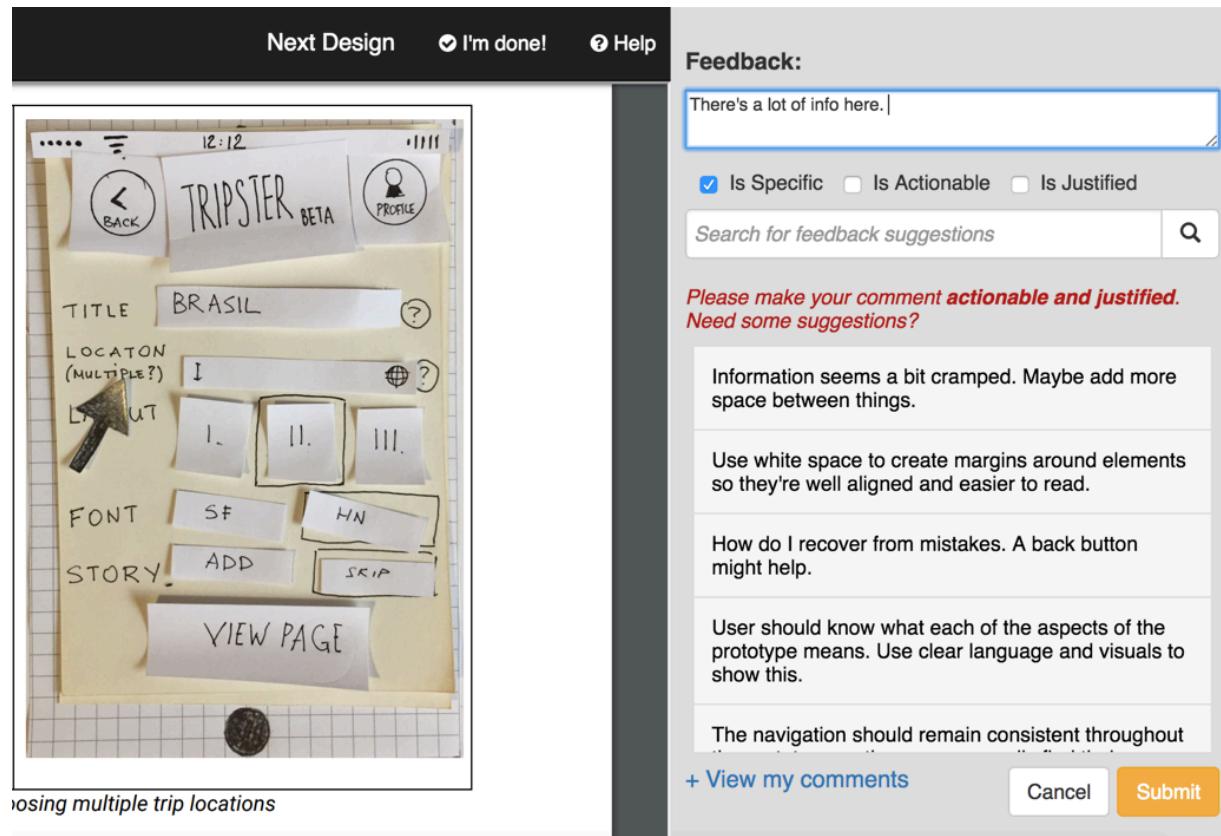


How do I frame creative problems?

Theoretical contribution: Simple framing scaffolds explicitly defines and delineates exploratory and exploitative thinking.

Practical contribution: These visual metaphors embedded within creative tasks or tools can make shifting between explore and exploit more concrete.

How do I give effective critique?



The screenshot shows a web-based application for giving critiques. At the top, there are navigation links: "Next Design", "I'm done!", and "Help". Below this is a header bar with icons for "BACK", "TRIPSTER BETA", and "PROFILE". The main area displays a wireframe prototype of a mobile application. The prototype has sections for "TITLE" (BRASIL), "LOCATION (MULTIPLE?)", "LAYOUT", "FONT", and "STORY". A "VIEW PAGE" button is at the bottom. To the right of the prototype is a "Feedback:" panel. It contains a text input field with the placeholder "There's a lot of info here.", a checkbox group for "Is Specific" (checked), "Is Actionable" (unchecked), and "Is Justified" (unchecked), and a search bar with the placeholder "Search for feedback suggestions". Below these are several lines of adaptive feedback:

- Please make your comment actionable and justified. Need some suggestions?*
- Information seems a bit cramped. Maybe add more space between things.
- Use white space to create margins around elements so they're well aligned and easier to read.
- How do I recover from mistakes. A back button might help.
- User should know what each of the aspects of the prototype means. Use clear language and visuals to show this.
- The navigation should remain consistent throughout

At the bottom of the feedback panel are buttons for "+ View my comments", "Cancel", and "Submit".

CritiqueKit features two interactive scaffolds:

- An interactive guidance panel the checks for specific, actionable, & justified feedback
- An adaptive suggestions box of previously-given expert feedback

