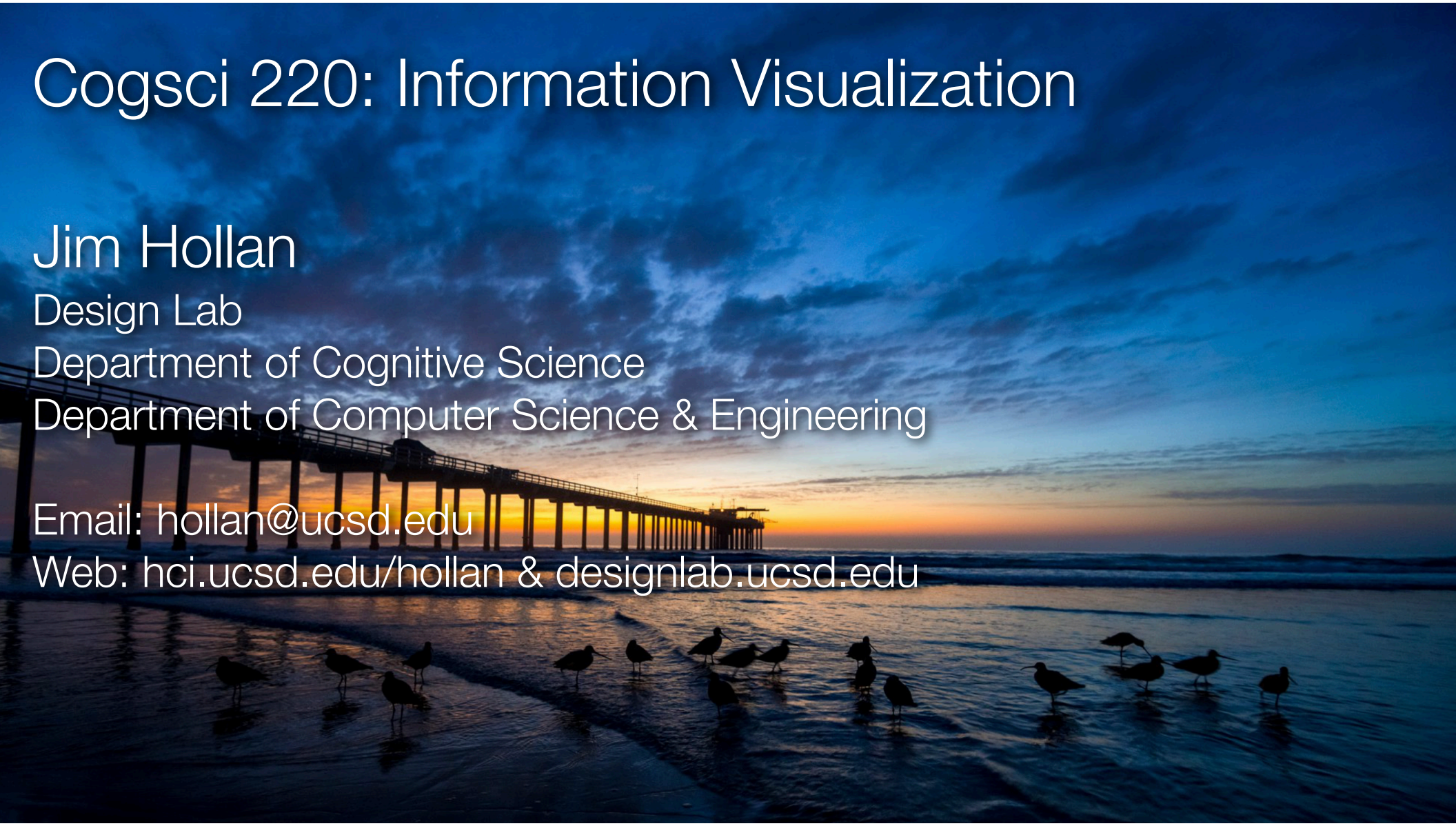

Cogsci 220: Information Visualization

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Department of Computer Science & Engineering

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Cogsci 220: Information Visualization

Welcome to week four.
Hope everyone continues to be safe in these challenging times.

Be sure you are keeping up with readings and going through the UW notebook introduction to Vega-Lite. There are also nice introductions to Observable notebooks and JavaScript.

Today:
Main goal today is to ensure project groups are formed and your initial topic is decided

We will start with hearing from your groups

Briefly talk about writing and especially about writing proposals

End with an interview with this week's *Researcher of Week:* Arvind Satyanarayan

Your group should get together soon to coordinate and prepare a note to sent to 220-g@ucsd.edu by Friday evening

