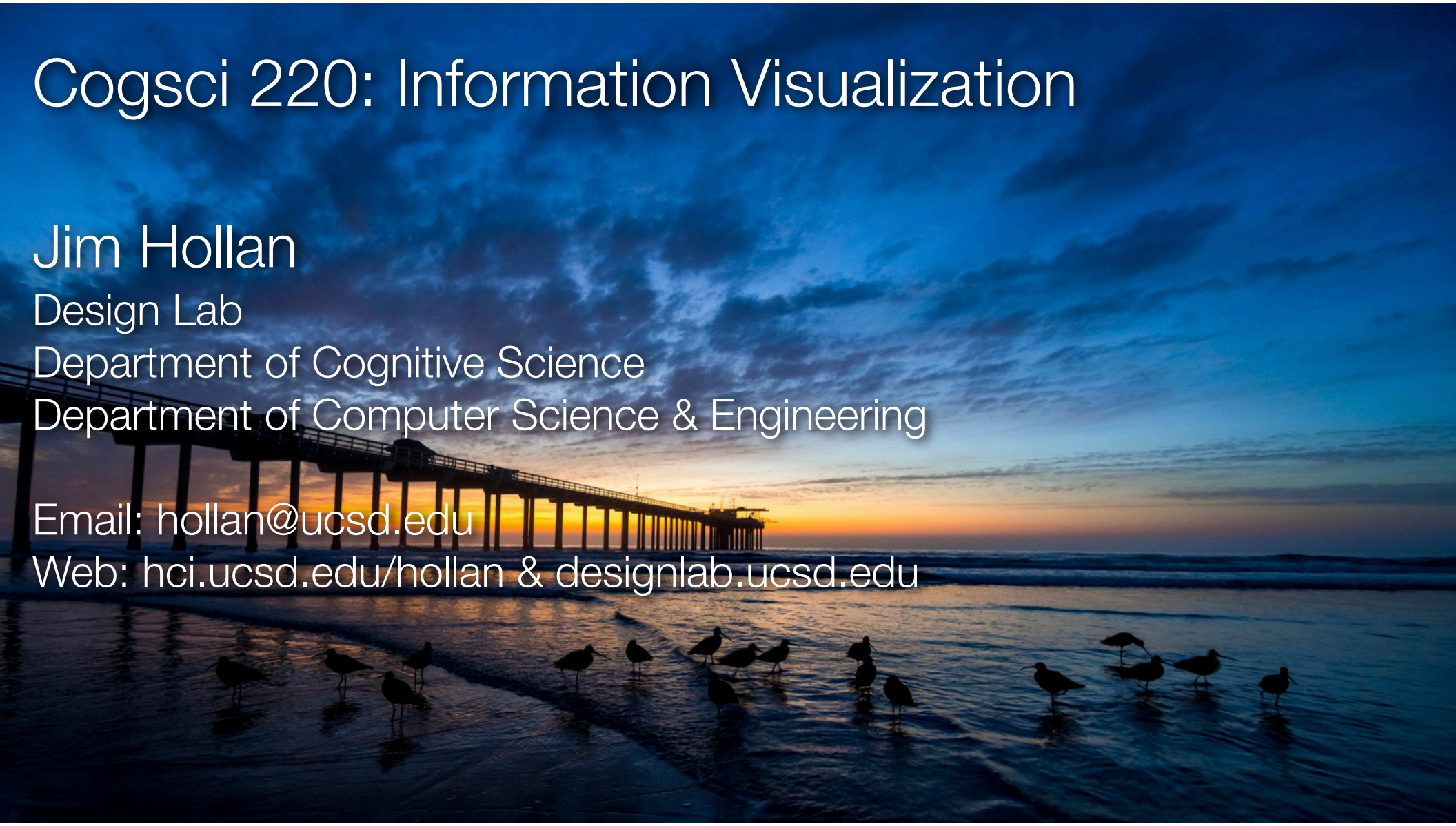

Cogsci 220: Information Visualization

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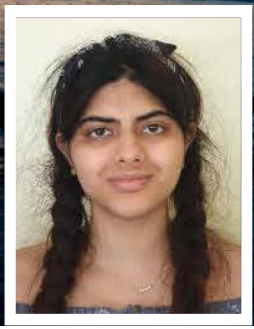
Cogsci 220: Information Visualization

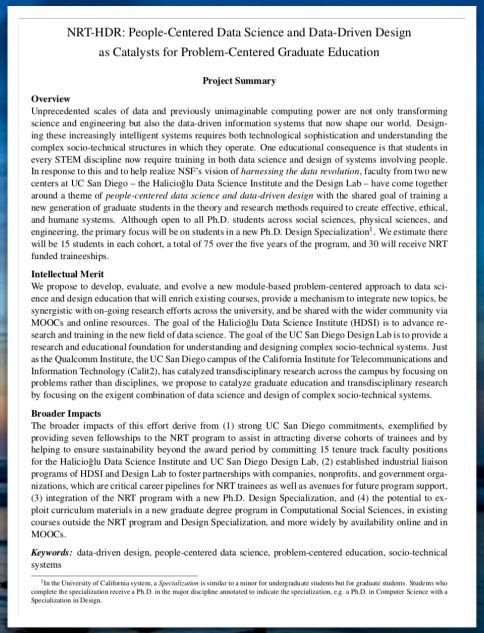
Welcome to week seven. Hope everyone continues to be safe in these challenging times.

Advice: Start writing proposal now.

- Summary (One page: Overview, Intellectual Merit, Broader Impacts)
- Introduction (Motivate the project and typically tie to literature)
- Explain what you plan to do and why it is important
- Describe how you will go about doing it (Prototypes, early results useful)
- Describe how will you evaluate and know successful
- Conclusion

Today: Podcast Visualization (Matin, Tommy, Chen, and Naba)





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 Halıcıoğlu 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 Halıcıoğlu 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 Halıcıoğlu 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.

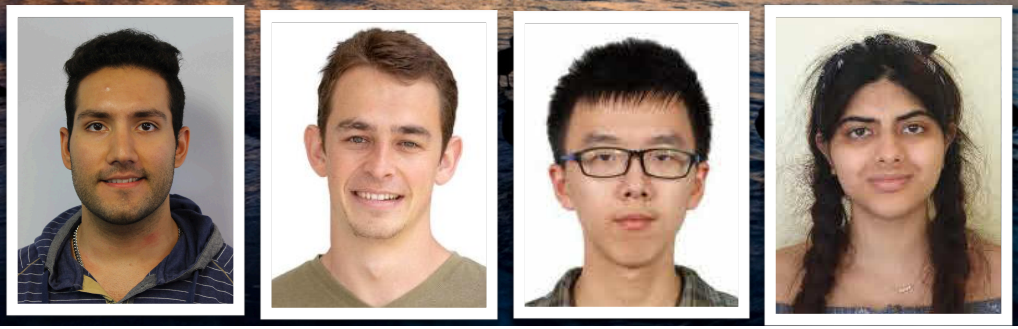
Cogsci 220: Information Visualization

Week 7

Tues 2/16 **Podcast Visualization (Chen, Matin, Naba, and Tommy)** Slides

- REQUIRED Neil P. Morris, Bronwen Swinnerton,and Taryn Coop. Lecture recordings to support learning: A contested space between students and teachers, Computers & Education (2019).
- REQUIRED Yang Shi, Chris Bryan, Sridatt Bhamidipati, Ying Zhao, Yaoxue Zhang, and Kwan-Liu Ma. MeetingVis: Visual Narratives to Assist in Recalling Meeting Context and Content, IEEE Transactions on Visualization and Computer Graphics, 2018, 1918-1929.
- REQUIRED Amy Pavel, Dan B Goldman, Björn Hartmann, and Maneesh Agrawala. SceneSkim: Searching and Browsing Movies Using Synchronized Captions, Scripts and Plot Summaries , UIST 2015, 181-190.

Today: Podcast Visualization (Matin, Tommy, Chen, and Naba)



Visualizing Lecture Capture Audio to Assist Pos-hoc Review

Chen Chen, Matin Yarmand, Naba Rizvi, Tommy Sharkey

Students Review Lecture Recordings - Morris et al. (2019)

Students rewatch lecture captures to:

- recap on content that may not have been understood after attending a lecture,
- seek help when writing assignments, and
- prepare for exams.

“Record seminars not just lectures. Would be useful for revision near exams as not possible to write notes for everything said in seminars.”