Interactive guidance of structural characteristics

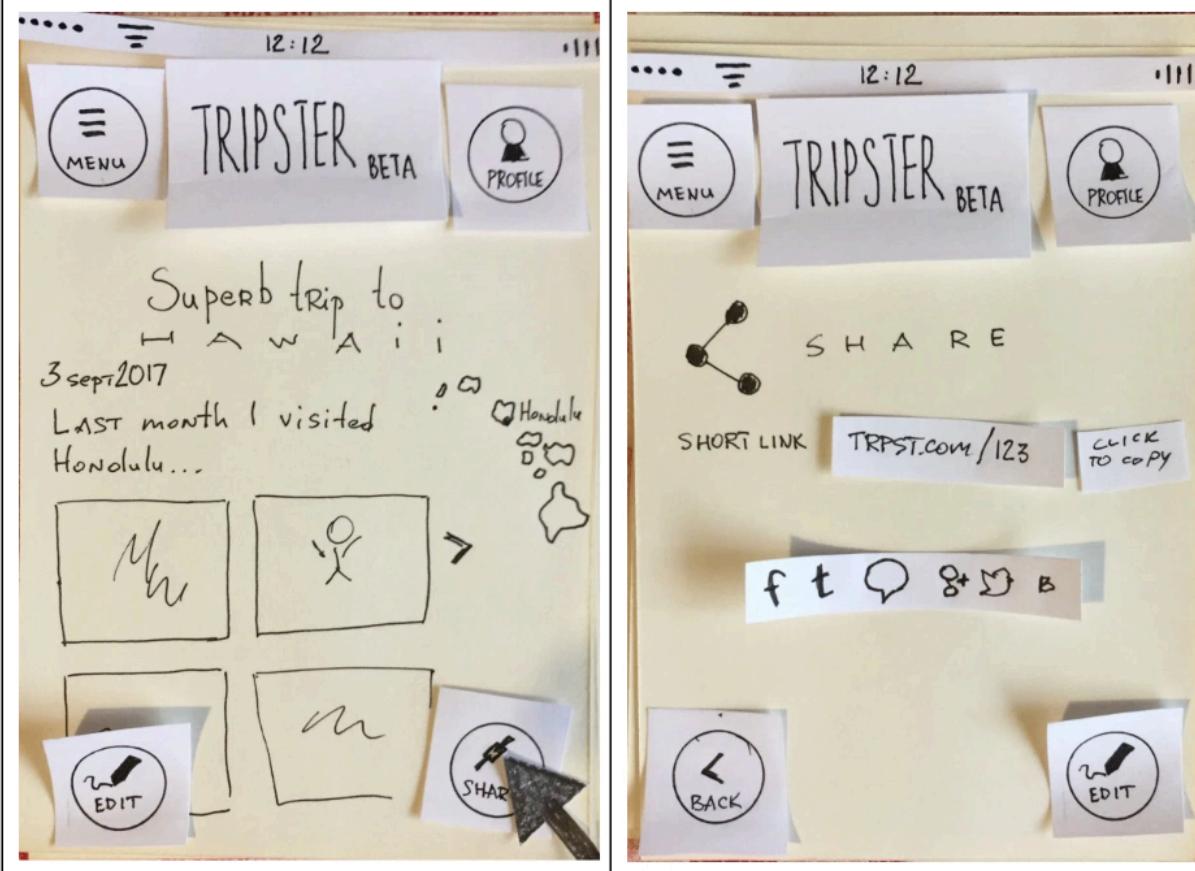
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CritiqueKit

Next Design

I'm done!

Help



Now it's possible to share Page in numerous ways

Feedback:

Type your feedback...

Is Specific Is Actionable Is Justified

Search for feedback suggestions



Provide feedback on something specific you thought was done well or should be improved. Need some suggestions?

Well Done:

Prototype interface is well-detailed.

Prototype clearly relates to Point of View.

User immediately knows the purpose of the prototype.

For Improvement:

Prototype does not clearly relate to Point of View.

Interface does not contain enough detail.

[+ View my comments](#)

Cancel

Submit

Suggestions that adapt to the guidance panel characterization

CritiqueKit

Next Design I'm done! [? Help](#)

Feedback:

T

Is Specific Is Actionable Is Justified

Search for feedback suggestions

Provide feedback on something specific you thought was done well or should be improved. Need some suggestions?

Well Done:

- Prototype interface is well-detailed.
- Prototype clearly relates to Point of View.
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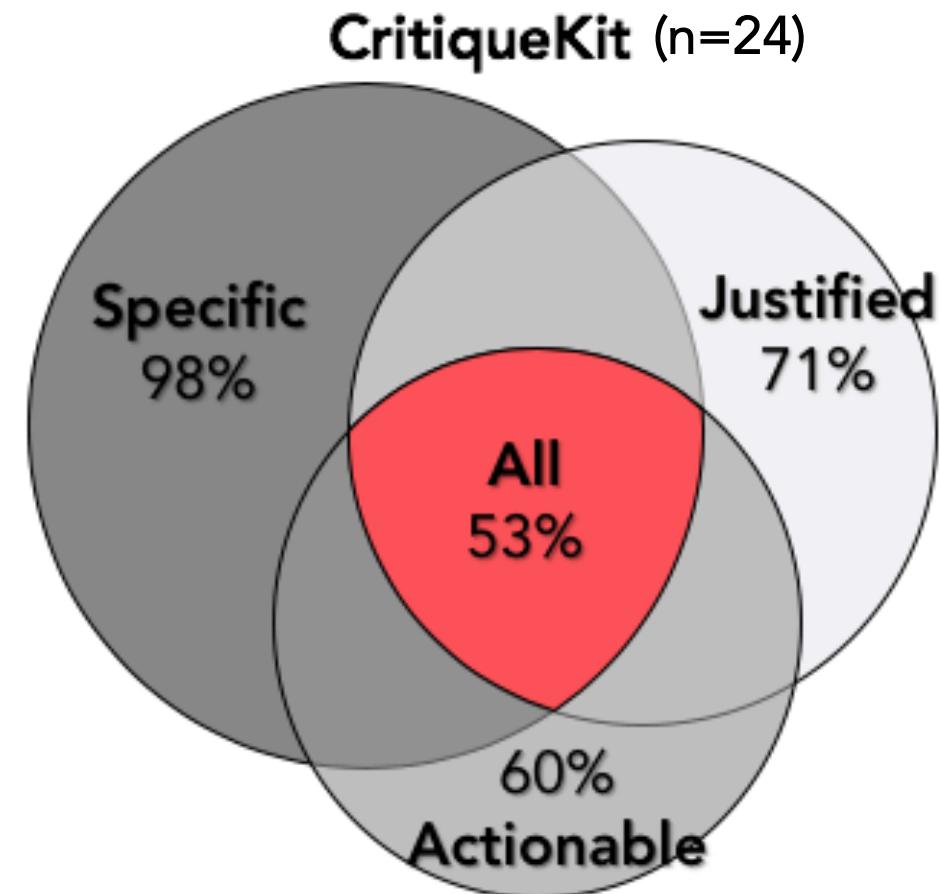
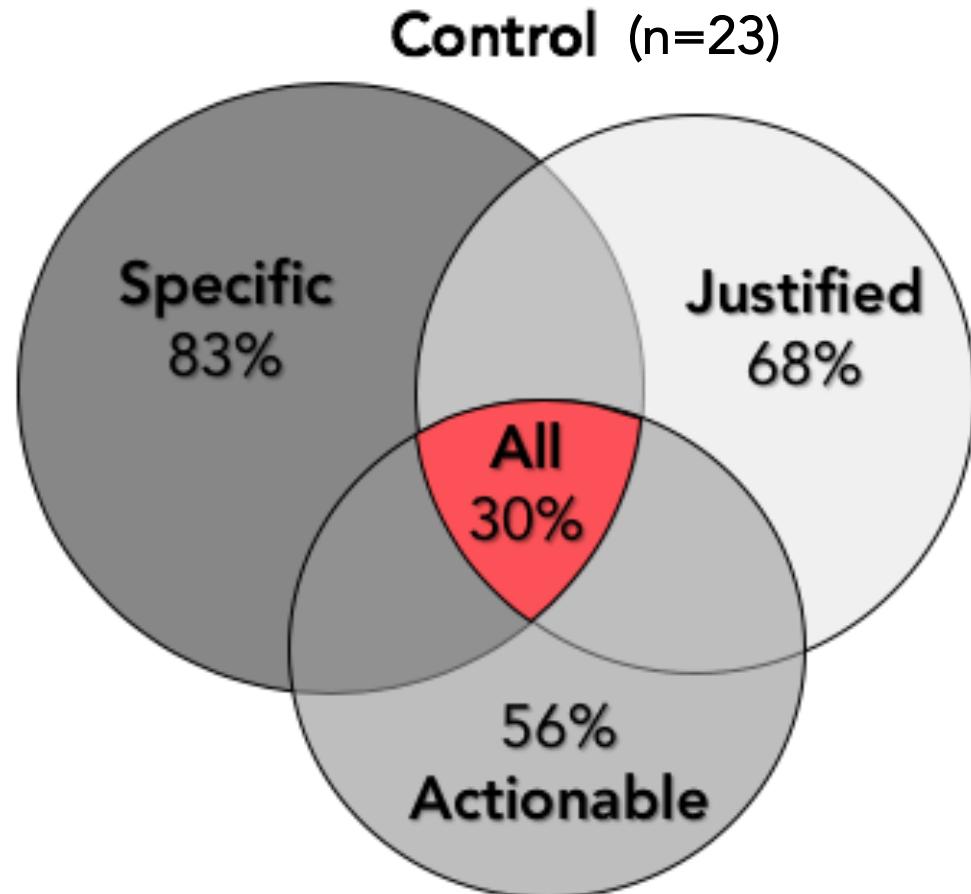
For Improvement:

- Prototype does not clearly relate to Point of View.
- Interface does not contain enough detail.

[+ View my comments](#)

Entering information to create new Page, and choosing multiple trip locations

CritiqueKit helped reviewers give more specific, actionable, & justified feedback



$\chi^2 = 8.33, p=.01$

[Ngoon et al, CHI 2018]

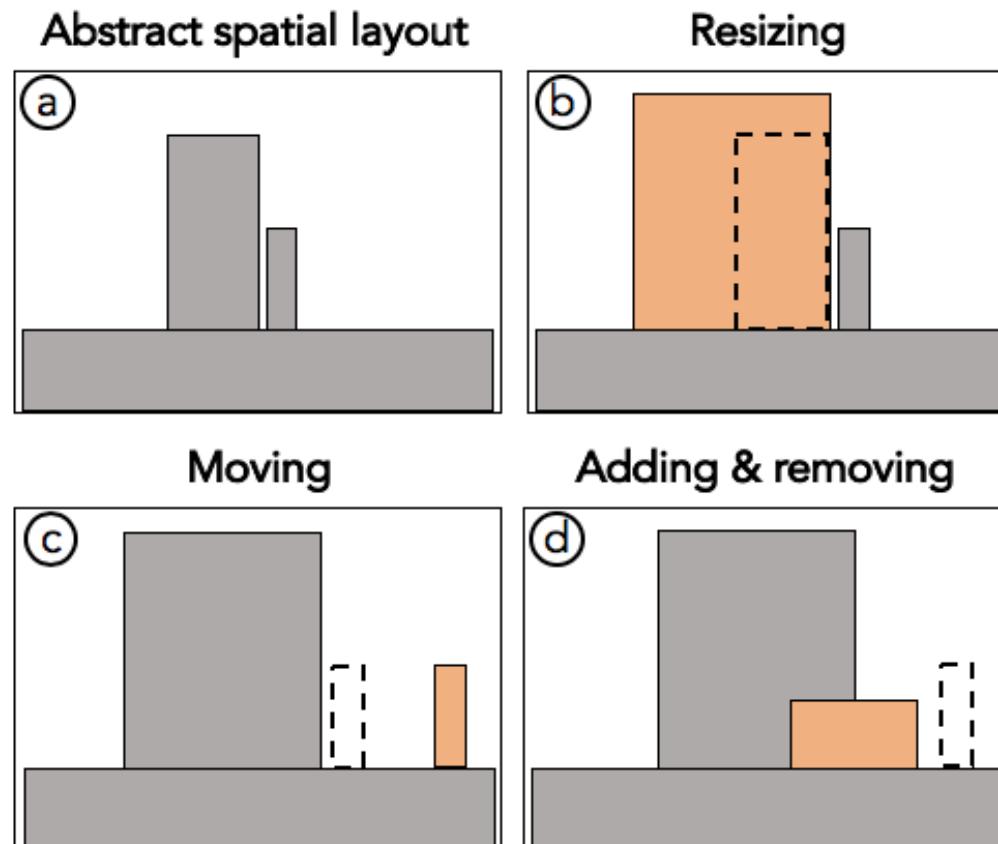
How do I give effective critique?