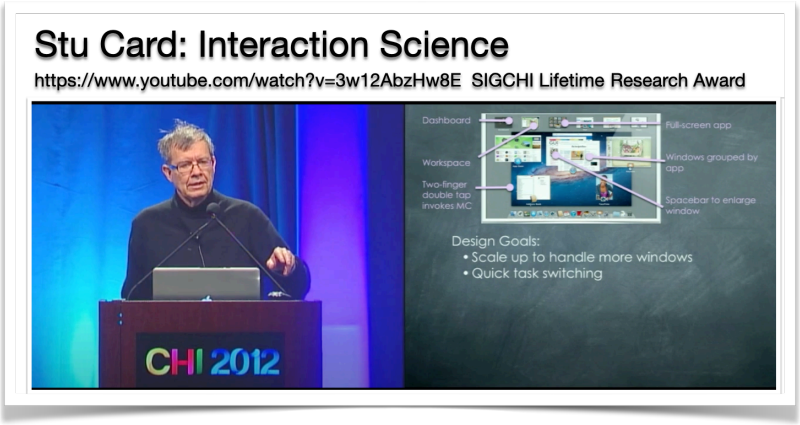
Stu Card:
The PhD Thesis Deconstructed

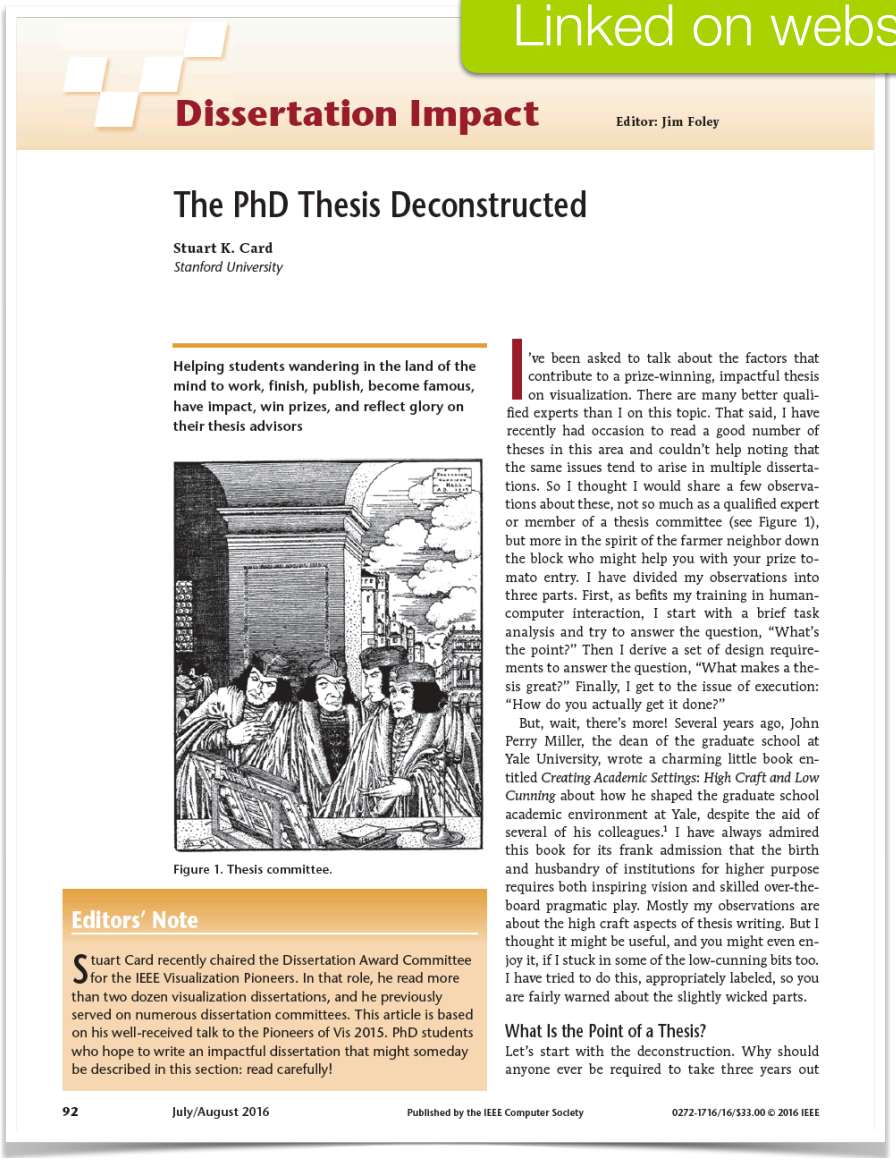
What is the point of a thesis?

What makes a great thesis?

How do you write a great thesis?

Linked on website





Dissertation Impact Editor: Jim Foley

The PhD Thesis Deconstructed

Stuart K. Card
Stanford University

Helping students wandering in the land of the mind to work, finish, publish, become famous, have impact, win prizes, and reflect glory on their thesis advisors

Figure 1. Thesis committee.

Editors' Note

Stuart Card recently chaired the Dissertation Award Committee for the IEEE Visualization Pioneers. In that role, he read more than two dozen visualization dissertations, and he previously served on numerous dissertation committees. This article is based on his well-received talk to the Pioneers of Vis 2015. PhD students who hope to write an impactful dissertation that might someday be described in this section: read carefully!

I've been asked to talk about the factors that contribute to a prize-winning, impactful thesis on visualization. There are many better qualified experts than I on this topic. That said, I have recently had occasion to read a good number of theses in this area and couldn't help noting that the same issues tend to arise in multiple dissertations. So I thought I would share a few observations about these, not so much as a qualified expert or member of a thesis committee (see Figure 1), but more in the spirit of the farmer neighbor down the block who might help you with your prize tomato entry. I have divided my observations into three parts. First, as befits my training in human-computer interaction, I start with a brief task analysis and try to answer the question, "What's the point?" Then I derive a set of design requirements to answer the question, "What makes a thesis great?" Finally, I get to the issue of execution: "How do you actually get it done?"

But, wait, there's more! Several years ago, John Perry Miller, the dean of the graduate school at Yale University, wrote a charming little book entitled *Creating Academic Settings: High Craft and Low Cunning* about how he shaped the graduate school academic environment at Yale, despite the aid of several of his colleagues.[1] I have always admired this book for its frank admission that the birth and husbandry of institutions for higher purpose requires both inspiring vision and skilled over-the-board pragmatic play. Mostly my observations are about the high craft aspects of thesis writing. But I thought it might be useful, and you might even enjoy it, if I stuck in some of the low-cunning bits too. I have tried to do this, appropriately labeled, so you are fairly warned about the slightly wicked parts.

What Is the Point of a Thesis?

Let's start with the deconstruction. Why should anyone ever be required to take three years out

 Published by the IEEE Computer Society

What, Why, and How of Visualization

What is shown?

