Semantically Far Inspirations Considered Harmful? Accounting For Cognitive States In Collaborative Ideation

Joel Chan[1], Pao Siangliulue[2], Denisa Qori McDonald[3], Ruixue Liu[3], Reza Moradinezhad[3], Safa Aman[3], Erin T. Solovey[3], Krzysztof Z. Gajos[2], Steven P. Dow[4]

[1]HCI Institute, Carnegie Mellon University

[2]SEAS, Harvard University

[3]College of Computing and Informatics, Drexel University

[4]Cognitive Science Department, UC San Diego

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my STARBUCKS IDEA

[topcoder]™

tongal®

IMAGINE BOSTON 2030

Climate CoLab

openIDEO

crowd innovation

IBM InnovationJam*

~46,000 ideas from **150,000** participants

$1,000,000,000 for most promising idea

(re)combination → **creativity**

(Sawyer 2012; Ward 2001)

↑

knowledge diversity

↑

crowds

how to design interactions at scale that optimize this pathway?

in particular: when should you be exposed to ideas that are different from your own?

answer 1: associationist theory

(Gupta et al 2012; Mednick 1962; Koestler, 1964)

(re)combination

knowledge

diversity

answer 1: associationist theory

(Gupta et al 2012; Mednick 1962; Koestler, 1964)

(re)combination +novelty +diversity

↑

remote associations

↑

far stimuli

↑

knowledge

diversity

answer 2: SIAM (search for ideas in associative memory)

(Nijstad & Stroebe 2006; Nijstad et al, 2010)