Plan for Today

1. Paper #1: Lecture Recordings to Support Learning
    - Motivation: why lecture capture?

2. Paper #2: MeetingVis
    - Supporting recall

3. Paper #3: SceneSkim
    - Supporting navigation

4. Proposal Discussion
    - progress updates and future plans

Lecture Recording to Support Learning: a Contested Space between Students and Teachers

Neil P. Morris, Bronwen Swinnerton, and Taryn Coop (2019)

RQ: How do instructors and students perceive lecture capture?

1. In what ways do student and teacher perceptions of lecture capture differ?
2. How do students use and perceive lecture recordings, and how does use vary by demographic groups?
3. Do teaching staff value lecture recording as a useful tool for student learning?
4. Do staff perceptions of lecture recordings change over time?
5. Are fears about the impact of lecture capture on attendance well-founded?

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5. Are fears about the impact of lecture capture on attendance well-founded?

Mixed-method Study

	Participants (N)	**Data Types**	**Method of Analysis**
I: Lecture Capture Survey	University Staff (472)	5-point Likert-scale and open-response questions	Descriptive statistics and association; inductive thematic
II: Systems Data	Students' views (~4M)	Views of lecture captures in a 4 year period	Non-parametric statistical significance
III:Student Digital Tracker	Students (1,734)	Multiple-choice and open-response questions	Descriptive statistics and association; inductive thematic

In what ways do student and teacher perceptions of lecture capture differ?

A Contested Space

Students

“How can anyone effective note take effectively for a solid hour

“[It is] useful for foreign or disabled students”

I would like to have [lecture recordings] online since it can help a lot to be able to listen to what the teacher says multiple times.”

Teachers

“I think there is a risk of students not taking sufficient notes or paying sufficient attention in class thinking they can review the subject later on using the lecture capture on line.”

“Access to captured lectures creates a parallel to Netflix in that students do not catch up on lectures during the semester, but rather binge watch lectures immediately

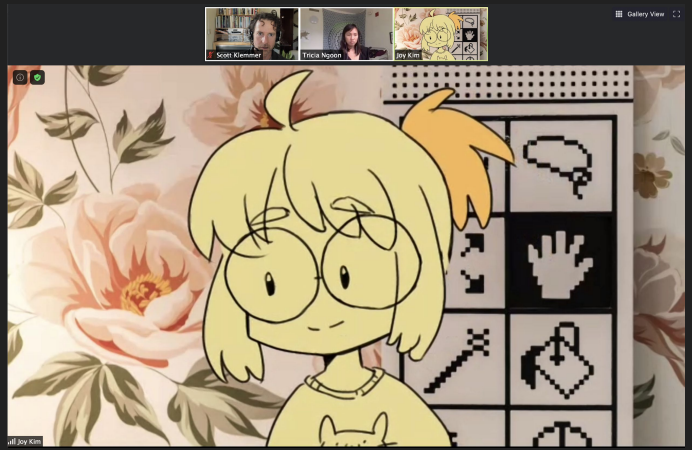
In what ways do student and teacher perceptions of lecture capture differ?

Lecture Captures Live Forever!

“Lectures have become a forum where I am less inclined to engage in interesting ideas or in a discursive manner in cooperation with a live audience, and much more concerned with how things might be taken out of context at a later date.”

“For interactive lectures, then it has a strong potential to discourage less confident students from contributing openly to the group.”

Improving Privacy, Introducing Anonymity



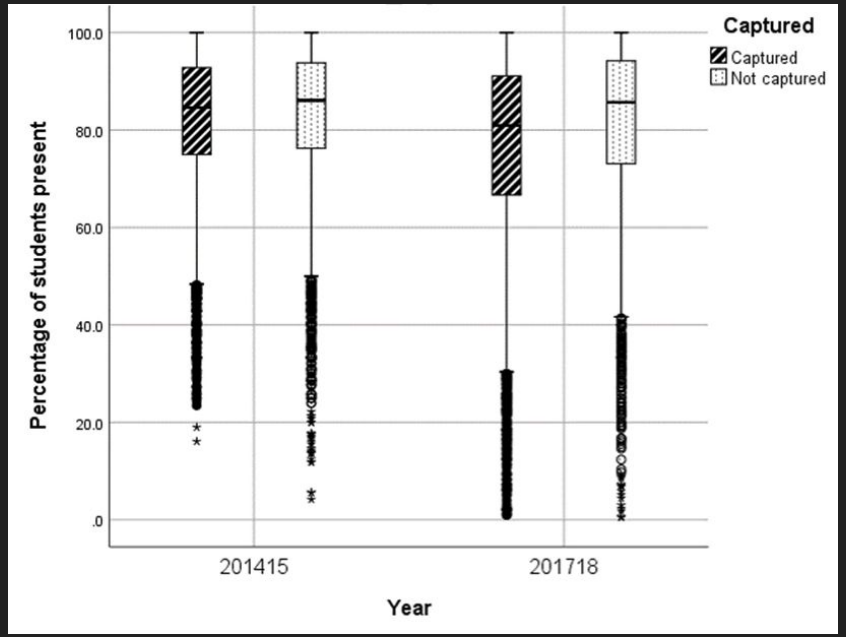
Discussion 1

- How would you address the privacy concerns of instructors and students?
  - What are your privacy reservations about lecture capture?
  - How would you address your concerns?
  - How would these solutions impact your participation?

! Focus on the *what*, and not the *how*

! Be creative. Anything is on the table

Lecture Capture Discourages Attendance



“They just don't turn up to lectures any more with attendance below 10% on occasion - this never happened before lecture capture!!”

Live Classroom Interactions

If the live lecture loses interactivity, discussion and intellectual richness, students may perceive that they are able to gain equivalent value from a recorded lecture, in reduced time.

Live Classroom Interactions

If the live lecture loses interactivity, discussion and intellectual richness, students may perceive that they are able to gain equivalent value from a recorded lecture, in reduced time.

Moore's *Three Types of Interaction* (1989):

1. Student-Student
   a. E.g., group discussion, friendship, community
2. Student-Teacher
   a. E.g., verbal participation, after-class questions, iclickers
3. Student-Content
   a. E.g., Powerpoint slides, note-taking

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   - ➢ E.g., Powerpoint slides, note-taking

Hillman et al. (1994) introduced a fourth type of interaction:

4. Student-Interface
   - ➢ E.g., video control, (a)synchronous chat

Discussion 2

- What student-interface interactions would you find helpful in lecture recordings?
- How would these interactions benefit your learning?
- How would these interactions impact your lecture attendance?

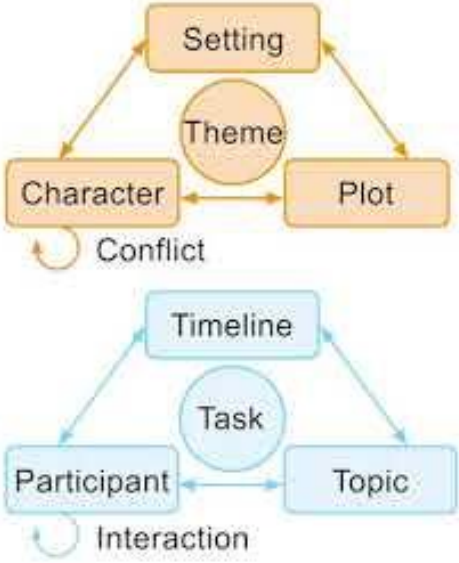
! Focus on the *what*, and not the *how*
! Be creative. Anything is on the table

MeetingVis

Recall

An Overview

How do we design a narrative-centered visual representation to help the recall of meetings?