Data abstraction

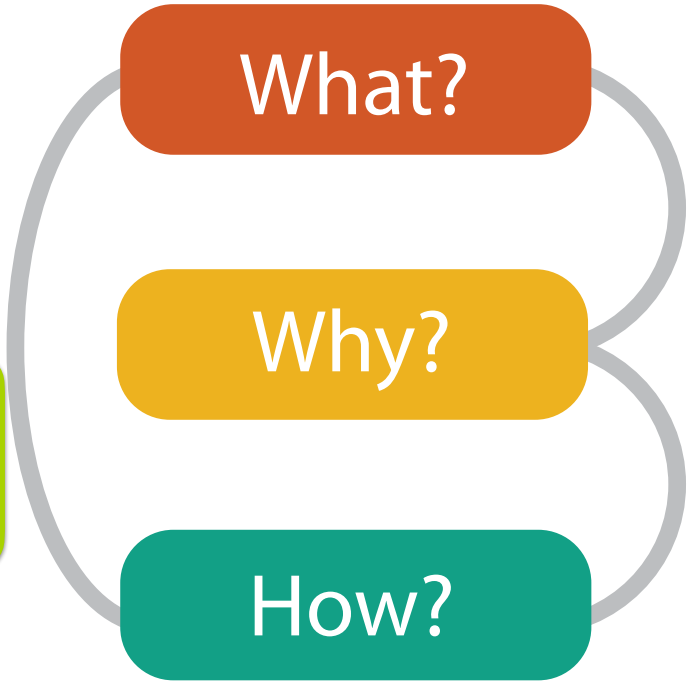
Why is the user looking at it?

Task abstraction

Increasingly important to look beyond task to encompassing activities.

How is it shown?

Idiom: visual encoding and interaction

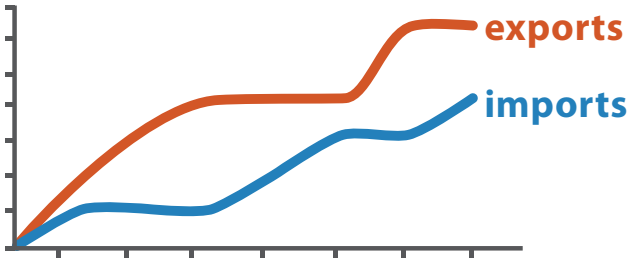


Goal: Reduce Task and Activity Complexity

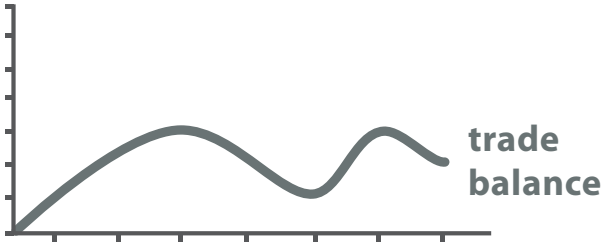
Don't just draw what you're given

- Decide what the right thing to show is
- Create it with a series of transformations from the original dataset
- Draw that "right thing"

Increasing need to take context into account, especially as part of interactivity and dynamic content.



Original Data

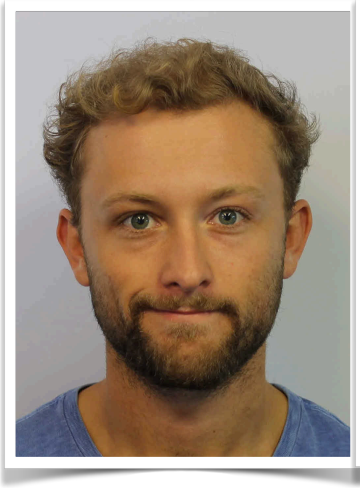


trade balance = exports – imports

Derived Data

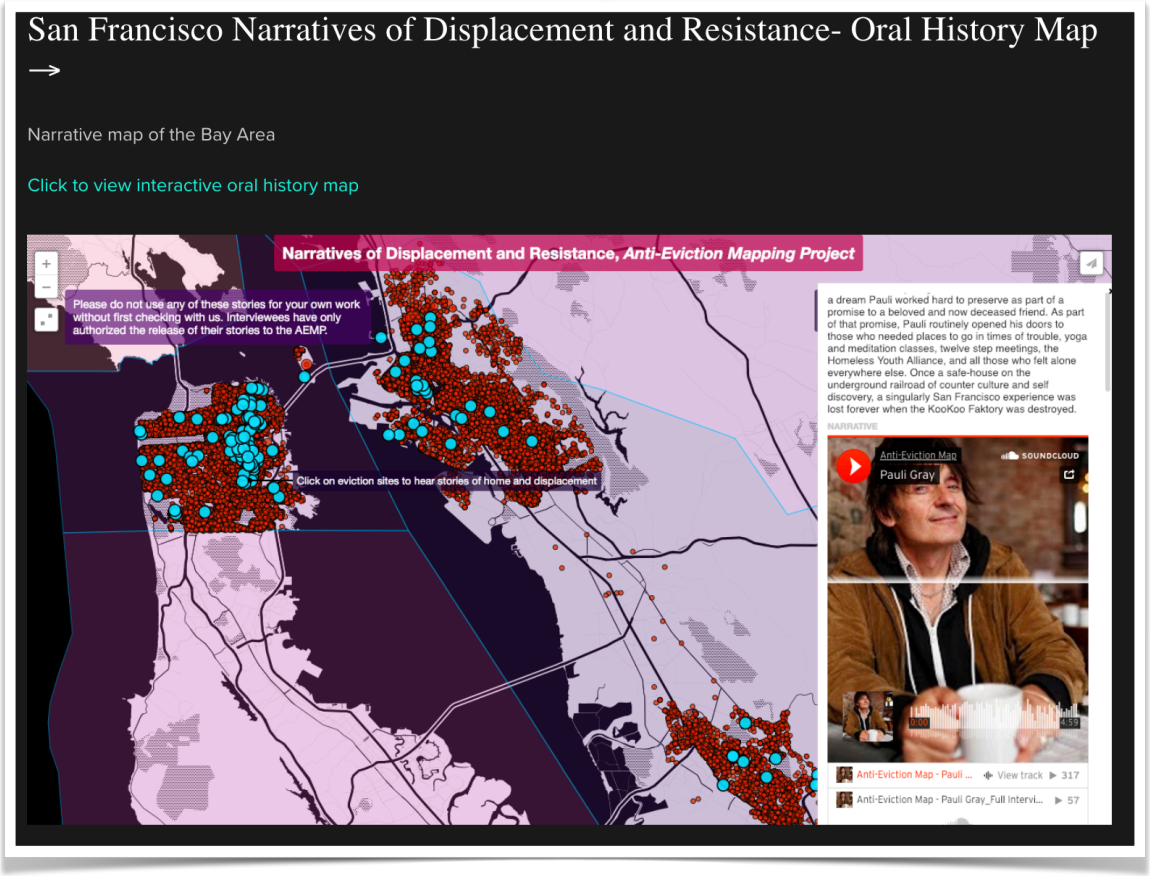
Mary Anne Smart, Casey Meehan, Lu Sun

Lu, Casey, and I are interested in working on visualizations related to data privacy. We're envisioning a tool that could track the kind of data that you share with different applications over time. You could use different lenses to focus on specific kinds of data; for example, you might be interested in specifically looking at location data that you have shared over time.