Theoretical contributions: Adaptive suggestions can enable better exploration by providing relevant alternatives that focus on deeper features.

Practical contributions: Creativity support tools should be designed with contextual interactivity in mind.

How do I explore & communicate ideas with others?

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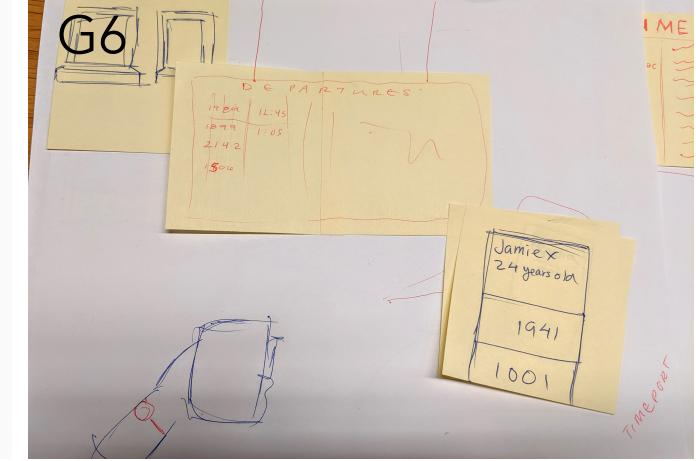
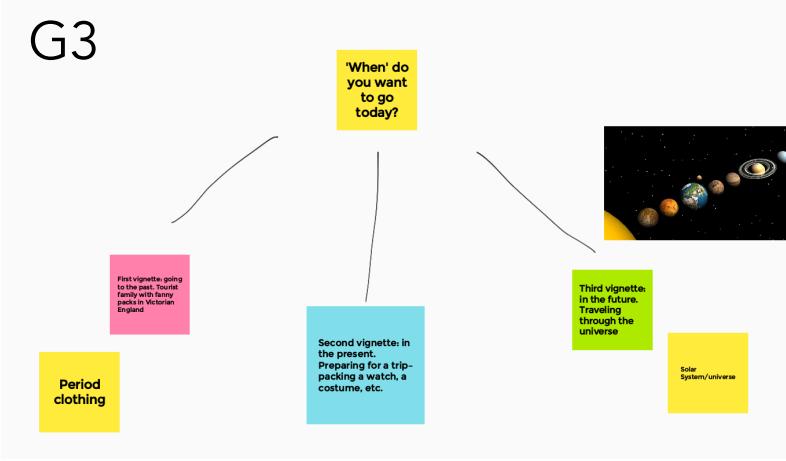
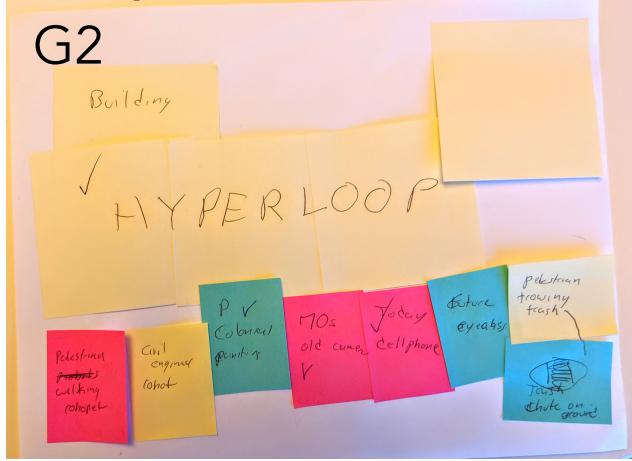


The SimpleSketch abstraction method:

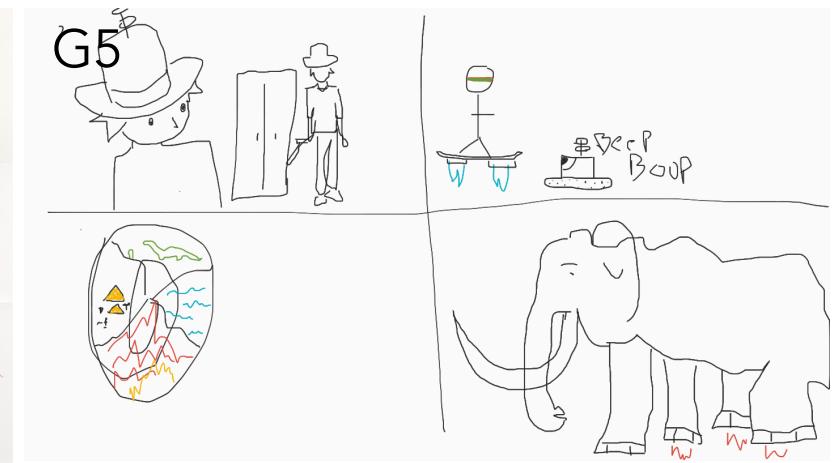
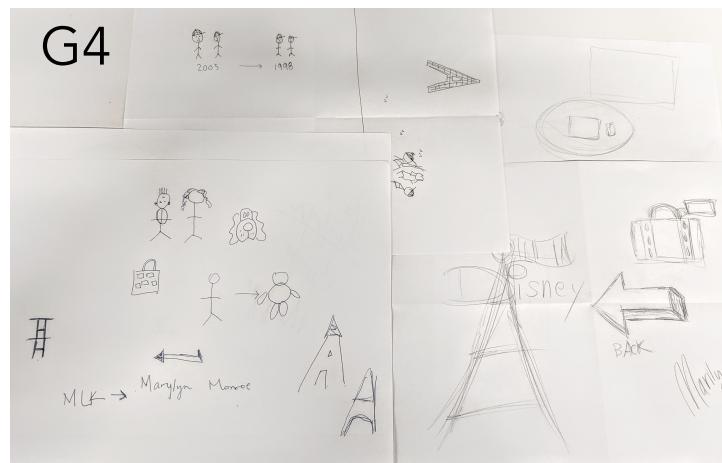
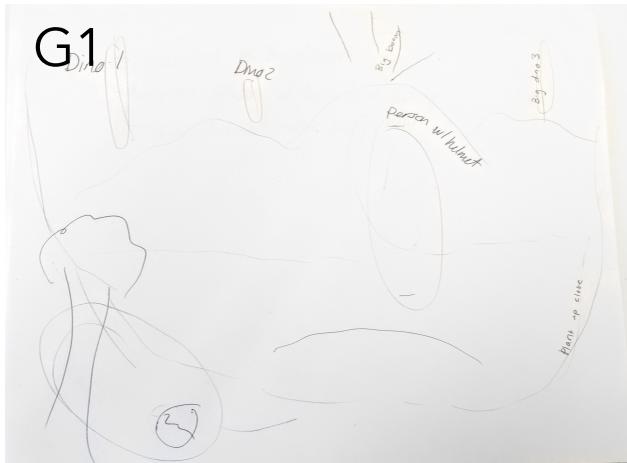
- Focuses attention on high-level composition concepts
- Allows users to create visual compositions without domain expertise

