User Experience (UX) of Advanced 3D Data Visualization Software

Mara Ulloa / MAHR-ah – OOh-YO-ah /

PhD Student
Department of Computer Science
Human-Computer Interaction (HCI)

NSF NCAR Operated by UCAR

Computational & Information Systems Lab (CISL)
Visualization Services & Research (ViSR)

Northwestern McCORMICK SCHOOL OF ENGINEERING

The Visualization Services and research group (ViSR)

Nihanth Cherukuru, PhD
ViSR Group Head

Mara Ulloa
Graduate
UX Researcher

Visualization Services & Research (**ViSR**)

Summer Internships in Parallel Computational Science
SIParCS
BOULDER · CO

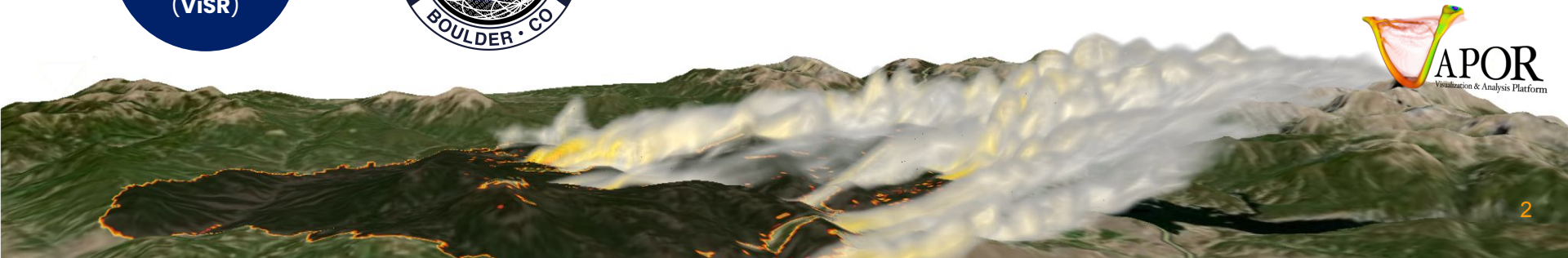
Develop/maintain VAPOR (**3D data visualization** app)

Collaborate with researchers to design **production-quality visualizations**

Design/develop **web interactive visualizations** for the broader audience

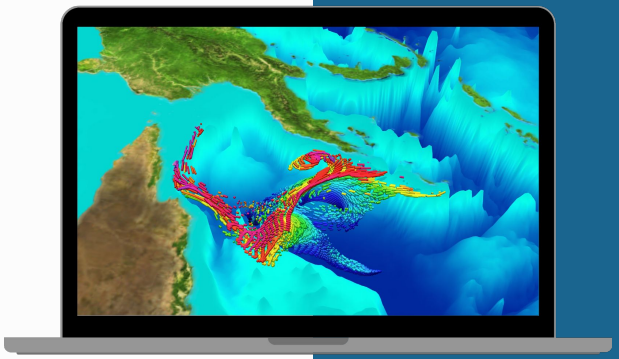
Research **data compression** within the geosciences

Use **UX methodologies** to understand societal needs & evaluate emerging technologies for visualizations



VAPOR
Visualization & Analysis Platform

Extending the impact of geoscience 3D data visualization software with UX research



It is imperative to understand who our end users are!

We have demographic data (e.g., location, area of expertise)

We don't have data on end users preferences (e.g., why tool A over tool B, what specific "job" they are "hiring" a tool for), **pain points** (e.g., hesitations/uncertainties, annoyances with a tool), **motivations** (e.g., allure of trying a new tool)

Having better theories about who our users are and what drives them will enable us to build better systems

Research questions

1. Why did a user start looking for a particular 3D data visualization tool ❓ What was the trigger ❓

2. Why did a user hire (download) a 3D data visualization tool for the first time ❓

3. Why and how did a user switch between two (or more) different 3D data visualization tools ❓

4. How did a user search for new 3D data visualization tools ❓

Jobs-to-be-Done (JTBD) Theory

HISTORICAL OVERVIEW

1991

Tony Ulwick:

IBM Sr. Product Manager

1992

First Use Case: Medical devices, 19 became # 1 or 2 in the market

1999 - 2003

Harvard Business School

Clayton Christensen: Popularizes JTBD

2003 - Present

JTBD: Applied across fortune 500 companies & research

Jobs-to-be-Done (JTBD) Theory cont.