Introduction

- Need of recall and reflect the information from the meeting discussions, and better prepare for the future works;
- Existing solution will not work!
  - Automatic text summarizations → lack of deeper and multifacet contexts;
  - Meeting browser → lack of overall discussions at a glance, causing hard to search and navigate;
  - Visual based meeting summarization → only focus on the single dimension of meeting discussions;
- We need a way to visualize the narrative structure of the meeting:
  - Who? The participants involving in the interaction;
  - When? The time duration when the interaction happened;
  - What? The topics of the discussions;
  - How? The ways and cues (verbal and non-verbal) while bringing up the topics;

Elements in Meeting

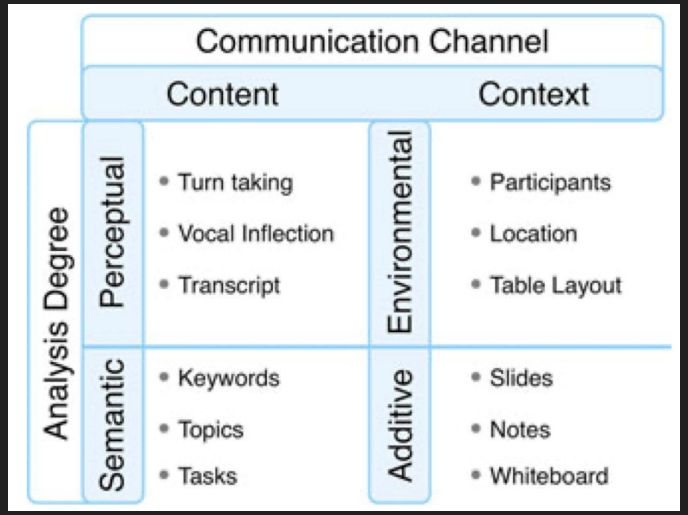
- Communication Channel;
  - Content: recordable/extractable data from the meeting itself;
  - Contexts: Participants involved, additional resources etc. (e.g., slides and notes);
- Analysis Degree;
  - Low level (Perceptual + Environmental):
  - High level (Semantic + Additive);

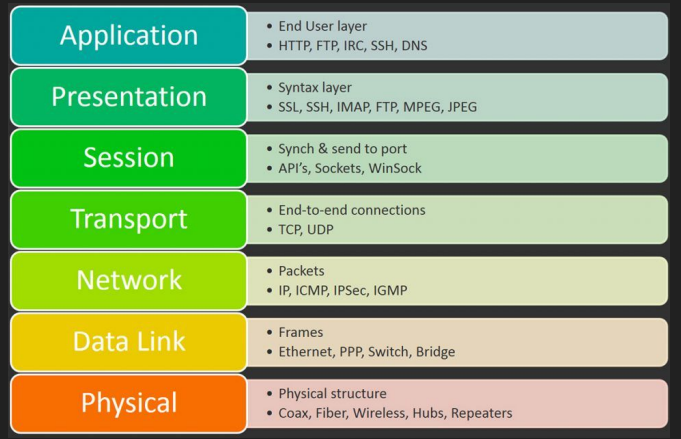
Some Thoughts:

Fundamental Problems: Trade-Offs for Design of Abstractions ⇒

Higher Level: Easy to understand, but sacrifice detail;

Lower Level: Hard to understand, but more detail;





A Micro Needs Finding

- Goal: what kinds of data is more important?
- Participants: 5 researchers, 2 engineers, 2 faculty, 1 PM;
- Findings:

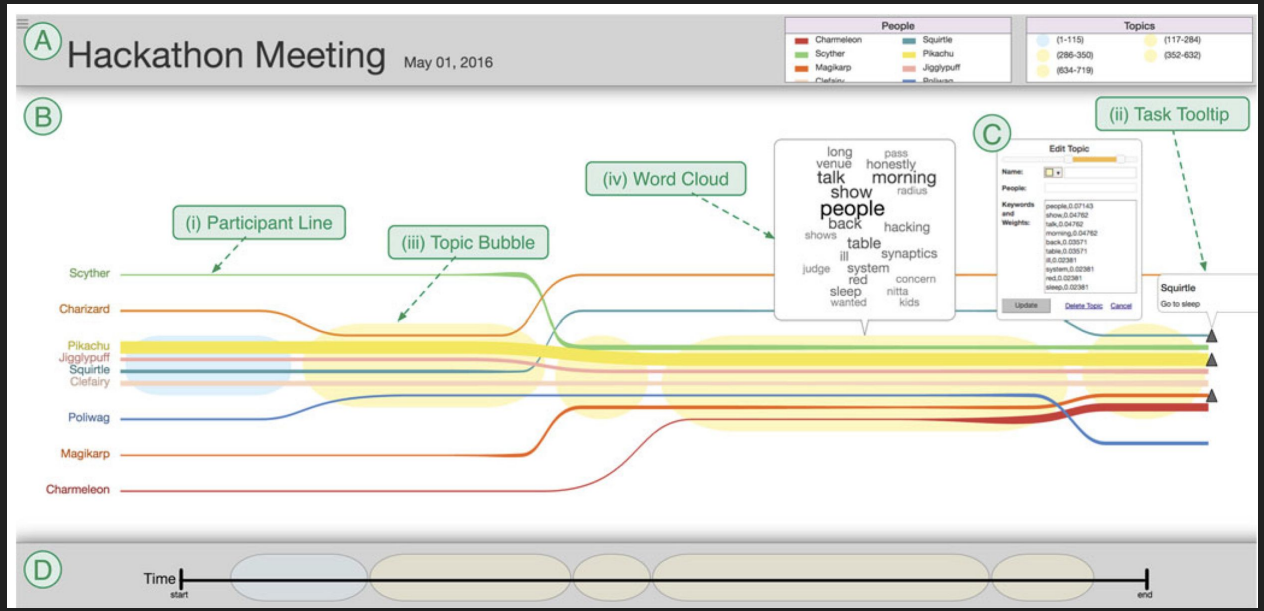
Meeting Element	*Narrative Structure Descriptor*	*Description*
Participants	Who	The people taking part in the discussion
Topics	What	The discrete subjects discussed
Tasks	What	The action items assigned for future work
Timeline	When	The temporal context of other meeting elements
Interaction	How	The level and type of discussion between participants

Design Decisions

- Intuitive representation of the meeting elements;
- Organize meeting elements to trigger recall of specific memories;
  - Connections of meeting elements;
  - Highlight of key interaction points;
- Enable user refinement of automatically generated meeting results;
  - Human in the Loop strategy for refining the results;

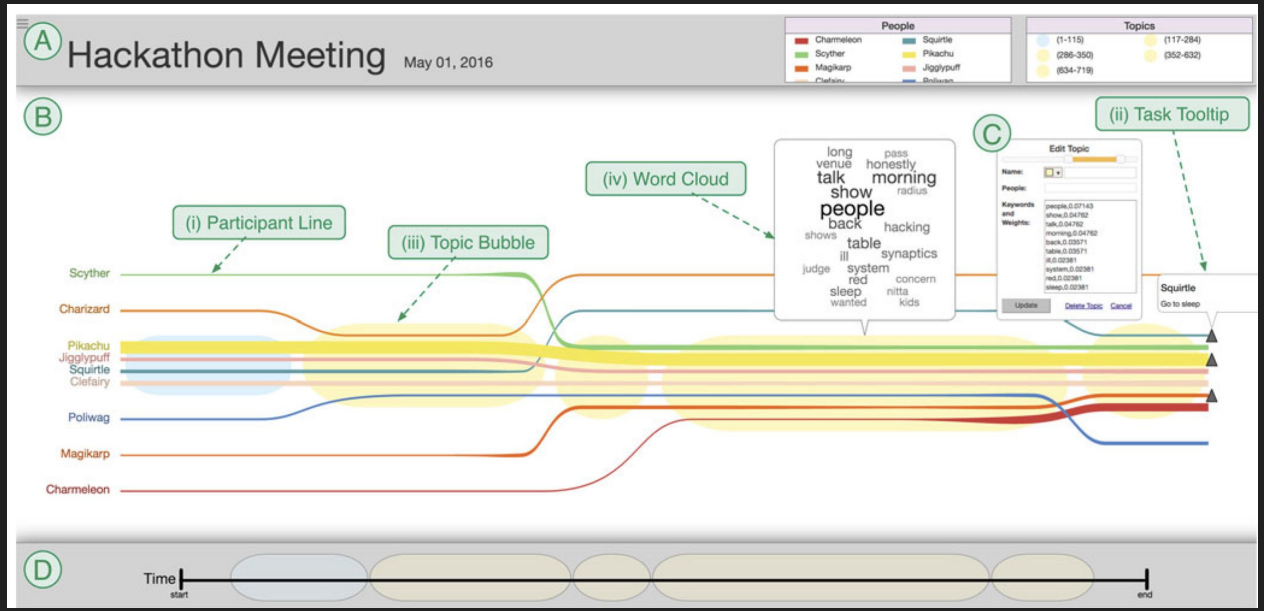
Design - Augmented Storyline Visualizations (Goal 1 & 2)

- Participant Activities;
- Task Assignments;
- Topic Evolution;



