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Research Spotlight Forum

Social Sciences & Decision Making

Characterizing and detecting agency to frame problems

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ABOUT MYSELF

- Associate professor, Organization, Information, & Learning Sciences + School of Engineering
  - PhD from UT Austin: Engineering education / learning sciences
  - MS from UT Austin: Structural geology
  - Side gig: Fashion design
- **Learning scientist** = study how people learn, generally in realistic & real world settings
- **Research areas:** design learning & thinking, identity development, agency, creativity/innovation

CURRENT WORK IN SOCIAL SCIENCES & DECISION MAKING

- We know a lot about how people *solve* problems, considerably less about how they *frame* problems
- Designers have agency to frame and reframe problems (Dorst & Cross, 2001; Harfield 2007)
  - Know how to direct their problem framing
  - Consequential decisions
- Like other constructs, agency should be considered in context
  - Example: Math self-efficacy, Science self-efficacy

Framing agency: taking opportunities to make decisions that are consequential to learning and designing

CURRENT WORK IN SOCIAL SCIENCES & DECISION MAKING

Methods:

- Participant observation
- Video/audio recordings of student design teams over the course of the project
  - 4 settings, ~30 teams, hundreds of hours of data
- Discourse analysis of transcribed talk
  - First-pass auto-coding in Excel
- **Research question**: What kinds of student design team discourse differentiate between framing agency and other kinds of agency (e.g., deciding to disengage, making decisions that situate work as well-structured)?

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High agency marker. First person singular pronoun (I, I've, I'm, I'll)
Shared agency marker. First person plural pronoun (we, we're, we've, we'll)
Low agency marker. External person or situation as subject, generic you
Lower agency marker. Speaker modifies statement with diminishing hedge terms. (seem, like, a bit, almost, mostly, actually, a little, nearly, really, perhaps, maybe, kind of, somewhat, sort of, any, possibly, I believe, probably, might, apparently, some, just, sometimes, hardly, I mean, I think, guess)
Lower agency marker. Verbs that show potential control (could, might, should, can, going to, would, will, shall, may, want to, gonna, wanna, 'd, 've, 'll)
Low agency marker. Verbs that indicate a lack of control (told to, needed to, instructed to, have to, need to, instructions, must, needs to, has to, had to, required, supposed to, had to)
Low agency marker. Mitigation via subordinate clause that offloads agency

Example 1: Tom's team

- Client: a physical therapist who wanted a means to measure limb movement
- Design a glove with a pressure sensor and accelerometer
- Tom feared an accelerometer could be moved in ways that would register no movement

Vignette 1: Feb 11

Addai: Instead of taking measurements in three dimensions, this is this is like maybe a first draft. //

Tom: //hm!//

Addai: //You throw away the position information.

Tom: Right.

Addai: And we roll the XYZ coordinates into just one combined vector and that way we've always accounted for your full gravitational contribution.

Shanti: That's a good idea!

Cynthia: Yeah.

Shanti: Like a magnitude (.) of all three of them like a//

Addai: //Exactly. Exactly. So if you roll them all together you can still figure out//

Shanti: //That's a good idea.

Example 1: Tom's team

Vignette 2: Feb 11, 5 min. later

Addai: Like I said I'm still not sold on it, but. I'm not sold on it, but I like the way it looks.

Tom: mmhmm [positive]

Shanti: Yeah anyway try it out it might work I don't know.

Addai: [quietly] You do lose, uh I think you do lose your position because you rolled all of your axes. [louder] But it would be a much easier way also to keep track of your overall change

Vignette 3: Apr 21

Addai: We calibrated the accelerometer and by doing a square root of sum of
Addai: squares. He says that it works the way it should.
Shanti: Okay.
Addai: And we subtract out gravity and then we'll stay at zero in a non-moving orientation.
Shanti: So you're taking the sum of squares? Uh:: and then you're subtracting out gravity how?
Addai: Yeah we're doing the square root of sum of squares first what we do is we convert each of those channels by the calibration curves to the units per second squared // Shanti: Okay // And then we have, so then we have three axes where there's 100% square root values and then we do sum of squares square rooted
Shanti: Okay
Addai: [quieter] And then we would just subtract 9.8 (.) [quieter still] 'cause 9.8 meters per second per second is the value of g (.)
Tom: It's basically getting a. (.) uh net. (.) acceleration. uh (.) magnitude.
Shanti: [looks concerned] Right.
Tom: and uh (.) which is one contribution of gravity and then mechanical contributions from movement
Shanti: And we don't anticipate any situations like we talked about where the two components would // cancel out
Tom: //Oh yeah like moving around, uh we // only transiently//
Addai: //We don't. // We don't anticipate it, we're gonna look at it.

- Very different from prior
- From end of semester
- Retain tentative quality

Example 2: Steve's team

- Client: measure specific biochemical processes in the body as an early warning system for sepsis following surgery

Daniela: I just thought that something bothers me the fact that (.) yeah we're gonna put the sensor on the stomach (.) right? During surgery? (.) But then (.) we're gonna, the surgery only lasts like one::: to two hours and we're gonna take it off and the patient is gonna be, (.) um well the surgery is gonna be over and there's not gonna be any monitoring afterwards, and I'm thinking (.) Well there's higher chance of sepsis or shock appearing after surgery. So::: should we think about leaving the sensor? or::: (.) 'cause I don't really think it's//

Dillon: //Seriously, that could be like, the next step.

Steve: Yeah.

Dillon: Right.

Steve: I think that—are you talking about like for like in real life? like

Daniela: Yeah. Like what what's the use of it if // you're just gonna

Steve: //I think

Bob: //I thought [increasing volume] // I thought the problem—the project was to do an internal sensor that it could be left there.

Daniela: So we are gonna leave it there?

- Daniela displays framing agency
  - Shut down by team mates
- Steve made decisions, but they were not consequential to the framing of a design problem
- Bob's language displays lack of control

Results

- Framing agency
  - Shared
  - Hedgy, tentative quality
  - Maintains potential control in verb choices and pronoun usage

FUNDING SOURCES

- Principal Investigator, **NSF *CAREER: the FRAME project*** *(Framing and Reframing Agency in Making and Engineering).* (FY18-22, $516,060, EEC #1751369).
  - vanessasvihla.org
- Co-principal Investigator, NSF (FY17-21, $1,999,957, EEC #1623105). *IUSE/PFE:RED:* ***FACETS****: Formation of Accomplished Chemical Engineers for Transforming Society.* With PI Datye, SOE & Co-PIs Chi & Han, SOE, & Kang, OILS.
  - http://facets.unm.edu/

RESEARCH NEEDS

- **Data collection sites / proving grounds / collaborative research:** Understand framing agency outside educational settings
  - How it develops
  - What conditions foster/constrain framing agency
  - What it predicts (innovation, identity formation, persistence)
- **Collaborative machine learning/data mining:** Automate detection of framing agency in talk
  - Based on discourse analysis techniques
  - Context specificity?
- **Assessment:** Automate analysis of design work on standardized tasks
  - Text/sketches