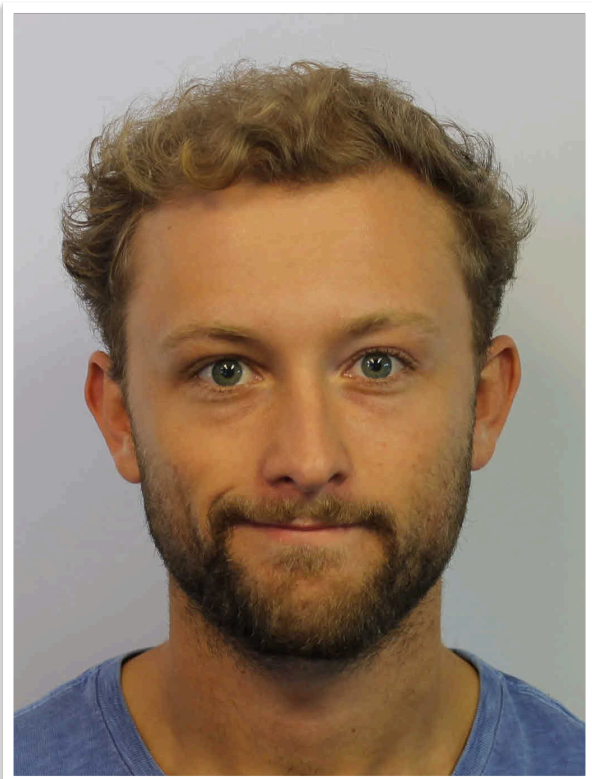




Mary Anne Smart, Casey Meehan, Lu Sun

We're also interested in finding a way to link your data as an individual to the broader collective issue of online data collection. For example, this visualization from the anti-eviction mapping project gives the viewer an idea of the "big picture" of the problem of evictions in the SF area. However, you also have the ability to "zoom in" and click on individual points on the map to hear individual stories. We'd like to do something similar to connect your privacy as an individual to the broader landscape of mass data collection.



Mary Anne Smart, Casey Meehan, Lu Sun



Kendall Nakai, Michael Haupt, Martha Gahl

Martha, Michael, and I are interested in representation and behavior of information entities through interactive interfaces. We want to provide customized representations of data narrative articles. These will give more context to potentially confusing or specific information on a website.

Kendall Nakai, Michael Haupt, Martha Gahl

For example, the New York Times "Upshot" articles have interactive data visualizations and websites like these could be expanded on and tailored for readers based on their background knowledge and interests they provide. Potential mediums could be a Jupyter notebook or desktop.plugin or website but we will figure that out as we go!

The Complete List of Trump's Twitter Insults (2015-2021)

This list documents all the verbal attacks Mr. Trump posted on Twitter, from when he declared his candidacy in June 2015 to Jan. 8, when Twitter permanently barred him.

January 20, 2021 · By KEVIN QUEALY

Kendall Nakai, Michael Haupt, Martha Gahl

Martin Yarmand, Tommy Sharkey, Chen Chen, Naba Rizvi

Matin, Tommy, Naba and I are interested in exploring the visualization of podcast audio for efficient navigation and information retrieval.

Podcast is a common source of information with many genres. People use podcasts while doing other activities, such as exercising. Cognitive load theory suggests that multi tasking diminishes understanding and recall of the content. As such, people tend to re-listen to specific bits of podcasts afterwards, such as specific comedic or informative bits.

However, navigating through lengthy auditory pieces is challenging and time-consuming. Thus, it is important to visually represent the audio information for efficient information retrieval.




Martin Yarmand, Tommy Sharkey, Chen Chen, Naba Rizvi

In this project, we aim to address the navigability of podcasts via a personalized and multi-layer visual representation: user's interaction with the podcast (e.g., skipping ahead for 15 sec) influences the weight of bits of the audio that the user might be more interested in reviewing. The multilayer structure starts from coarse content (i.e., words) to more granular phrases.

Some References:

CrossCast, UIST '20: https://urldefense.com/v3/__https://dl.acm.org/doi/10.1145/3379337.3415882__;!!Mih3wA!RwPOrUI5RGVX_ZdfhVS4AIMM2ByM5BE0gdR_lAvsPzG3-Z1UVi_vlxhV_HZxSA$

TalkTraces, 'CHI '19: https://urldefense.com/v3/__https://doi.org/10.1145/3290605.3300807__;!!Mih3wA!RwPOrUI5RGVX_ZdfhVS4AIMM2ByM5BE0gdR_lAvsPzG3-Z1UVi_vlxixEm-DRw$

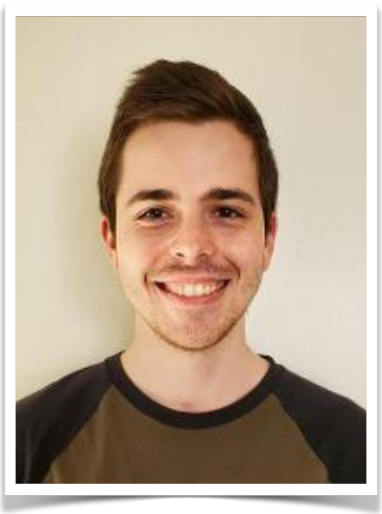
Quality'Alone'Time through Conversations and Storytelling: Podcast Listening Behaviors and Routines, https://urldefense.com/v3/__https://dl.acm.org/doi/abs/10.20380/GI2018.11__;!!Mih3wA!RwPOrUI5RGVX_ZdfhVS4AIMM2ByM5BE0gdR_lAvsPzG3-Z1UVi_vlxgB-i0unA$

Matin Yarmand, Tommy Sharkey, Chen Chen, Naba Rizvi




Sloan Hill-Lindsay, Garrett Wolfe, Xuhan Yang

We interested in exploring ways of representing activity histories particularly focusing on a more intuitive organization of tabs. The core idea being to cluster tabs into related ideas or categories. And perhaps automating that feature when examining a browser history. Let us know if you would like to join us!