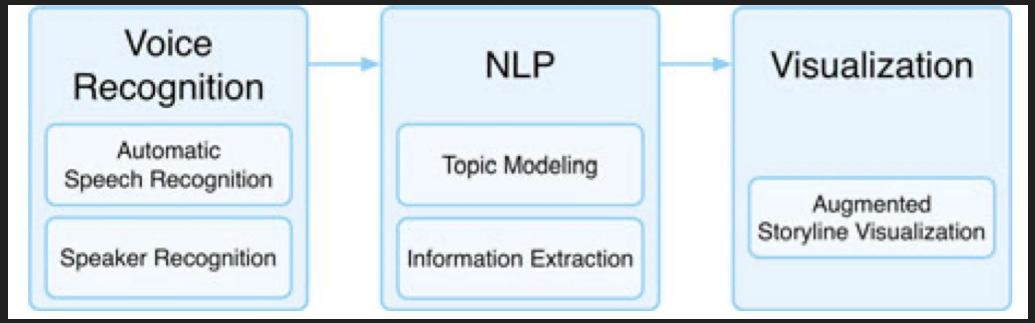
Design - UI & Interactions (Goal 3)

- Title View;
- Storyline View;
- Edit Panel;
- Control Panel



Implementations

- Speech Recognition: Google Speech to Text Service;
- Speaker Recognition: MS Cognitive Services API;
- Topic Modelling;
- Information Extractions;



Evaluations - Method

3RQs:

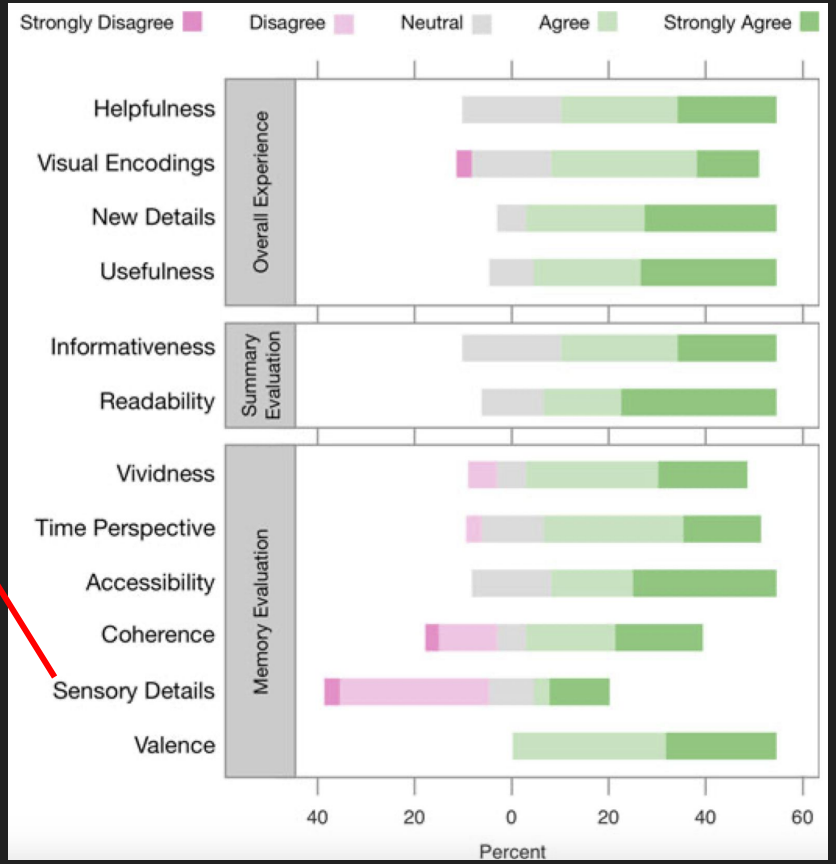
- How do participants perceive the visualization?
- How does the system support memory retrieval;
- What refinement strategies are applied to the automatic generated results (HITL)?

3 Phases: Meeting → Recall → Explorations

Group ID	*# of Participants (females)*	*Ave Age*	*Discussion Time*	*Discussion Topic*
G1	9 (4)	19.7	0:14:25	Hackathon Schedule
G2	5 (2)	33.4	1:08:58	Writing Club
G3	4 (1)	21.2	0:31:51	Management Coursework
G4	5 (0)	27.8	0:23:29	Charity Event Planning
G5	5 (1)	25.8	0:26:52	Charity Event Planning

Evaluations - Results

Your memories for this event involve a lot of physical reactions and sensory information (e.g., sounds etc.); But [G1P13] do mention that "*I wish there is a way to analyze emotion, like how their tone of voice is*" [see next slide];



Qualitative Takeaways for the Designed System

- How Users Perceived the Visualization?
  - Topic bubbles brings up more details;
  - Participant lines for tracking individual activities and interactions (e.g., the use of line thickness ⇒ talk less or too much);
  - Timelines for cognitive orientation;
  - Task icons work as reminders;
- How the system supports memory recall?
  - It is a self-contained meeting summary (need of incorporating the emotions [G1P13]);
  - It shows different discussion structures;
  - It acts as a note-taking assistants;
- How users refined the automated visual summary?
  - Less important topics were deleted, instead of being ignored;
  - Less important keywords were ignored, instead of being deleted;

Discussions

- Narrative Structure in Meeting Summary:
  - Using sensory details to find the speakers' inflection (e.g., tones and emotional valence);
  - Connections with "relations" (e.g., time, location, causality). Existing research has shown that "*in storing episodic content, the memory units are linked by narrative relation (time, location, causality, agency, abstraction, composition*";
  - "Detail on demand" of different level of abstractions;
- Visual Encodings of the Meeting Elements;
  - Word clouds → multiple word phrases / sample quotations;
- Collaborative refinement of a full meeting picture;
- Comparative analysis of Meeting Sequence;

Reviewing meetings and lecture video shares things in common. So, what kind of elements would you think is helpful to search and navigate in the recorded lecture.

SceneSkim

Navigation

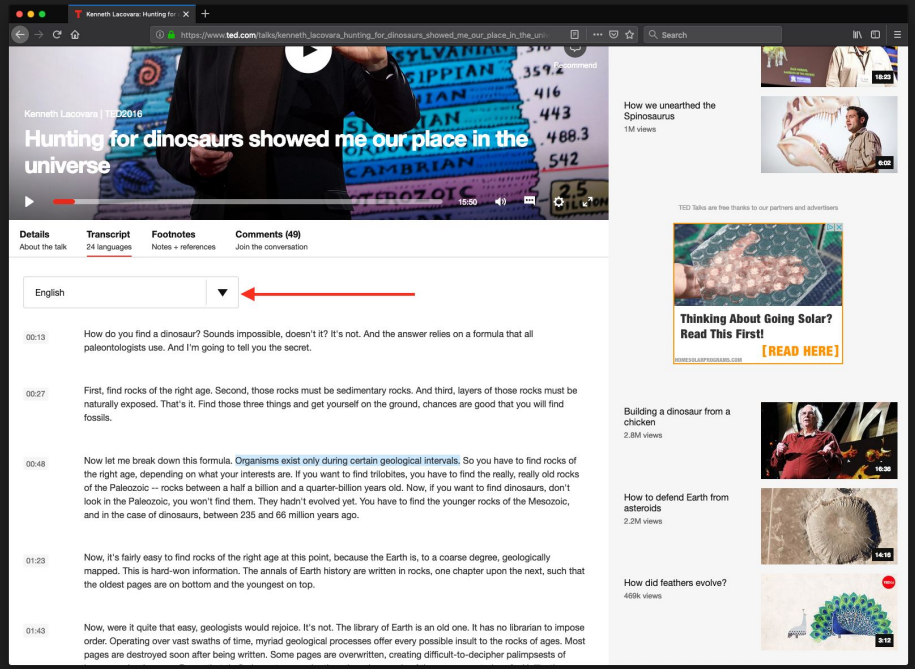
Introduction

- Searching for scenes in movies (necessary for film studies) is difficult
- Existing solutions:
  - Watch entire movie
  - Scrubbing video timeline
  - Navigating via DVD chapter menus
  - Index through film transcripts (no visuals)
- SceneSkim: uses synchronised captions, scripts, and plot summaries to search and browse through movies.
  - Search pane for finding clips matching a query
  - Movie pane for browsing within movies using synchronized documents

Existing Systems

Video Search & Navigation Tools:

- Commercial video players (i.e. TED) have synchronized transcripts



Current Practice

- Film studies researchers search for specific actions, props, locations, characters to study audiovisual attributes of corresponding clips
- Identify text results through web search and watch and scrub through -> time consuming, can miss short events
- Film professionals search for locations and props to design new sets and concept art
- Search for clips on YouTube and other sites hoping that someone has uploaded a particular scene
- Also use DVDs as fallback

Queries

Film studies researchers and professionals search for:

- Performances by particular character(s)
- Locations (e.g. bedroom)
- Actions (e.g. car chase)
- Objects (e.g. phone)
- Words or phrases (e.g. slang)

SceneSkim Interface

Search pane: search for movie clips through keyword search bar, search filter, search results

Movie pane: Allows users to browser within a movie using synchronized documents

Algorithms

Caption to film word-level alignment:

Captions aren’t always labeled by speakers so SceneSkim generates expected phonemes from the caption words and perceptual linear prediction features from the audio. Then they use a Hidden Markov Model to compute the alignment.