Participatory Design Study

SimpleSketch



Freeform



SimpleSketch enables concrete & malleable composition planning

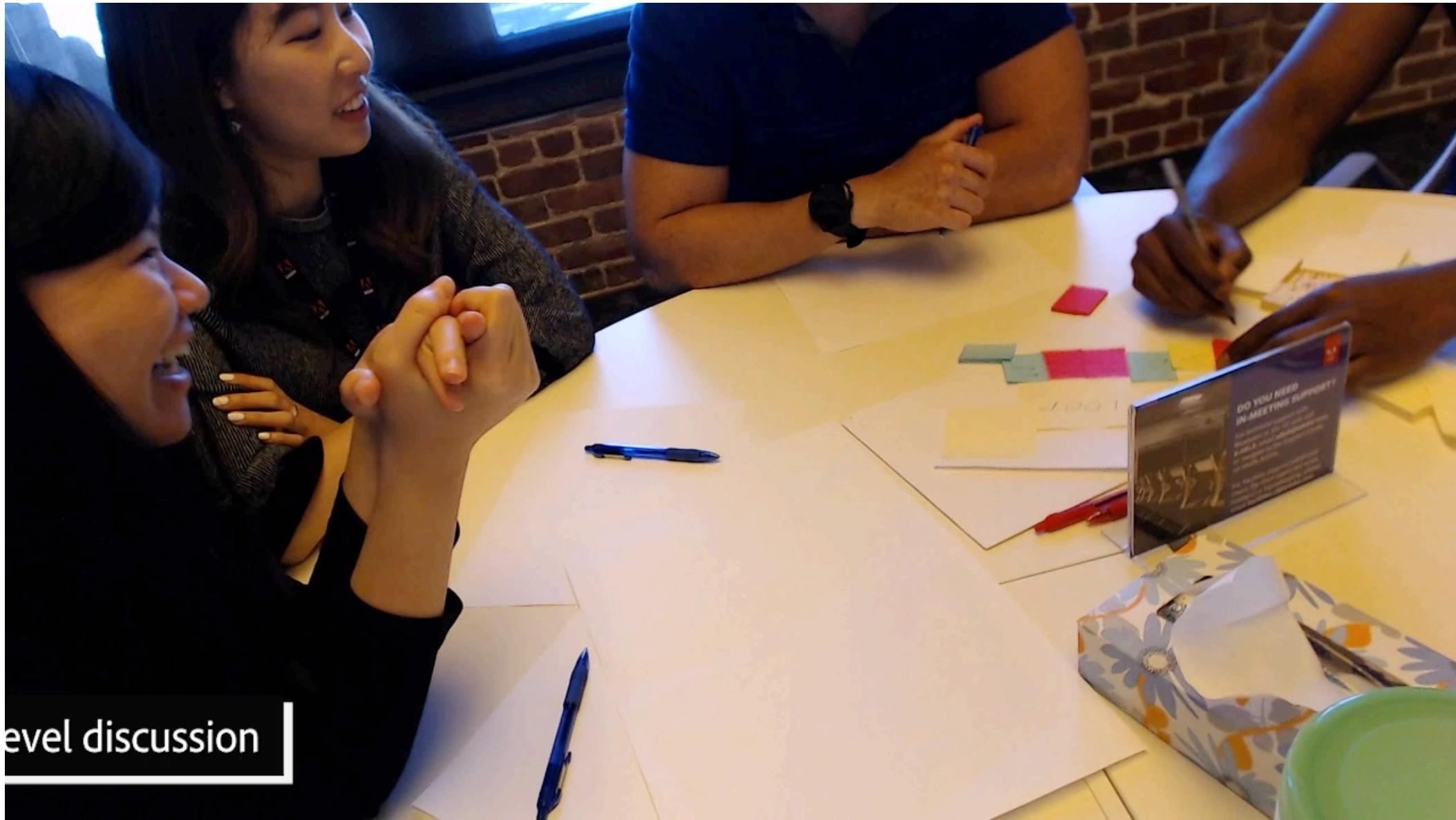


Lack of tangibility led to vagueness



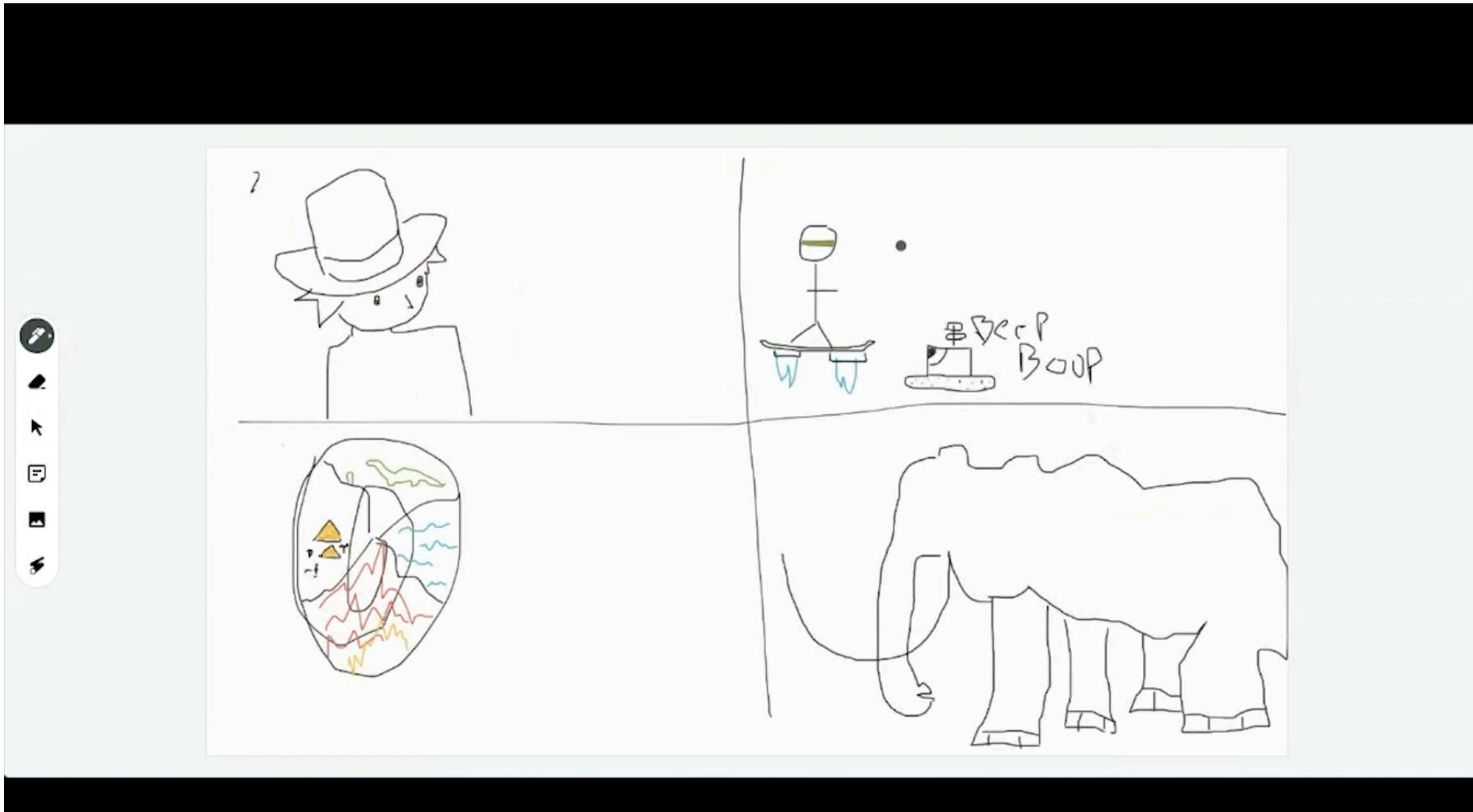
SimpleSketch facilitates high-level discussion

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evel discussion

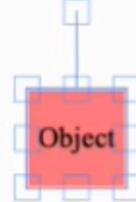
Lower-level details can lead to fixation



SimpleSketch Web Prototype

Idea
A quiet and happy evening at home.

Workspace



Add rectangle Remove selected rectangle

Label for selected rectangle:
Object

How do I explore & communicate ideas with others?

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Theoretical contributions: Abstracting visual elements focuses attention to higher-level concepts.

Practical contributions: Tools that enable simple and malleable exploration of ideas can attune people towards exploration.

3 important questions & process skills

Framing: How do I frame creative problems?

Critique: How do I give effective critique?

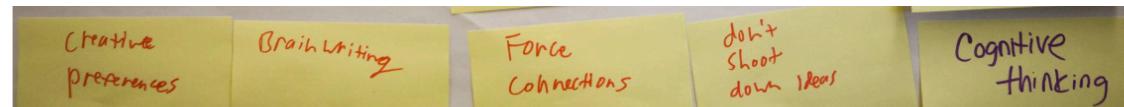
Collaboration: How do I explore & communicate ideas with others?

