Preference and Decision Making in Large-Scale Communities

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ABSTRACT

Understanding the formation of preferences as they relate to decision making is a crucial task in identifying aspects of major projects; however, current literature has a deficit of this focus in regards to large-scale projects and large communities. This study aims to bolster the understanding of these large community preferences as they relate to large-scale projects. The study was conducted at two American Astronomical Society (AAS) conferences to gain information from the astrophysics community regarding NASA Decadal missions. Community preferences for Decadal missions are assessed through the Decadal Survey to summarize the opinions of the astronomical community regarding which missions should be prioritized in the next decade of NASA research. Data were collected using an online survey intended to measure community preferences. Researchers hypothesized that community preferences for engineering attributes of large-scale projects would differ, such as preferences for attributes such as the profitability of the mission, efficiency, reliability, resilience, etc. Conditions were derived from actual responses, and participants were sorted into four existing conditions: industry, academia, undergraduate/graduate students, and other communities. Most results were insignificant, but support was found that community preferences differed, particularly preferences of industry and academia versus students. Implications of this research suggest that project leaders of Decadal missions should take into consideration the preferences of each community separately. When predicting the decisions that agencies and communities will made, understanding the differences in the type of preferences formed will provide a valuable tool.

LITERATURE REVIEW

Preference Formation

- Typically defined as an attitude or an underlying inclination to find something either desirable or undesirable
- Utility theory describes preference formation as stable and complete, but individuals rarely have complete knowledge of all alternatives and preferences are effected by context
- Within context, individuals use heuristics to assess alternatives when in situations with limited time or complicated input
- Groups adapt to peer influence, especially when dealing with intellectual problems
- The confidence in preferences are boosted through group unity; however, this rise in confidence creates the potential for a "risky shift"

Decision Making

- Realistically, most decisions satisfy a different set of preferences, but there is not a decision available that satisfies all
- Due to this reality, individuals tend to focus on decisions that provide maximum utility with minimum consequences
- Decisions are made with comparisons to alternatives, which can include attributes that are easily comparable and those that are not comparable.
- Individuals polarize preferences and decisions to avoid cognitive dissonance, even in the case of false feedback

Large Scale Product Design

- Growing tendency for large scale products to include input from multiple communities to address the complexity of the product
- Synthesis of cultural identities creates brand identity; the identity of the product weighs into what preferences will be valued when making decisions
- Information sharing is crucial for success, bolstered by collaborative sharing that allows differing communities to align their overarching goals

HYPOTHESES

H_1: There will be a significant difference between community preferences

Communities		
Industry	Academia	Students
• Management • Engineers	• Tenure-tracked • Tenure	• Undergraduate • Graduate

MATERIALS & METHODS

Participants

Members of the astrophysics community (N = 322) who attended the June 2018 and January 2019 AAS conference

Women, 39.4%; men, 58.4%; other genders, 0.9%; missing values, 1.2%

71.7% Caucasian, 2.5% African American, 10.9% Asian, 5.9% Hispanic/Latino

Preference Survey

Designed with an Expert Team from NASA to reliably relate to the upcoming Decadal Survey

Measured on a 5-point Likert scale, from (1) Strongly Disagree to (5) Strongly Agree

Closed-ended questions were followed by space where participants were able to provide remarks to further explain their preferences; no forced response

Design

3x1 Between-Subjects (Community Association), with levels Industry, Academia, and Students

Conditions were predetermined, but participants were sorted based on a targeted response in the demographic questionnaire

Qualitative Data Coding

Analysis of open-ended questions followed open coding process: de-contextualization, recontextualization, identification of categories, and compilation of categories

Eight questions led to 796 responses that were organized into 24 classifiers; e.g., scientific return, further exploration, wavelength coverage, flagship missions, etc.

Questionnaire Development

Process: (1) conceptualization of survey, (2) design and obtain Institutional Review Board (IRB) approval, (3) Testing, (4) Revision, (5) Data collection, and (6) Data monitoring and evaluation

Questionnaire ultimately contained close-ended scale questions, open-ended questions intended to better elicit preferences and professional risk attitudes, and finally a demographic questionnaire

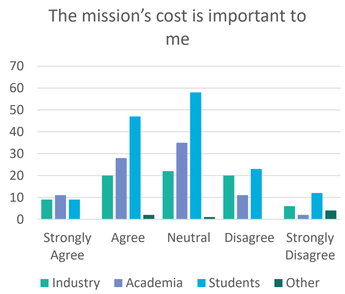
PROCEDURE

Convenience Sampling
Community members were approached by researchers during the conference and asked if they would be willing to participate.

Apparatus
The survey was administered through the Qualtrics survey platform, accessed through either a tablet or laptop provided by researchers.

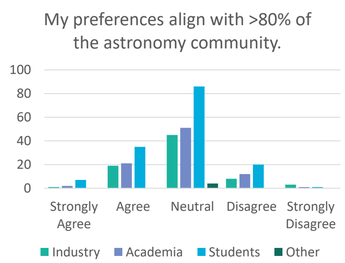
Researchers
To eliminate bias, researchers used a script to ensure all participants received the same information. The average survey time was approximately 10 minutes.

RESULTS



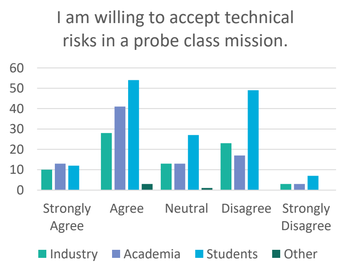
Industry
***M* = 2.92, *SD* = 1.14**
Academia
M = 2.60, *SD* = .946
Students
M = 2.88, *SD* = 1.01
Other
M = 3.00, *SD* = 1.41

Overall significant difference, $X^2(2, N = 322) = 9.782$, $p = .021$.
Specific significant difference between **Industry** and **Students**, $p = .017$



Industry
M = 2.84, *SD* = .933
Academia
M = 2.87, *SD* = .712
Students
M = 2.82, *SD* = .745
Other
M = 3.00 *SD* = .000

Overall significant difference, $X^2(2, N = 322) = 8.633$, $p = .035$.
Specific significant difference between **Industry** and **Students**, $p = .047$



Industry
M = 2.75, *SD* = 1.14
Academia
M = 2.49, *SD* = 1.08
Students
M = 2.90, *SD* = 1.10
Other
M = 2.25 *SD* = .500

Overall significant difference, $X^2(2, N = 322) = 15.083$, $p = .002$.
Specific significant differences between **Industry** and **Students**, $p = .047$, and **Academia** and **Students**, $p = .021$

DISCUSSION

Discussion

- Overall differences tended to be between students and other communities, despite student beliefs that their opinion aligned with more than 80% of the astronomy community
- Students were more likely to be significantly different from industry than academia, reflecting the closer context of student life and the academic community
- However, students do not hold specific investments within the decadal missions, unlike industry or academia
- Therefore, students portray a more idealistic preference that sets them apart from a professional viewpoint

Limitations

- Convenience sampling did not allow for equal distributions of conditions
- Participants expressed impatience and may have provided satisficing responses to more quickly return to the conference

Future Research

- Attempts to streamline the survey may provide more reliable data if impatience was a contributing factor
- Sample collecting from professional environments to balance out condition distributions

Conclusions

- The study provides a basis for moving forward in preference elicitation across sub-communities within large scale product design
- Results do indicate differences exist between subcommunities and must be addressed when displaying information, while still coinciding with ethical information.

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