(re)combination +novelty

↑

deep exploration within categories +fluency +iteration

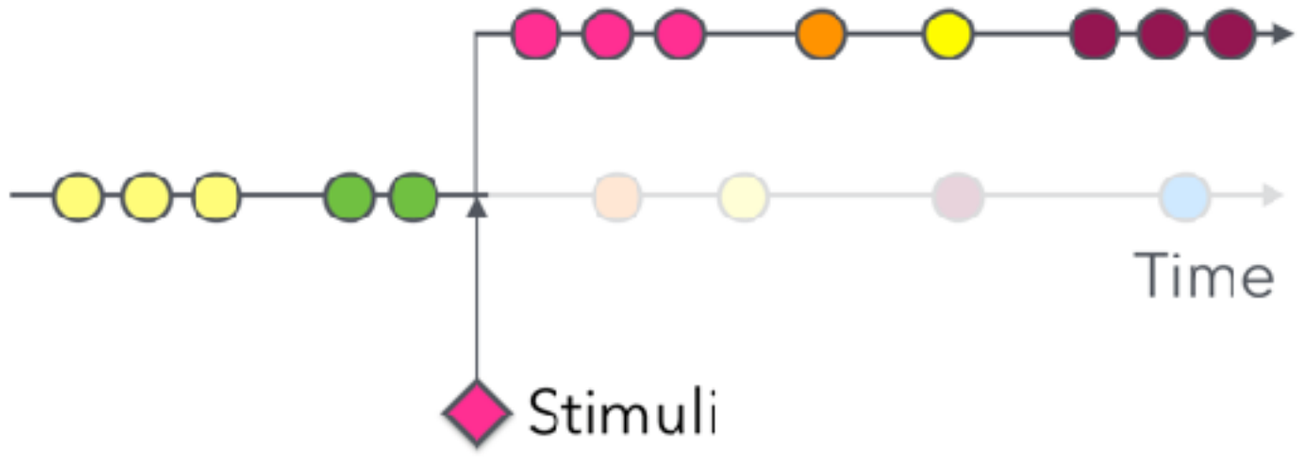
↑

if stuck, then far stimuli; else near

↑

knowledge

diversity



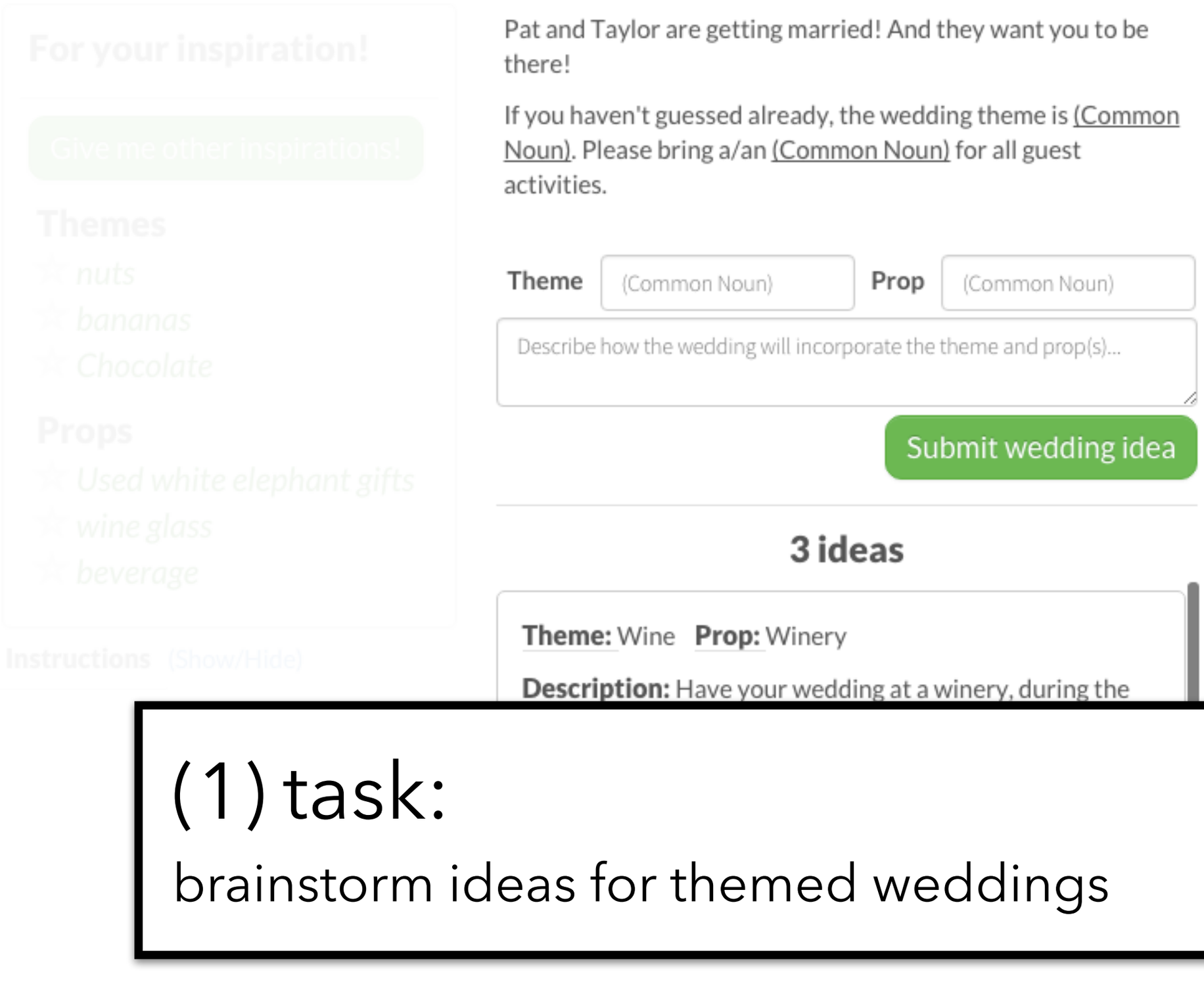
hypotheses to test

	Predicted best	**Predicted worst**
Associationist	**Always-Far:** maximize novelty+diversity w/ **remote associations**	**Always-Near**
SIAM		