21st century knowledge work requires creative thinking

Learning to Think Outside the Box



Traditional academic disciplines still matter, but as content knowledge evolves at lightning speed, educators are talking more and more about “process skills,” strategies to reframe challenges and extrapolate and transform information, and to accept and deal with ambiguity.

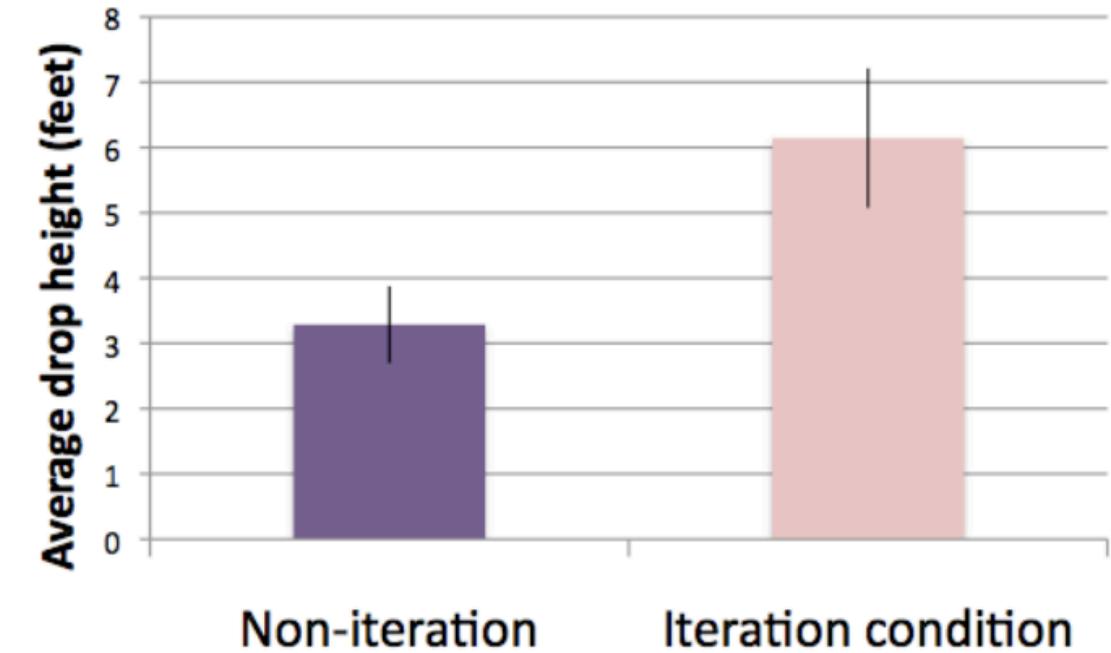
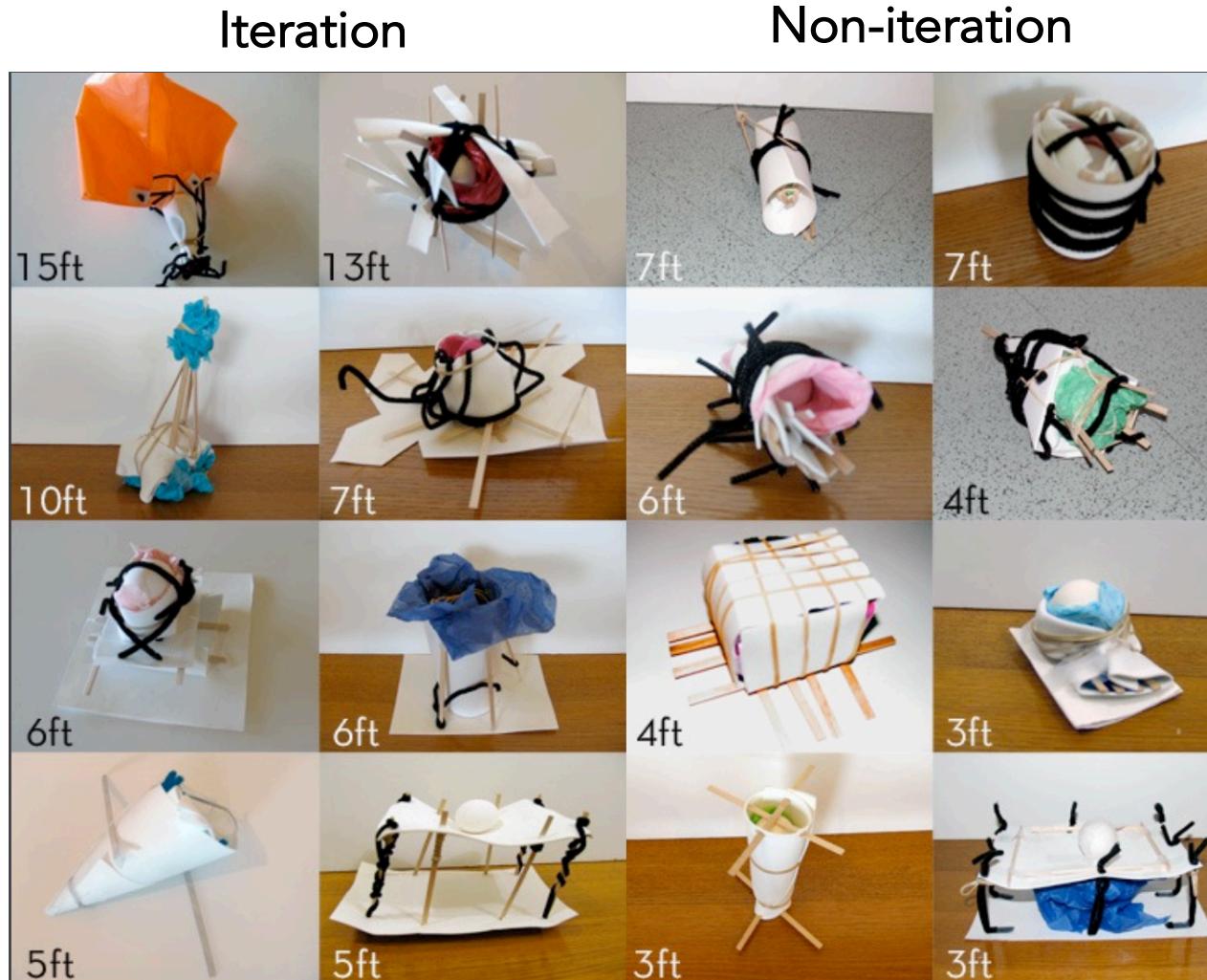