RATIONALITY OVERVIEW

1. Users **don't buy** products; they **hire them** to complete a job they need done!

2. Cause behind a user's decision to hire a product, which can often be **different from what the organization**

3. Goes beyond understanding what features to implement; it's about **understanding the people** who we're developing these products for

4. Streamline the innovation process by uncovering the true purpose of a product or service

5. By understanding users' motivations, we can effectively compete not just with similar tools but with alternative solutions as well.

Companies that have successfully developed products and services focused on JTBD:

zoom Microsoft DOORDASH PayPal

Jobs-to-be-Done (JTBD) Theory cont.

McDonald's wanted to increase milkshake sales; they had data and demographic profiles about the typical milkshake customer.

Somewhere, people hire a milkshake for a specific job; we need to understand what that job is!

Ethnography & most are purchased before 8AM

Long, boring drive to work & other milkshake competitors

Thicker, more accessible milkshakes!

How does User Experience (UX) research benefit from the JTBD framework?

The JTBD Interview is a research method to uncover the users' job at the moment they hired (downloaded) your tool

Struggling Moment

Looking for a solution for their goal

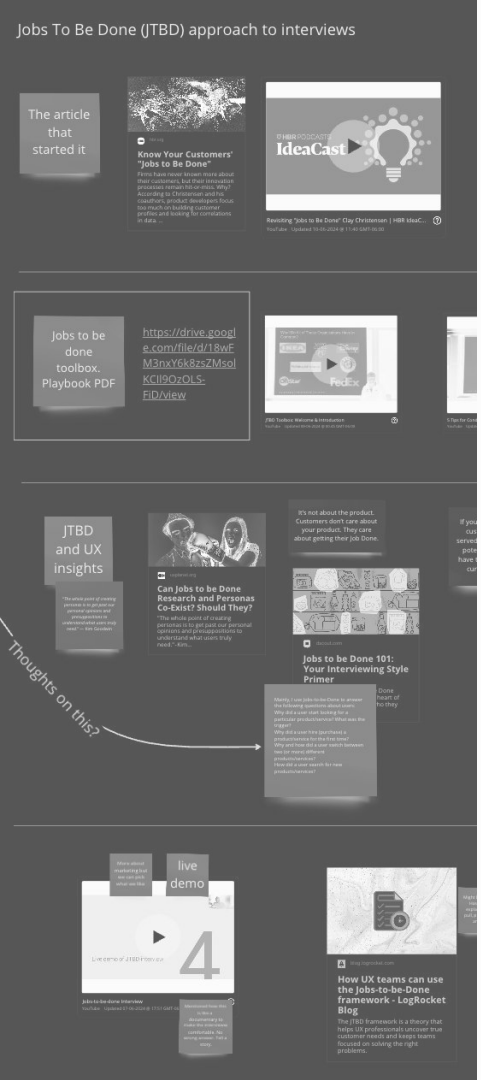
User Values

Uncover user values and benefits

Timeline of Events

That led them to hire our tool

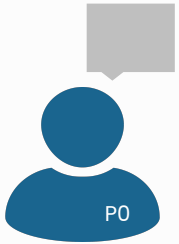
Sharing these insights with product management, development, and leadership can guide roadmap prioritization towards high-demand initiatives and help design a solution that addresses your users' true JTBD ❗



Applying JTBD to user interviews

- **Insights gained during the first month(s) of the project**
  - Selecting the first President's Strategic Initiative Fund (PSIF) UX project
  - UX research maturity of NSF NCAR
  - Literature reviews
    - HCI → UX
    - UX Trainings
    - Framework selection: JTBD and its applications
  - Trial and error (e.g., mock interviews)
  - Scoping
    - Analysis methods selection
- **7 JTBD user interviews**
  - 30 - 60 minutes, virtually
  - 3 university users, 4 internal users