Sloan Hill-Lindsay, Garrett Wolfe, Xuhan Yang

Brinley Stringer, Talia Latona-Tequida, Isabel White, Kristin Tenney

We will be focusing on behaviors within the information space of Teacher Desmos. We will be exploring ways that behaviors can be changed so that it is more intuitive for teachers to find relevant activities for their math classrooms, as well as the relevant research that supports the use of those activities so that teachers have a one stop shop where they can find good resources and information to feel confident about the practices they implement in their classrooms. There is also potential to explore activity history within Teacher Desmos as well as lenses… we will narrow that down as we get further along! The emphasis will be on behaviors though.

Brinley Stringer, Talia Latona-Tequida, Isabel White, Kristin Tenney

Proposal vs Paper

Would you be able to clarify the scope of the project topics? We are not sure if our project should align with a paper publication (narrow topic followed by a concrete prototype) or a grant proposal (broad topic followed by multiple research directions with viable prototypes).

For instance, a narrow topic of our group is to visualize podcasts personalized by user's interactions (e.g., skip ahead for 15 sec). A broader topic would be to visualize all auditory content (including conversations).

Best wishes,

Matin

Why a proposal rather than a paper?

What your group should produce for the course is a draft of a proposal. Of course the more finished it is the better. Writing and research projects are never finished. One just runs out of time.

It may well include a description of a running implementation that could itself be the focus of a paper. A proposal fits better because you will likely not be finished nor have time to do an evaluation but you can (and it is important to) include more about what you didn't have time to do as well as a plan for evaluation.

Your ideas are likely to be much more ambitious than you have time to explore. A proposal will allow you to include them.

It is very useful to get experience with and develop expertise in proposal writing.

Writing

Clear Writing Goes Hand in Hand with Clear Thinking

Donald Schön: Reflective conversation with materials

Rewriting and Iterations

Moving from Writer-Centric -> Reader-Centric

Takes Time; Learning Genre; Different Levels; Trip Metaphor; Style of Work; Learn to share early drafts and structure feedback; Tools (Dave Wroblewski);

Writing from the Inside Out

- What are the main points you want to make?
- What does the reader need to know to understand those points?

Backward-Outline

Proposal Evolution

Ideas to **Ideas Informed by Literature** to **Draft Proposal**
to **Many Iterations of Draft** to **Final Proposal**

Writing always needs to move from **something to help you think** to **something that communicates to others**

Initial Focus

Clear formulation of question you are addressing and why it is important

Informing the question based on the literature

Later Focus

Specifics of how you will address the question and

Why your approach is promising. An initial implementation or preliminary data strengthens.

Proposal Writing

Writing about what you plan to do rather than what you've done is different and challenging

Avoid vagueness and handwaving

If you don't know how you are going to accomplish some aspect of the project, describe how you are going to find out, describe alternative approaches, and how you will make a decision. Similar to talking about possible outcomes of experiments

Get feedback from others

Difficulty of allowing others to see early drafts

Structure your interactions to get the right level of comments

Proposal Heuristics

Look at instructions reviewers are given. Make their job easy.

Summaries are particularly important

Show you really know the literature (sometimes via the appropriateness of citations)

Placement of related work

In information visualization area, one challenge is how to depict dynamic interactive systems. Unlike for NSF your proposal can have links dynamic depictions or might even be authored as a computational notebook or website.

List possible criticisms and how you respond to them

Proposal Heuristics

Don’t wait for funding, get started on the project, data and early prototypes will make proposal much stronger

Know the genre of writing for funding agency

Get to know and consult program directors; brief concept papers

Participate on review panels

Appreciate admin and contracts & grants staff

Involve your students and others

Heilmeier

What is the question?

Why is the question important?

Who cares? If you're successful, what difference will it make?

What are you trying to do?

Articulate your objectives without jargon

How is it done today?

What are limits of current practice? What is your approach?

How will you determine if you are successful?

What are the risks and payoffs?

How much will it cost and how long will it take? Importance of balanced portfolio of research projects.

What are midterm and final "exams" to check for success?

Proposals

Program Solicitation
Due Dates: department, contracts and grants, agency

Formal Proposal

Merit Review

(1) the intellectual merit of the proposed activity

(2) the broader impacts resulting from the proposed activity

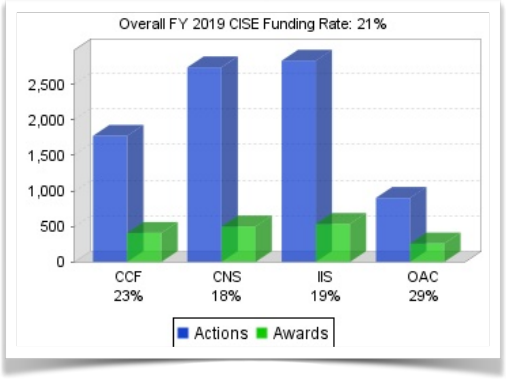
Get involved in this process

Get to know program directors

Decision

At least 6 months and often longer

Faculty Early Career Development Program



Office of Advanced Cyberinfrastructure (OAC)
Computing and Communication Foundations (CCF)
Computer and Network Systems (CNS)
Information & Intelligent Systems (IIS)