hypotheses to test

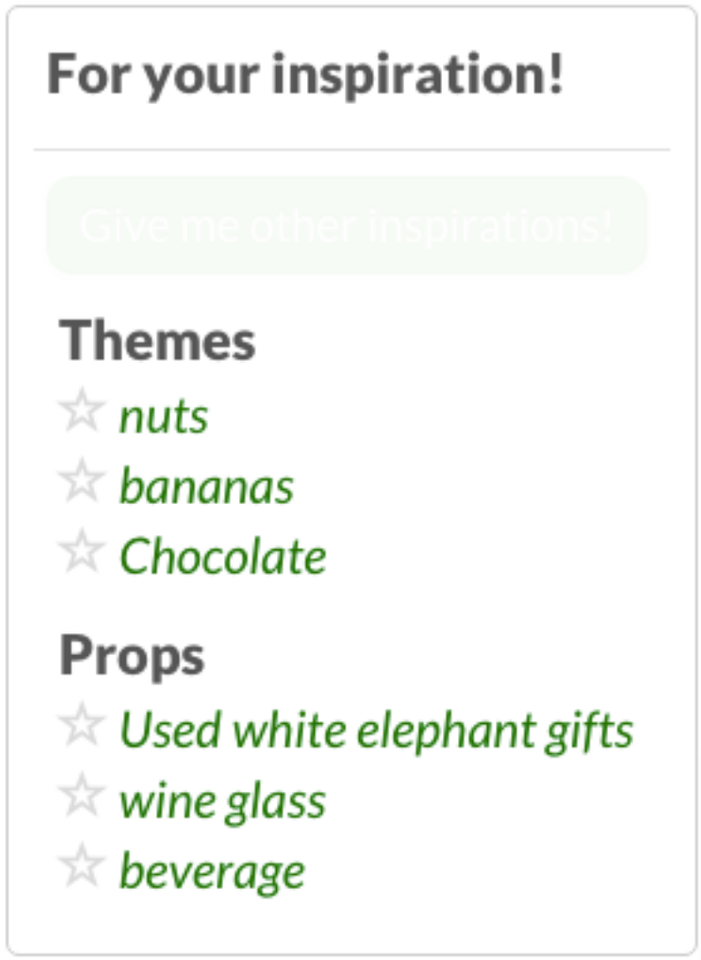
	Predicted best	**Predicted worst**
Associationist	**Always-Far:** maximize novelty+diversity w/ **remote associations**	**Always-Near**
SIAM	**Match-State:** maximize “roll” exploration within categories: **far when stuck, else near**	**Mismatch-State**

no direct data yet: let’s find out!



(1) task:

brainstorm ideas for themed weddings



other examples - for "football" theme:

- *Near*: [season, fun and games, fourth of July]
- *Far*: [toga, hula, prom].

(2) inspirations

- themes + props sampled from other brainstormers
- near/far tailored to last idea, using GloVe (Pennington et al 2014)

For your inspiration!

Give me other inspirations!

Themes

- ☆ *nuts*
- ☆ *bananas*
- ☆ *Chocolate*

Props

- ☆ *Used white elephant gifts*
- ☆ *wine glass*
- ☆ *beverage*

Instructions (Show/Hide)

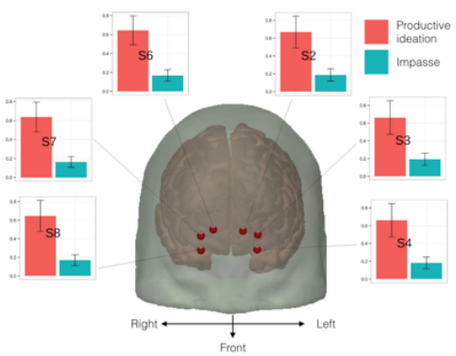
Pat and Taylor are getting married! And they want you to be there!

If you haven't guessed already, the wedding theme is (Common Noun). Please bring a/an (Common Noun) for all guest activities.

Theme (Common Noun) **Prop** (Common Noun)

Describe how the wedding will incorporate the theme and prop(s)...