Preliminary findings



FORCES OF PROGRESS DIAGRAM

TIMELINE

Background: Prof X at Uni Y, 1K years experience with 3D visualizations

First thought: their first thought

Event 1: Downloaded tool Z when working in grad lab, influenced by forces ABC

Event 2: looking for solutions with the intention of getting one

Buying: what happened when they bought it

Participant 0

PUSH

Anything that's forcing user out of their current workflow ✌️

MAGNETISM

Attractive 🔥 attributes about a new tool the user wants to pick up

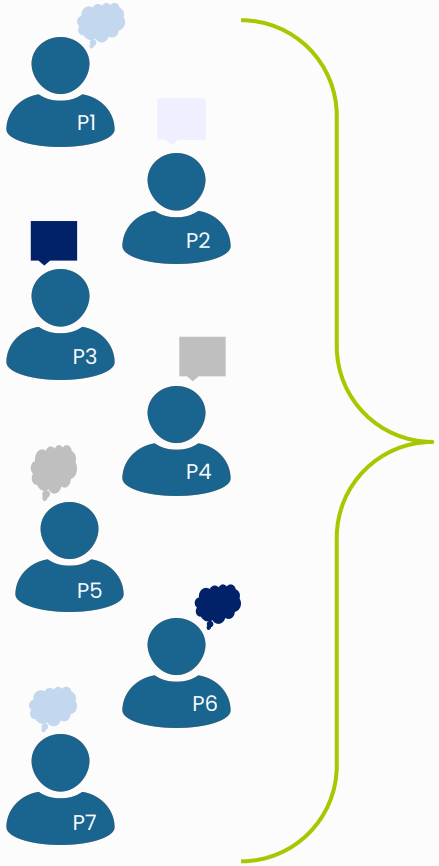
INERTIA

What's stopping 🛑 user from moving away from their existing workflow

ANXIETY

Even if they ❤️ the new tool, what's preventing user from fully adopting it 😬

Preliminary findings cont.



FORCES OF PROGRESS DIAGRAM

TIMELINE

Background: 4 experienced users, 3 novice users, 4 NCAR users, 3 uni users

First thought: Current solution isn't working for them

Event 1: Cause for them to start looking for a new solution

Event 2: User decided to address their situation by a certain point

Buying:

COLLECTIVE DIAGRAM

PUSH

- Outdated tool (no longer supported, runs slower than newer tech)
- Learning curve is a commitment

MAGNETISM

- Human support after hiring
- Lab/uni preferred tool

INERTIA

- Infrequent use
- Unable to measure task length

ANXIETY

- Impact factor (e.g., grants)
- Memory recall for infrequent users

Limitations

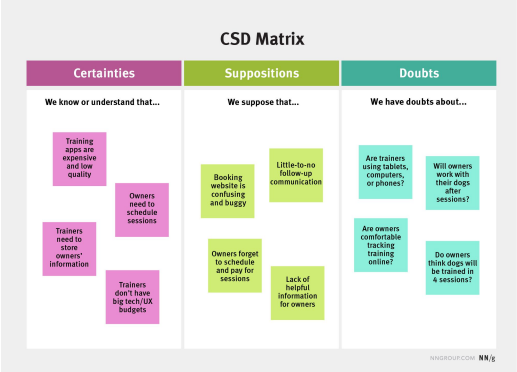
- Confirmation bias of our participants
- Dataset size
- NSF NCAR's UX research maturity
- US-based study

Future work

- Expand external recruitment
- Continue data collection
- Scale to other NSF NCAR projects
- More international participants