Org (Drill to Next Level)	FY	Number of Proposals	Number of Awards	Funding Rate	Average Decision Time (months)	Mean Award Duration (years)	Median Annual Size
NSF	**2019**	**41,032**	**11,252**	**27%**	**5.76**	**2.67**	**$134,999**
	2018	**48,334**	**11,716**	**24%**	**5.63**	**2.74**	**$130,000**
	2017	**49,425**	**11,457**	**23%**	**5.53**	**2.79**	**$111,402**
	2016	**49,307**	**11,894**	**24%**	**5.39**	**3.10**	**$100,000**
	2015	**49,631**	**12,017**	**24%**	**5.75**	**3.24**	**$92,095**
	2014	**48,200**	**11,115**	**23%**	**5.75**	**3.35**	**$90,607**
	2013	**49,152**	**10,983**	**22%**	**5.77**	**3.37**	**$88,213**
	2012	**48,716**	**11,627**	**24%**	**5.64**	**3.34**	**$84,247**
	2011	**51,568**	**11,201**	**22%**	**5.59**	**3.37**	**$81,463**
	2010	**55,559**	**13,015**	**23%**	**5.58**	**3.34**	**$85,232**
▼ BIO	2019	3,115	1,051	34%	5.50	2.99	$175,108
	2018	4,767	1,192	25%	6.09	2.96	$166,460
	2017	5,010	1,147	23%	5.71	2.99	$136,922
	2016	5,211	1,335	26%	5.33	3.28	$125,767
	2015	5,123	1,383	27%	5.39	3.44	$111,927
	2014	4,792	1,280	27%	5.41	3.65	$108,679
	2013	5,938	1,254	21%	5.11	3.65	$102,941
	2012	5,272	1,296	25%	5.27	3.51	$98,256
	2011	7,439	1,310	18%	5.53	3.65	$108,445
	2010	8,056	1,553	19%	5.37	3.65	$100,790
▼ CSE	2019	8,616	2,009	23%	5.73	2.66	$158,728
	2018	9,149	2,097	23%	5.72	2.74	$152,809
	2017	8,769	1,865	21%	5.47	2.86	$133,455
	2016	8,320	1,938	23%	5.23	3.16	$112,500
	2015	8,076	1,925	24%	5.01	3.35	$100,000
	2014	7,456	1,708	23%	4.85	3.55	$104,252
	2013	7,838	1,633	21%	5.61	3.62	$100,000
	2012	7,695	1,741	23%	5.44	3.52	$100,367
	2011	6,714	1,541	23%	5.20	3.58	$96,618
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Proposal Review

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful.

These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

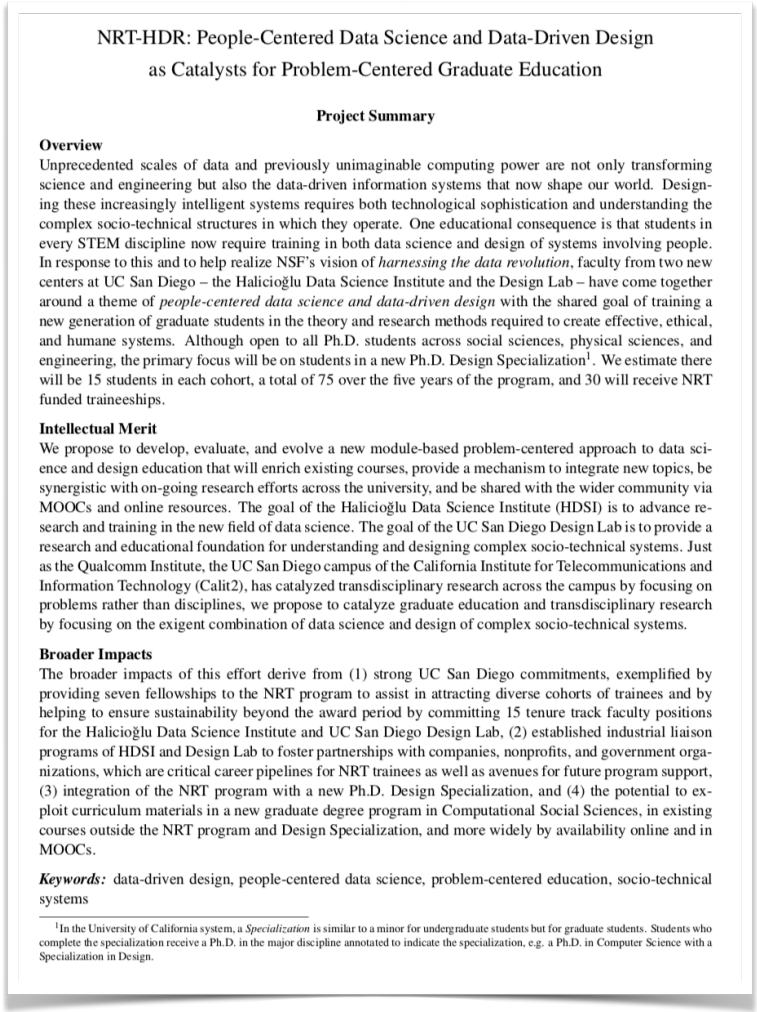
Intellectual Merit: The Intellectual Merit criterion encompasses the potential to advance knowledge.

Broader Impacts: The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

Summary

Overview

Unprecedented scales of data and previously unimaginable computing power are not only transforming science and engineering but also the data-driven information systems that now shape our world. Designing these increasingly intelligent systems requires both technological sophistication and understanding the complex socio-technical environments in which they operate. One educational consequence is that students in every STEM discipline now require training in both data science and design of systems involving people. In response to this and to help realize NSF's vision of harnessing the data revolution, faculty from two new centers at UC San Diego – the Halicioğlu Data Science Institute and the Design Lab – have come together around a theme of people-centered data science and data-driven design with the shared goal of training a new generation of graduate students in the theory and research methods required to create effective, ethical, and humane systems. Although open to all Ph.D. students across social sciences, physical sciences, and engineering, the primary focus will be on students in a new Ph.D. Design Specialization1. We estimate there will be 15 students in each cohort, a total of 75 over the five years of the program, and 30 will receive NRT funded traineeships.