Submit wedding idea



(2) inferring participants' cognitive states

- user-driven approach
- button click = "stuck"; else, "roll"

more details

- 245 participants from Amazon Mechanical Turk
- 5 conditions:
  - No-stimuli (baseline)
  - Always-Far
  - Always-Near
  - Match-State (far if stuck; else near)
  - Mismatch-State (near if stuck; else far)
- 8 minutes for brainstorming

overview

	Inter-idea interval	Transition similarity	Fluency	Diversity	Novelty
No-stimuli					
Always-Far					
Always-Near					
Match-State					
Mismatch-State					

Inter-idea interval

No-stimuli

Always-Far

Always-Near

Match-State

Mismatch-State

measured by:

median # seconds between ideas

lower is better

slower ideation if far when not stuck

	Inter-idea interval
No-stimuli	64.2 *(5.3)*
Always-Far	**86.2 *(5.7)* ***
Always-Near	74.3 *(5.6)*
Match-State	76.6 *(5.5)*
Mismatch-State	**88.7 *(5.8)* ****

measured by:
median # seconds between ideas

F(4,233)=3.2, p=.01

Transition similarity

No-stimuli

Always-Far

Always-Near

Match-State

Mismatch-State

measured by:
mean GloVe similarity between temporally adjacent ideas

higher is better

always-far reduces iteration

	Transition similarity
No-stimuli	0.19 *(0.01)*
Always-Far	**0.12 *(0.02)*** ******
Always-Near	0.20 *(0.02)*
Match-State	0.19 *(0.01)*
Mismatch-State	0.14 *(0.02)*

measured by:
mean GloVe similarity between temporally adjacent ideas

$F(4,218)=4.9$, $p<.01$

Novelty

No-stimuli

Always-Far

Always-Near

Match-State

Mismatch-State

measured by:

max (highest) z-scored subjective (1-7) rating by workers (r = .64)

ex. high: “[Chemistry] [Lab experiment] (z-score=1.61).

ex. low: “[formal] [gift]” (z-score=–1.94)

higher is better

always-far reduces novelty

	Novelty
No-stimuli	0.88 *(0.07)*
Always-Far	**0.64 *(0.07)*** [m]
Always-Near	0.67 *(0.07)*
Match-State	0.88 *(0.07)*
Mismatch-State	0.79 *(0.07)*

measured by:

max (highest) z-scored subjective (1-7) rating by workers (r = .64)

ex. high: "[Chemistry] [Lab experiment] (z-score=1.61).

ex. low: "[formal] [gift]" (z-score=–1.94)

F(4,239)=2.5, p=.04

summary: slower, less iteration, lower novelty if far stimuli when not stuck

	Inter-idea interval	Transition similarity	Novelty
No-stimuli	64.2 *(5.3)*	0.19 *(0.01)*	0.88 *(0.07)*
Always-Far	**86.2 *(5.7)* ****	**0.12 *(0.02)* ****	**0.64 *(0.07)* m**
Always-Near	74.3 *(5.6)*	0.20 *(0.02)*	0.67 *(0.07)*
Match-State	76.6 *(5.5)*	0.19 *(0.01)*	0.88 *(0.07)*
Mismatch-State	**88.7 *(5.8)* ****	0.14 *(0.02)*	0.79 *(0.07)*

implications

- be careful with far inspirations
  - complementary to other work on distance from *problem* (Fu et al, 2013; Goncalves et al 2013; Chan et al 2015)
    - better strategies/scaffolding?
    - better mindset?
    - respect constraints (Yu et al 2016)?
- need better theories (SIAM only slightly less bad)
- dual paths of creativity (Nijstad et al 2010)

looking ahead

- how can we create context-aware creativity support tools?

can [physiological computing, BCI] give us real "thinking caps"?

- how can we best design both sampling (IR) and interactions with inspirational stimuli?

THANK YOU!

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Participants, PC,
Reviewers, and YOU!

QUESTIONS?

joelchan.me // joelchuc@cs.cmu.edu

validate inspiration sampling

- good agreement (Cohen's k = .84) with human near/far judgments (Cohen's k = .95) for inspirations for 100 "seed" ideas
- near stimuli ~4 nodes away in Wordnet (e.g., WOLF-->canine-->carnivore-->feline-->CAT), vs. ~9 nodes away for far stimuli.

validate states