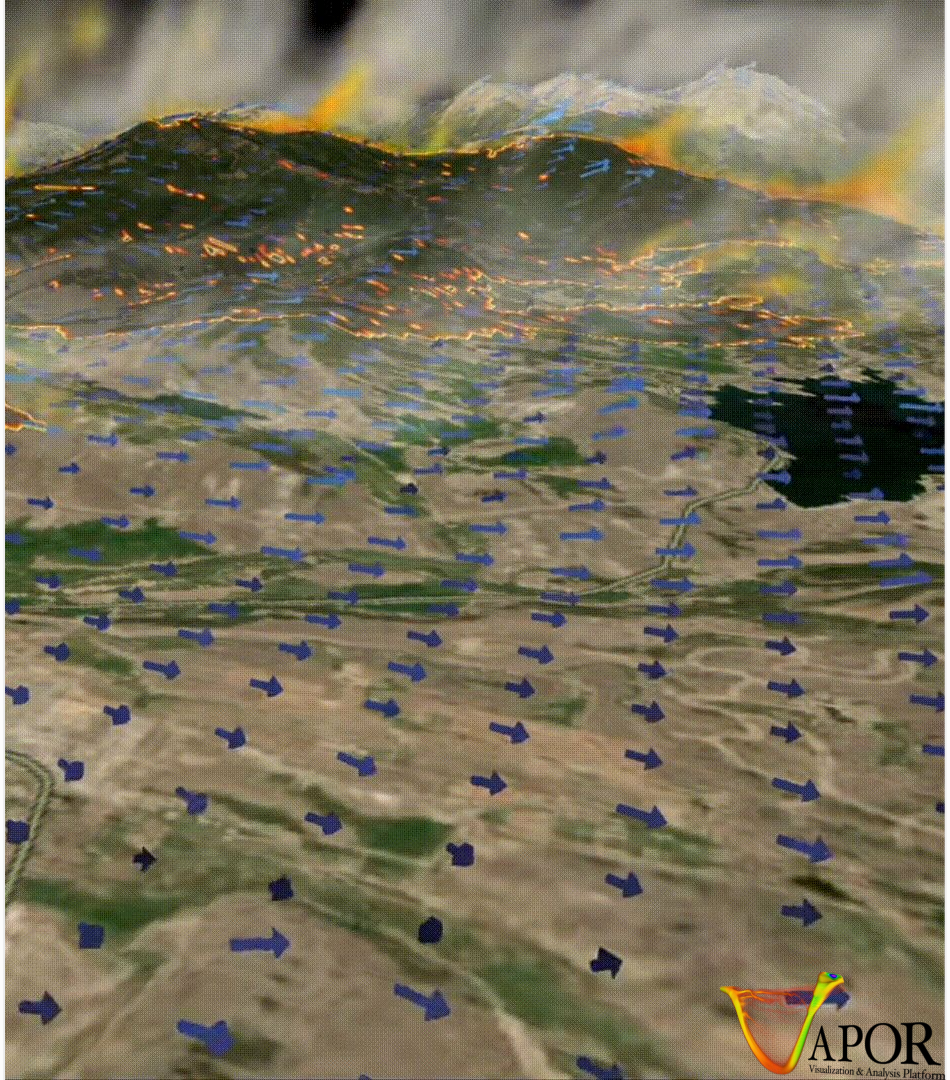
Post JTBD

- Personas
- Empathy maps
- User journey maps
- Assumption matrix
- CSD matrix



Thank you!

MaraUlloa.com
@mara_ulloa__
mara.ulloa@u.northwestern.edu



References and suggested resources

- **Jobs-to-be-done (JTBD)**
  - Know Your Customers' "Jobs to Be Done"
  - Revisiting "Jobs to Be Done" Clay Christensen | HBR IdeaCast
  - JTBD Toolbox: Welcome & Introduction
  - History of Jobs-to-Be-Done
  - The History of Jobs-to-be-Done and Outcome-Driven Innovation
- **JTBD and UX Insights**
  - Can Jobs to be Done Research and Personas Co-Exist? Should They?
  - Jobs to be Done 101: Your Interviewing Style Primer
  - 5 Tips for Conducting JTBD Interviews
  - Jobs-to-be-done Interview
  - How UX teams can use the Jobs-to-be-Done framework
  - UX Strategy: Definition and Components
- **User-centered design (UCD) and others books**
  - Lean UX, Designing Great Products with Agile Teams
  - Sprint, How to Solve Big Problems and Test New Ideas in Just Five Days
  - User Centered System Design, Donald A. Norman and Stephen W. Draper (1986)
  - The Two Cultures, C.P. Snow (1959)