Parsing Scripts:

Generates label (e.g. character name, dialogue, action, etc) for each script line. 95.7% accuracy

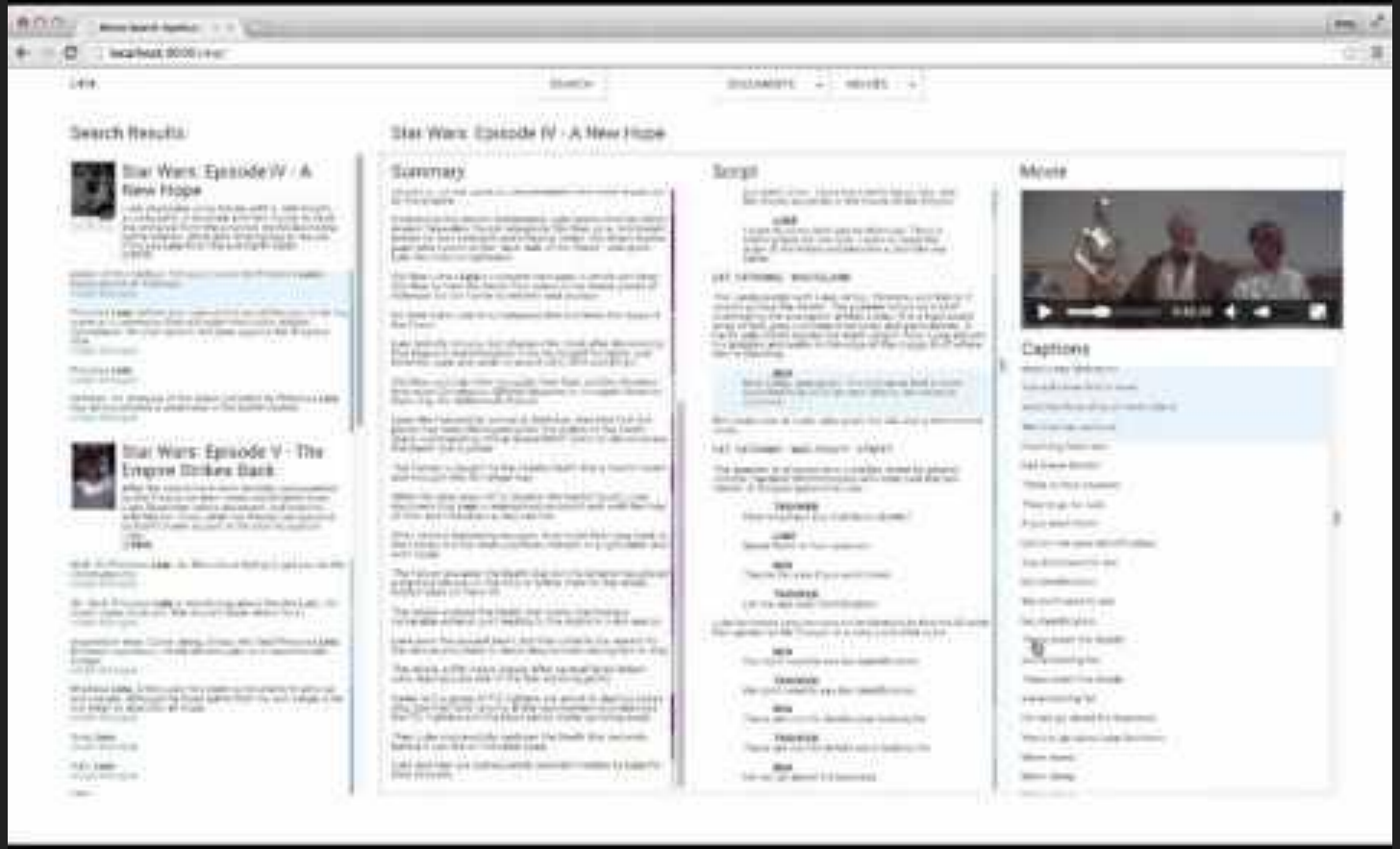
Algorithms (ctd.)

Script dialogue to caption dialogue alignment:

When users click on a script dialogue line, the system plays caption lines where one or more words aligned with words in the script line with 81% accuracy. Uses Needleman-Wunsch algorithm.

Summary sentence to script alignment:

Uses TF-IDF to summarize. 57%-83% accuracy (works better with more distinct characters, actions, locations, etc)


Search Results
Star Wars: Episode IV - A New Hope
Star Wars: Episode V - The Empire Strikes Back
Star Wars: Episode IV - A New Hope
Summary
Script
Movie
Captions

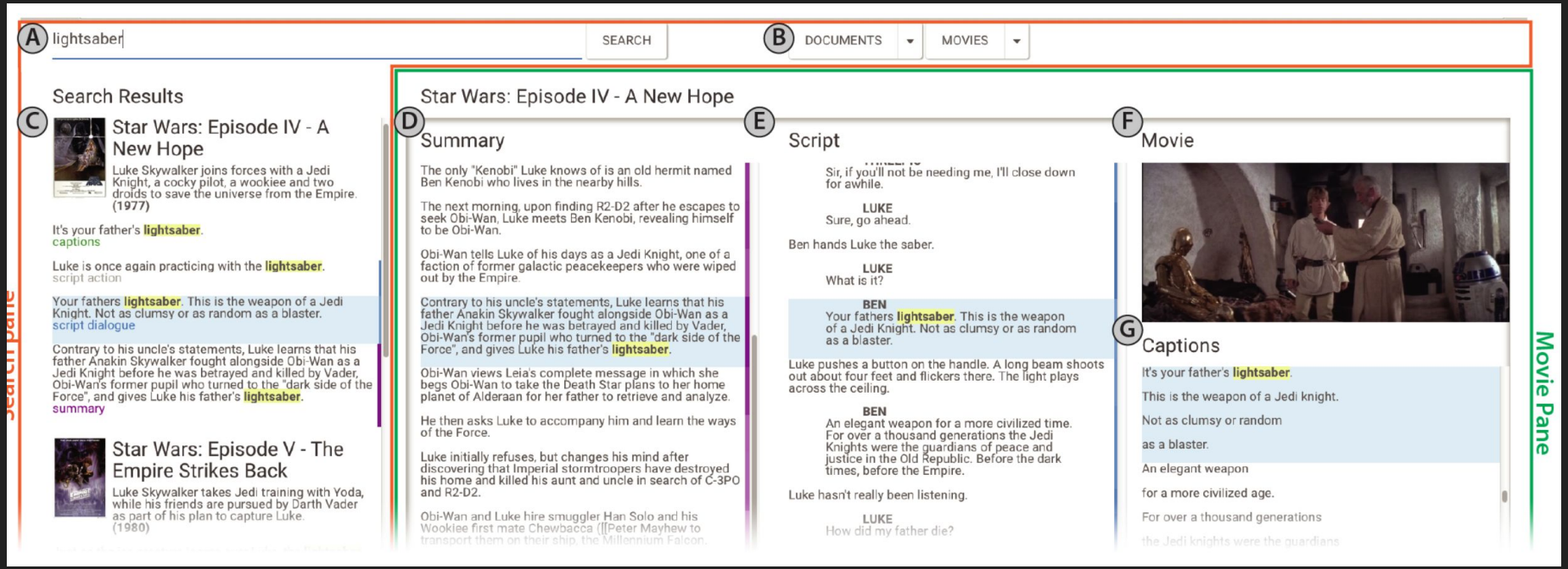
Informal Evaluation

The authors instrumented the interface to record interactions while answering queries. The “task” shows specific things they searched for, while the results show the results displayed by SceneSkim. The time shows how quickly the task was completed.