NRT-HDR: People-Centered Data Science and Data-Driven Design as Catalysts for Problem-Centered Graduate Education

Project Summary

Overview

Unprecedented scales of data and previously unimaginable computing power are not only transforming science and engineering but also the data-driven information systems that now shape our world. Designing these increasingly intelligent systems requires both technological sophistication and understanding the complex socio-technical structures in which they operate. One educational consequence is that students in every STEM discipline now require training in both data science and design of systems involving people. In response to this and to help realize NSF's vision of *harnessing the data revolution*, faculty from two new centers at UC San Diego – the Halicioğlu Data Science Institute and the Design Lab – have come together around a theme of *people-centered data science and data-driven design* with the shared goal of training a new generation of graduate students in the theory and research methods required to create effective, ethical, and humane systems. Although open to all Ph.D. students across social sciences, physical sciences, and engineering, the primary focus will be on students in a new Ph.D. Design Specialization[1]. We estimate there will be 15 students in each cohort, a total of 75 over the five years of the program, and 30 will receive NRT funded traineeships.

Intellectual Merit

We propose to develop, evaluate, and evolve a new module-based problem-centered approach to data science and design education that will enrich existing courses, provide a mechanism to integrate new topics, be synergistic with on-going research efforts across the university, and be shared with the wider community via MOOCs and online resources. The goal of the Halicioğlu Data Science Institute (HDSI) is to advance research and training in the new field of data science. The goal of the UC San Diego Design Lab is to provide a research and educational foundation for understanding and designing complex socio-technical systems. Just as the Qualcomm Institute, the UC San Diego campus of the California Institute for Telecommunications and Information Technology (Calit2), has catalyzed transdisciplinary research across the campus by focusing on problems rather than disciplines, we propose to catalyze graduate education and transdisciplinary research by focusing on the exigent combination of data science and design of complex socio-technical systems.

Broader Impacts

The broader impacts of this effort derive from (1) strong UC San Diego commitments, exemplified by providing seven fellowships to the NRT program to assist in attracting diverse cohorts of trainees and by helping to ensure sustainability beyond the award period by committing 15 tenure track faculty positions for the Halicioğlu Data Science Institute and UC San Diego Design Lab, (2) established industrial liaison programs of HDSI and Design Lab to foster partnerships with companies, nonprofits, and government organizations, which are critical career pipelines for NRT trainees as well as avenues for future program support, (3) integration of the NRT program with a new Ph.D. Design Specialization, and (4) the potential to exploit curriculum materials in a new graduate degree program in Computational Social Sciences, in existing courses outside the NRT program and Design Specialization, and more widely by availability online and in MOOCs.

Keywords: data-driven design, people-centered data science, problem-centered education, socio-technical systems

[1] In the University of California system, a *Specialization* is similar to a minor for undergraduate students but for graduate students. Students who complete the specialization receive a Ph.D. in the major discipline annotated to indicate the specialization, e.g. a Ph.D. in Computer Science with a Specialization in Design.

Summary

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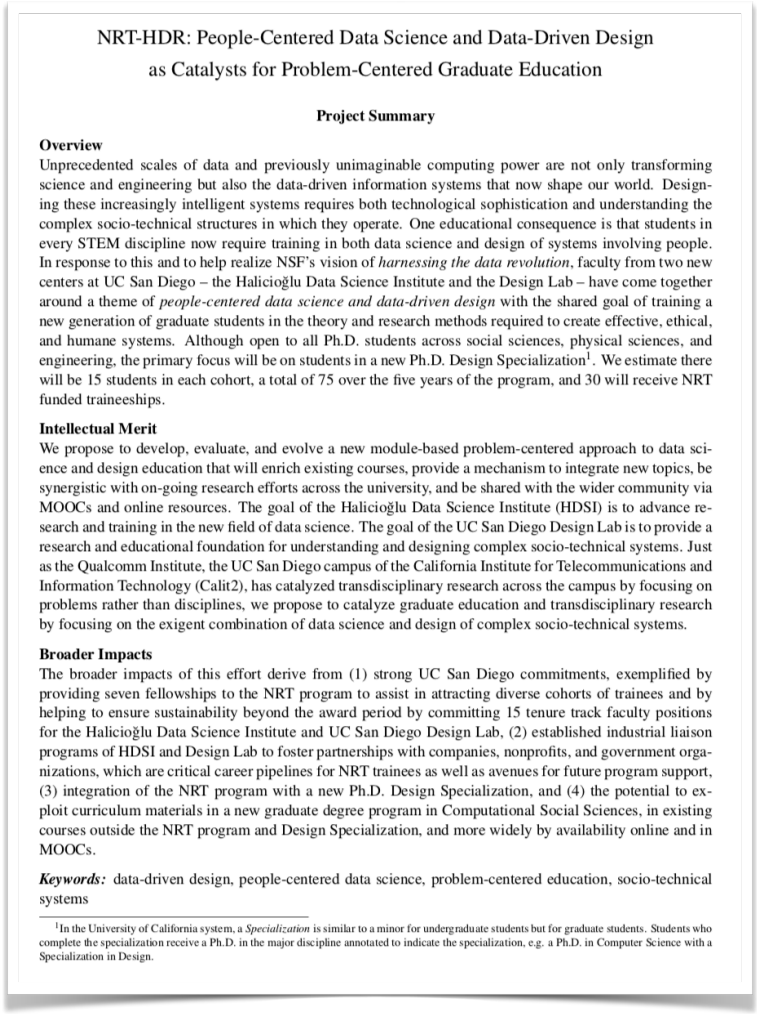

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We propose to develop, evaluate, and evolve a new module-based problem-centered approach to data science and design education that will enrich existing courses, provide a mechanism to integrate new topics, be synergistic with on-going research efforts across the university, and be shared with the wider community via MOOCs and online resources. The goal of the Halicioğlu Data Science Institute (HDSI) is to advance research and training in the new field of data science. The goal of the UC San Diego Design Lab is to provide a research and educational foundation for understanding and designing complex socio-technical systems. Just as the Qualcomm Institute, the UC San Diego campus of the California Institute for Telecommunications and Information Technology (Calit2), has catalyzed transdisciplinary research across the campus by focusing on problems rather than disciplines, we propose to catalyze graduate education and transdisciplinary research by focusing on the exigent combination of data science and design of complex socio-technical systems.