Students in creative studies at Buffalo State College posted key points to being a creative thinker.
Brendan Bannon for The New York Times

By Laura Pappano

Feb. 5, 2014

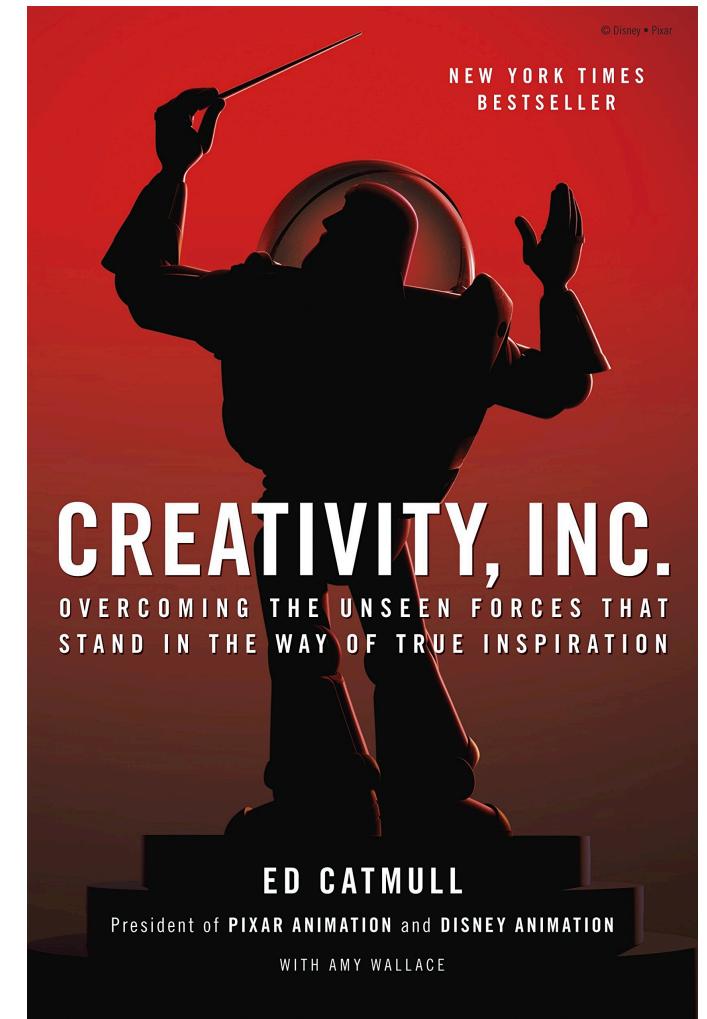
Why perfectionism early on is harmful



[Dow, Heddleston, & Klemmer, C&C 2009]

Giving space for challenge and failure

[Many people] think it means accept failure with dignity and move on. The better, more subtle interpretation is that failure is a manifestation of learning and exploration. If you aren't experiencing failure, then you are making a far worse mistake: You are being driven by the desire to avoid it. And, for leaders especially, this strategy — trying to avoid failure by out-thinking it — dooms you to fail.



Scaling open-ended work is hard

3+4 = 7,
16 oz in 1 lb,
Calculate the speed of a car,
Towers of Hanoi,
Writing a for loop in Python



Objective Truth

Strength of a design,
Measuring quality of a
literary work,
Increasing accessibility,
Decreasing wage inequality



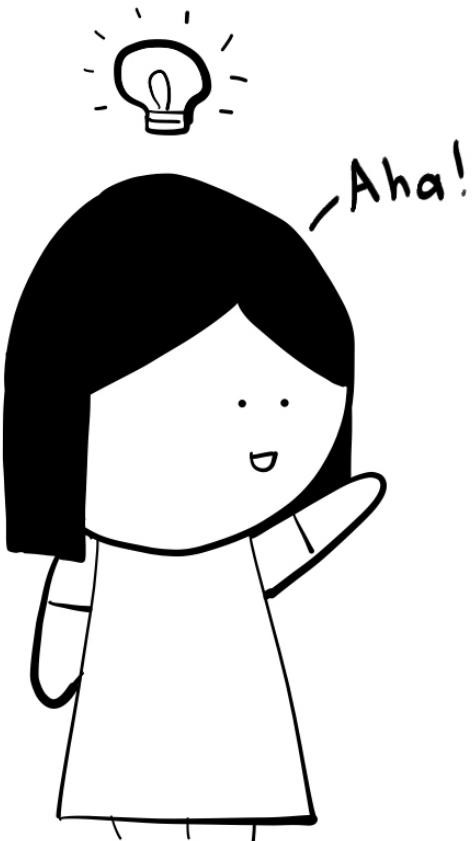
Contextual Truth

Open-Endedness

“If I only had an hour to solve a problem and my life depended on it, I would spend the first 55 minutes defining it and then I could solve it in the last five minutes.”

- Albert Einstein

Thank you!



3 important process skills for exploratory thinking in creativity:

- Framing
- Critique
- Collaboration