		Search result clicks			Document clicks				
Label	Task	Summary	Script	Captions	Summary	Script	Captions	Video watched	Completion time
A	Vader	10	0	0	0	3	0	3:48	5:37
B	lightsabers	1	22	1	0	37	0	20:00	21:44
C	Luke’s costumes	17	0	0	0	16	0	4:23	5:20
D	22 quotes	0	2	19	0	0	5	4:31	8:36
E	main locations	3	24	0	0	2	0	2:57	4:23
F	anger/patience	0	0	12	0	0	0	00:21	1:37
G	R2D2 beeps	0	13	0	0	3	0	1:23	1:56
H	Han and Leia	0	16	0	0	5	0	2:28	3:10

SceneSkim

Search pane: keyword search bar (A), search filters (B), a search results view (C).
Movie pane: synchronized summary (D), script (E), captions (G), and movie (F)



A Movie Scenes

B Captions

```
00:15:24,470 --> 00:15:27,371
Will you be saving her?
I can't swim.

00:15:29,042 --> 00:15:31,272
Pride of the King's Navy,
you are.

00:15:31,344 --> 00:15:33,244
Do not lose these.
```

Dialogue (transcription)
Audio timestamp

C Script

```
EXT. PORT ROYAL - NAVY DOCKS - DAY
Jack, Murtogg and Mullroy are still in shock
from the sight.

                    JACK
          Aren't you going to save her?

                    MULLROY
          I can't swim.

Murtogg shakes his head -- neither does he.

                    JACK
               (rolls his eyes)
          Sailors.

EXT. PORT ROYAL - CLIFFSIDE - DAY
Norrington rushes down, intent on the climb.
Beyond him, out to the sea, FOG gathers ---
```

Slug Line
Action
Character Name
Dialogue (draft)
Parenthetical

D Plot Summary

Eight years later, now Commodore Norrington proposes marriage to Elizabeth. However, her over-tightened corset causes her to faint before she can answer, and she falls from the fort into the bay. The gold medallion she wears as a necklace emits a pulse in the water which signals the Black Pearl. She is saved by pirate Jack Sparrow, who is in Port Royal to steal a ship.

The script (C) contains locations, character names, actions, parentheticals and draft dialogue of the movie (A), in which scenes comprise multiple shots.

The captions (B) contain timestamped dialogue as spoken, while the summary (D) contains a high-level description of the plot.

Limitations & Future Work

- Availability of scripts and movies: need to add more
- Summary to script alignment: currently time-consuming, does not support re-ordering of scenes which occurs during editing, may present events in different order
- Adding new types of metadata: shot length, lighting, set design, etc
- Adding more visualization capabilities: adding more information on time within the movie, genre, release date, writer, director
- Adding bookmarks and correcting mistakes: allows researchers, students, etc to take notes

Conclusion

SceneSkim allows users to search and browse videos through aligned captions, scripts, and summaries relatively quickly as opposed to existing methodologies. However, there are several improvements that can be made in the future to improve the usability, accuracy, and efficiency of the system.

Discussion - break out rooms

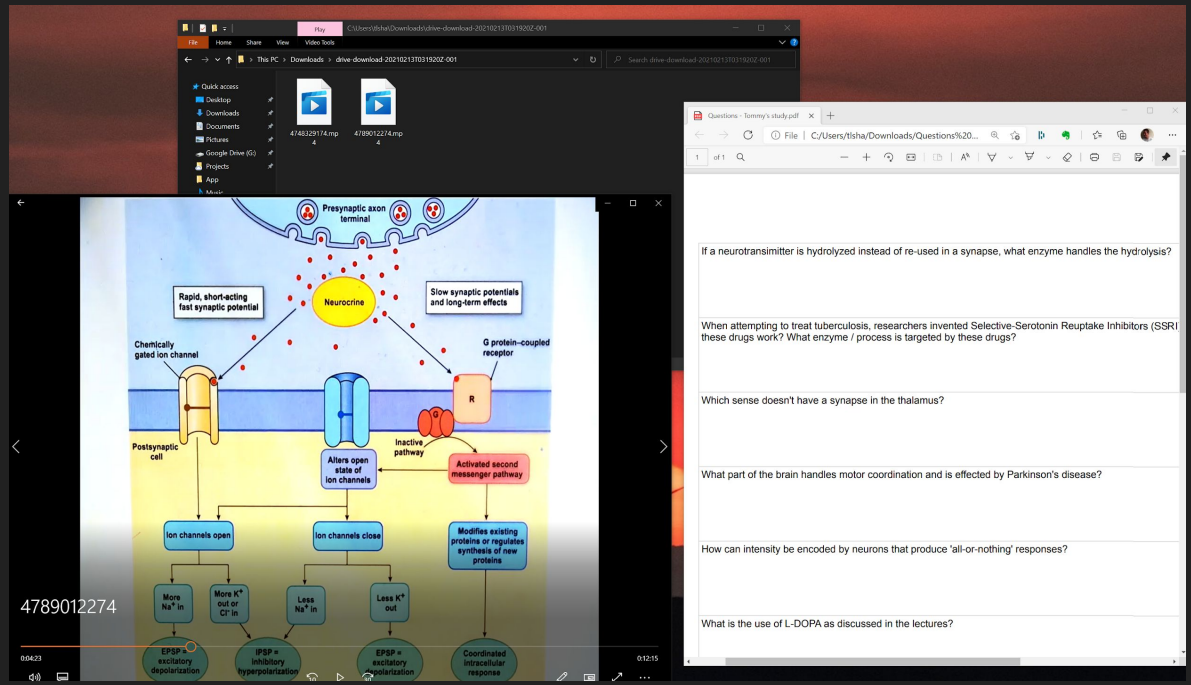
- SceneSkim relies heavily on well structured video scripts. How would you create a text-based structure for a lecture?
- Brainstorm ways for searching through lectures

Our Proposal

Visualizing Lecture Capture Audio to Assist Pos-hoc Review

Need Finding

1. Watch 2 Physiology Videos
   a. 10-15 mins each
   b. 2 slides per video
2. Answer questions about videos
   a. Participants think out loud while looking for answers in videos



It took subjects longer to search than it would have to just re-watch the lectures

Contrasting approaches

P0

- Mentally partitioned videos into 4
  - 1 for each slide in each video
- Random Jumps around videos
  - Uses mouse (unaccustomed to the computer OS)
- 33 mins to completion

P1

- Mentally partitioned videos into 6
  - 1 for each slide in each video
  - 2 for the diseases discussed
- Linear movement through videos
  - Uses keyboard shortcuts
  - Skips over verbal pauses and filler
- Noted lecture structure/format to guide search
- Used word association and memory to find unfamiliar topics
- 33 mins to completion

Similarities

- Pull keywords from questions
  - Associate with a visual (the slides) / mental partition
  - Rewatch that partition
- Keyword search
  - Listen for keywords
  - When found, would rewind to capture full sentence(s)
- Often would listen to the answer and not realize it
- 10 - 15 min videos broken into 2 or 3 parts
  - ~5 minute sections
  - Average 3.3 mins / question
  - Shortest (few seconds) and Longest (~10 mins) times were the result of luck
  - Took longer to answer all the questions than it did to watch the videos
- Participants relied on audio (not video) to find answers
  - “most of the slides are the same” and aren’t useful for search, just structure
- Personalization
  - Times when participants looked down and away were times when they were taking notes
  - Facial expressions while watching
  - When re-watching videos

Themes

- Keywords
  - Listen for keywords
  - When found, would rewind to capture full sentence(s)
  - Word Association for unfamiliar words
- Partition Video
  - Associate with a visual (the slides)
  - Speaker/Lecture structure
- Time-to-task
  - Took longer to answer questions than it would have to rewatch the entire video
  - Repeated sections
  - Process: Random vs Linear
- Participants relied on audio (not video) to find answers
  - “most of the slides are the same” and aren’t useful for search, just structure
- Personalization
  - Looking down to take notes
  - Facial expressions
  - First time watching vs re-watching videos

Structuring our intervention

	File	Folder
VISUALIZATION		
Signal	The graph of sound and time	A visual identifier that allows the user to easily scan a list of files and recognize a particular recording
Semantic	The words in a recording	
User	The pieces a specific user remembers and notes	