Broader Impacts

The broader impacts of this effort derive from (1) strong UC San Diego commitments, exemplified by providing seven fellowships to the NRT program to assist in attracting diverse cohorts of trainees and by helping to ensure sustainability beyond the award period by committing 15 tenure track faculty positions for the Halicioğlu Data Science Institute and UC San Diego Design Lab, (2) established industrial liaison programs of HDSI and Design Lab to foster partnerships with companies, nonprofits, and government organizations, which are critical career pipelines for NRT trainees as well as avenues for future program support, (3) integration of the NRT program with a new Ph.D. Design Specialization, and (4) the potential to exploit curriculum materials in a new graduate degree program in Computational Social Sciences, in existing courses outside the NRT program and Design Specialization, and more widely by availability online and in MOOCs.

Keywords: data-driven design, people-centered data science, problem-centered education, socio-technical systems

[1] In the University of California system, a *Specialization* is similar to a minor for undergraduate students but for graduate students. Students who complete the specialization receive a Ph.D. in the major discipline annotated to indicate the specialization, e.g. a Ph.D. in Computer Science with a Specialization in Design.

Summary

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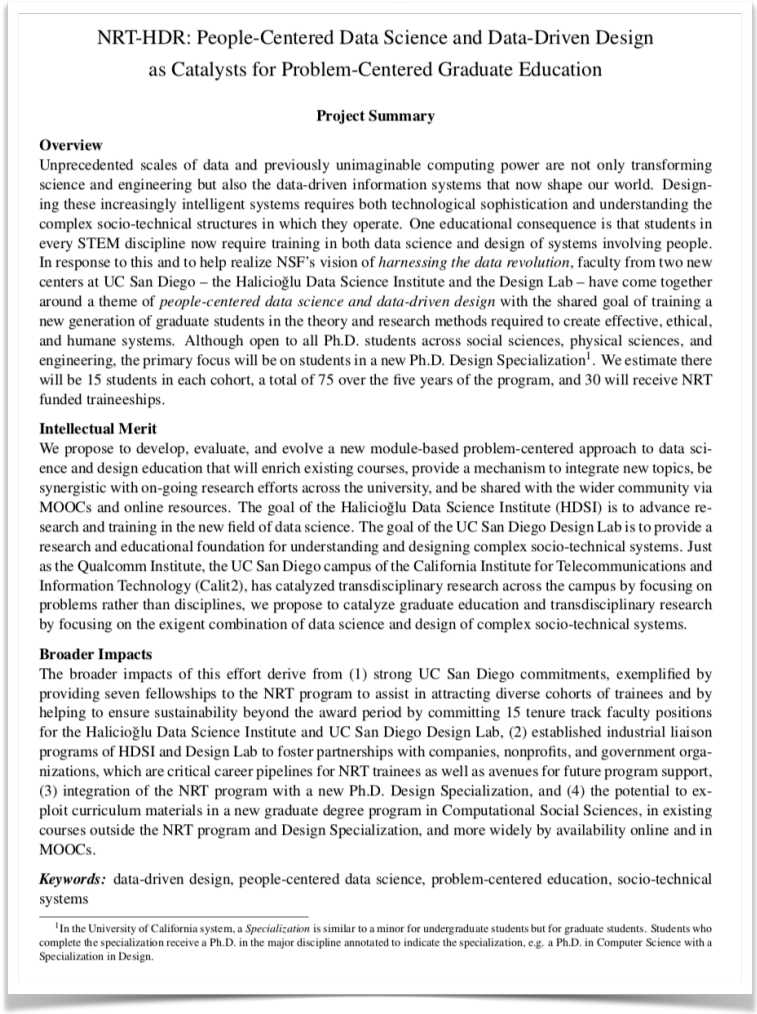

NRT-HDR: People-Centered Data Science and Data-Driven Design as Catalysts for Problem-Centered Graduate Education

Project Summary

Overview

Unprecedented scales of data and previously unimaginable computing power are not only transforming science and engineering but also the data-driven information systems that now shape our world. Designing these increasingly intelligent systems requires both technological sophistication and understanding the complex socio-technical structures in which they operate. One educational consequence is that students in every STEM discipline now require training in both data science and design of systems involving people. In response to this and to help realize NSF's vision of *harnessing the data revolution*, faculty from two new centers at UC San Diego – the Halicioğlu Data Science Institute and the Design Lab – have come together around a theme of *people-centered data science and data-driven design* with the shared goal of training a new generation of graduate students in the theory and research methods required to create effective, ethical, and humane systems. Although open to all Ph.D. students across social sciences, physical sciences, and engineering, the primary focus will be on students in a new Ph.D. Design Specialization[1]. We estimate there will be 15 students in each cohort, a total of 75 over the five years of the program, and 30 will receive NRT funded traineeships.

Intellectual Merit

We propose to develop, evaluate, and evolve a new module-based problem-centered approach to data science and design education that will enrich existing courses, provide a mechanism to integrate new topics, be synergistic with on-going research efforts across the university, and be shared with the wider community via MOOCs and online resources. The goal of the Halicioğlu Data Science Institute (HDSI) is to advance research and training in the new field of data science. The goal of the UC San Diego Design Lab is to provide a research and educational foundation for understanding and designing complex socio-technical systems. Just as the Qualcomm Institute, the UC San Diego campus of the California Institute for Telecommunications and Information Technology (Calit2), has catalyzed transdisciplinary research across the campus by focusing on problems rather than disciplines, we propose to catalyze graduate education and transdisciplinary research by focusing on the exigent combination of data science and design of complex socio-technical systems.

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Proposal Review

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to:
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?

2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

4. How well qualified is the individual, team, or organization to conduct the proposed activities?

5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Brief Group Coordination Meeting

By Friday evening, send a note to 220-g@ucsd.edu

1. Describe and motivate your project focus. Why is it interesting and important?

2. Detail the central question(s) you are addressing. Not only what the questions are but how you plan to address them.

3. Provide a timeline for the rest of the quarter. Convince us (and yourselves) your plan is doable. Be as specific as you can. Of course your plan will change.

4. Suggest a couple of papers (2 or 3; coordinate with me) relevant to your project for us all to read. These should be selected to provide background and help us help you with your project. You will lead discussion of these papers in class. Provide links to the papers.