The Key Behavioral Practices that Define Cyberinfrastructure

Abbey Francis, Alyssa Karpas, Amber Ingram, Chase Vombaur, Jack McKeon
Kerk Kee COM329, Fall 2018 – Chapman University; Orange, CA

Introduction

"So we're going to start by talking about cyberinfrastructure. And an analogy of that could be like a city's transportation infrastructure. You'll kind of see our image of that on slide number three. So there are multiple dimensions and aspects that make up a city's transportation infrastructure. We have material objects, behavioral practices, and philosophical ideologies. So for material objects, you'll see in the transportation analogy we have cars, traffic lights, and signage. And then behavioral practices include wearing a seat belt, using a turn blinker, and abiding by the speed limit. And then for ideology we have the idea of choosing to drive an electric- or hybrid-powered car in order to be more environmentally 'green.' So you can see how we kind of compartmentalized the different aspects of city transportation" (Participant #15).

Research Question

How do behavioral practices define cyberinfrastructure?

Literature Review

Behavioral practices allow the technologies and objects within cyberinfrastructure to work at their greatest capacity. In this project, three dimensions are conceptualized to define cyberinfrastructure: material objects (networks, computing resources, etc.), behavioral practices (how the research is carried out), and ideologies (values and norms driving the research). Behavioral practices are an instrumental dimension of cyberinfrastructure projects because they enable the material objects to 'come to life'. To further examine how this enabling dimension operates, we pose the research question, **"How do behavioral practices define cyberinfrastructure?"** In order to answer this research question, we analyzed 20 interviews with individuals/experts who have extensive experience in the cyberinfrastructure field to understand the key behavioral practices in cyberinfrastructure projects. Our analysis shows that there are five components of behavioral practices in cyberinfrastructure: data sharing and networking, central computing, user support, actual practitioner workflow, and resources. We found that behavioral practices are more influential than ideologies alone because actions yields greater impact than thoughts alone.

Methodology

This poster analyzed twenty transcripts from industry experts in cyberinfrastructure in order to determine the defining behavioral practices of cyberinfrastructure.

Findings

Three key behavioral practices were identified through this research:

Data Sharing and Networking

Having a network of scientists and cyberinfrastructure professionals expands on previous physical limitations. Professionals use central computing systems and other data sharing tools to create a global workplace for cyberinfrastructure to grow.

- "The intense need for interaction and collaborations with all kinds of government organizations in the U.S. and outside of the U.S., as well as academia. -- It's really a two-way flow. We prepare data in ways that it can be used in other projects, at other institutions. So that means doing data stewardship things, quality controlling, multiple different kinds of activities on the data to make sure it's correct and usable. And in return they use it and then return to us other products that our scientists might use. So consider that to be something like a model analysis of the observations taken in the atmosphere for the past 100 years." (Participant #2)
- "I think one thing would be people are trying to get the best bang for their buck. So if they can use a central computing or cloud computing rather than have to stand up their own server, they tend to be more interested in that sort of thing" (Participant #16)

Community and Peer Support

People interact with cyberinfrastructure in a variety of ways. It is crucial to the integrity of its systems that users have a shared understanding of its functionality. Therefore, consistent trainings eliminate misconceptions, better utilizing cyberinfrastructure systems.

- "So since everything is in kind of a distant setting, no one is local—or very few people are local—so how to support users in a distributed environment, so that would be how to have good documentation, how to run good training" (Participant #18)
- "So, there's a lot of training that goes on, involved – students have to know quite a bit. They have to know about compiling a code, linking libraries, submitting a job…So, I would say it's the practice of computing that the behavioral practice." (Participant #7)
- "So it's not just like when you want to develop a programming language or any other standard – we want to somewhat standardize things, otherwise people don't adopt it. Or the landscape will be kind of scattered and not as productive. So standardization is important both on sort of implementation level then also on a policy level also." (Participant #14)

Resource Selection

Researchers are all equipped with a cyberinfrastructure toolkit in which they utilize material objects in different ways. Selecting appropriate resources is an important behavior that researchers perform when interacting with cyberinfrastructure.

- "So behavioral practices is…selecting the right resources to perform your research, managing the results – or the ongoing data and the results of your research...it's helping your researchers to select the right tools and procedures and methods to utilize and optimize what they have to work with." (Participant #9)
- "So a university analogy of capacity would be a university would need to provide adequate resources and support to their students. So some of these items that make up optimal capacity include having enough classroom space, a bookstore, a library, technology services, dining services, and a health center." (Participant #11)
- "How we organize and socialize – you know, simple things like how you carry yourself on e-mail lists and send out e-mails to people in order to be – actually collaborate... the only way to actually operate [material objects] is, you know, kind of interacting still at this point with humans." (Participant #6)

Conclusion

Although more research is necessary to understand how behavioral practices define cyberinfrastructure, it is apparent that the core fundamentals of these behavioral practices are data sharing and networking, user support, resources. Cyberinfrastructure is still evolving; therefore, these behavioral practices may be the defining factors today, but are subject to change with the growth of cyberinfrastructure practices. While the material objects and ideologies of cyberinfrastructure should not be ignored, the behavioral practices contain measurable milestones of cyberinfrastructure development that this research just scratches the surface of. In conclusion, we found that behavioral practices are more influential than ideologies alone because actions yields greater impact than thoughts alone.

This material is based upon work supported by the National Science Foundation under Grant No. 1453864. This poster was presented on 12/5/2018 at the Fall 2019 Chapman University Student Symposium, Orange, CA.