Structuring our intervention

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VISUALIZATION		
Signal	Time, spectrogram (loudness)	Name, Timestamp, Duration
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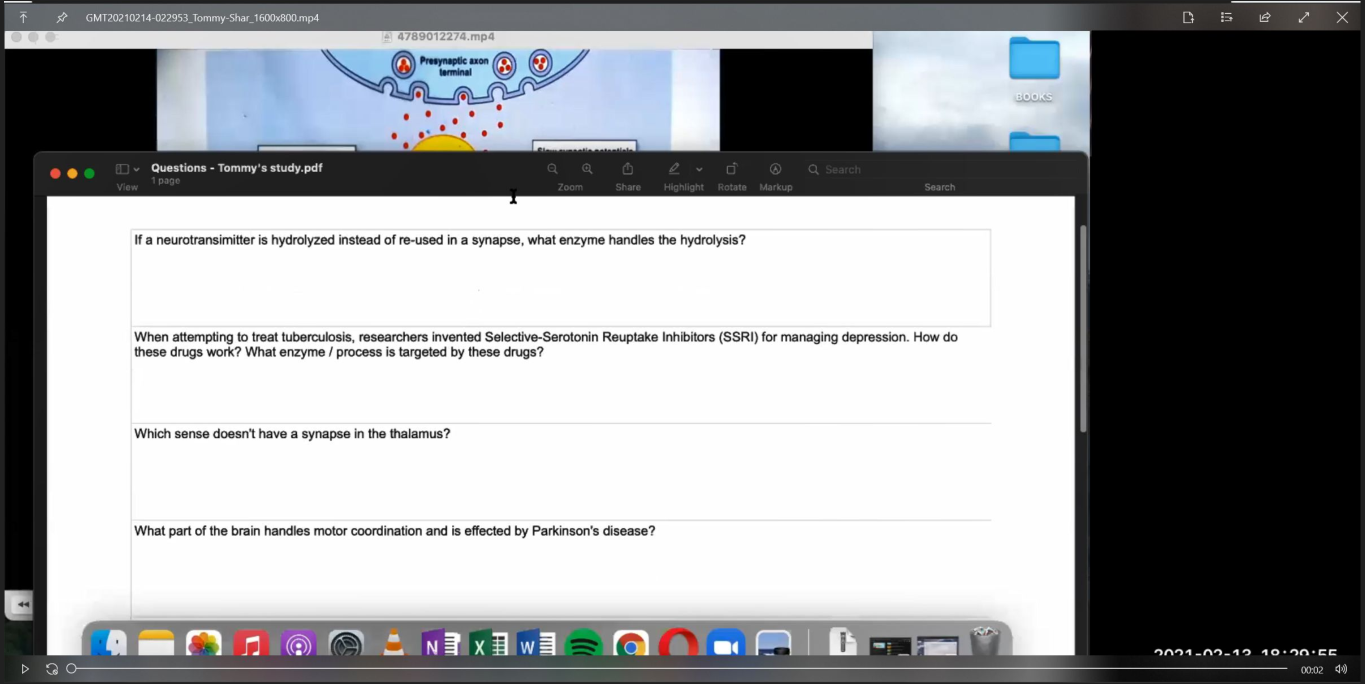
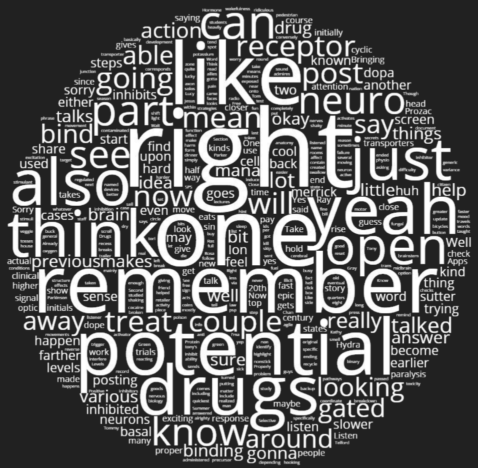
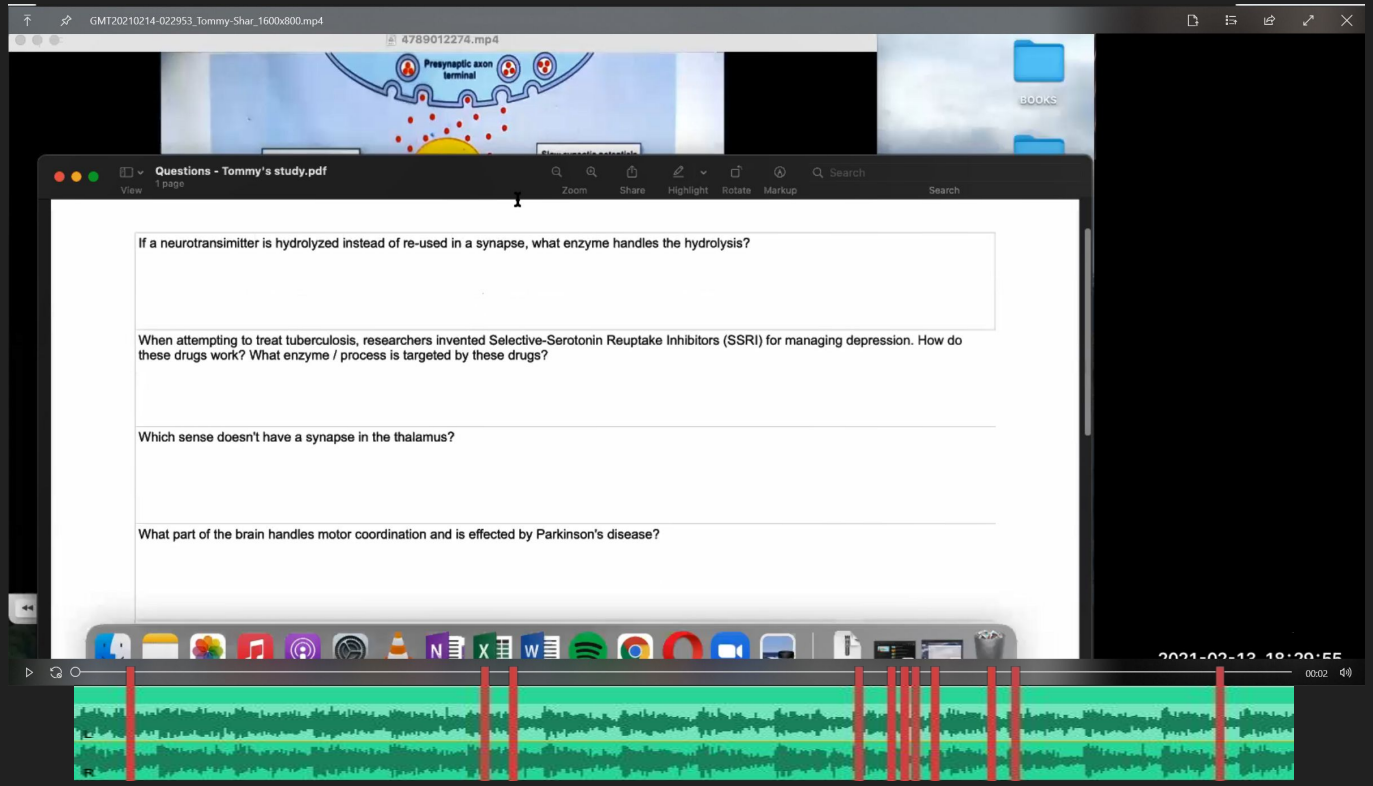
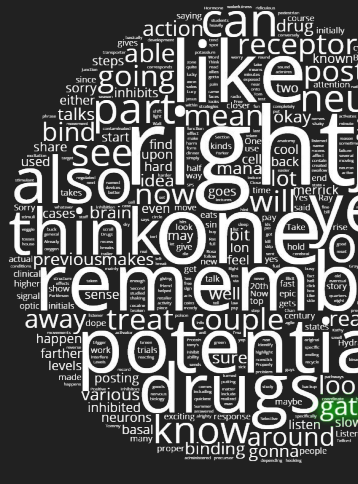




Interviewer: Okay.
Participant_1: What if I know all these answers off the top of my head.
Interviewer: Well that's why I didn't have Ray do it restarted it.
Interviewer: Wait Ray did you take physio and he was like yeah.
Participant_1: I say start.
Interviewer: share your screen and then start.
Participant_1: Or you share the screen.
Interviewer: Green share screen button.
Participant_1: You can see it.
Participant_1: yeah.
Yeah. It's the gated one
Participant_1: Alright, so I start now.
Interviewer: yep before.





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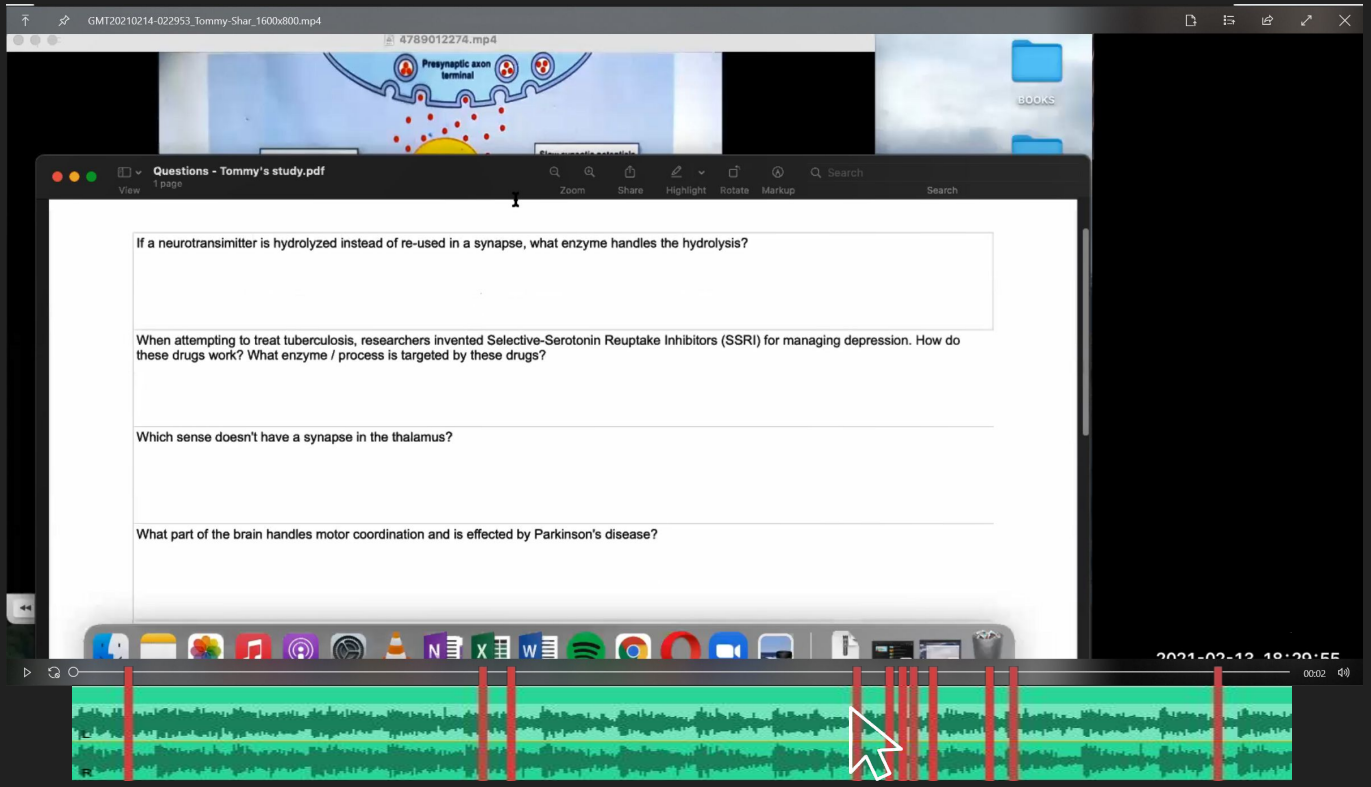
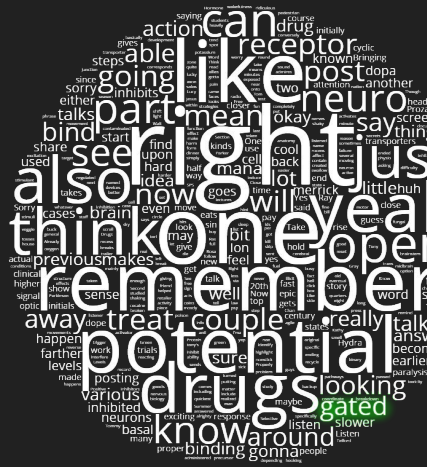
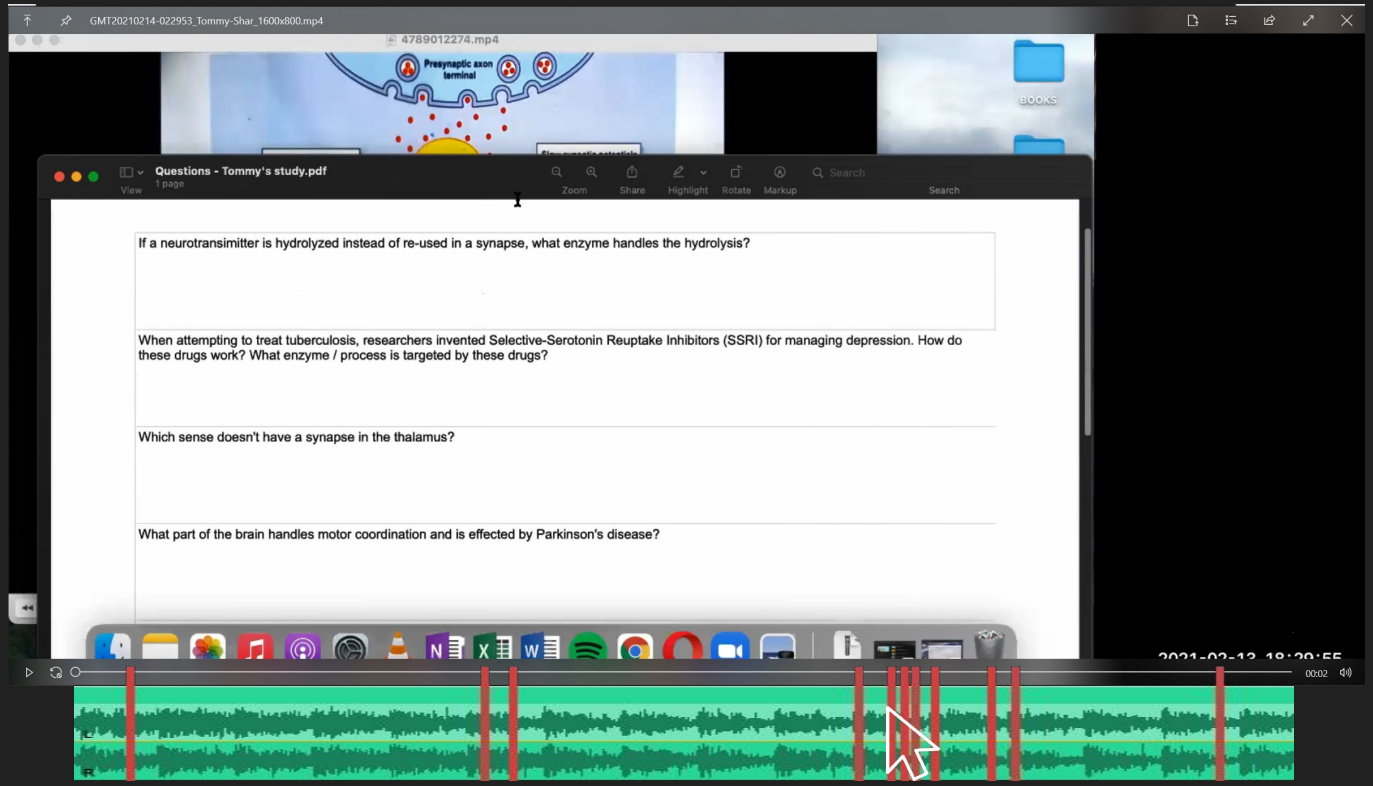




00:01:24.930 --> 00:01:40.230
i'm just gonna kind of fast forward and see, I think it was the second diagram or second this one is the one I think he was talking about enzymes more heavily.

Participant_1: Think.
Participant_1: To the part where I was he had just finished up talking about.
Participant_1: summarizes summarize here so here are me.
Participant_1: The.
Participant_1: synaptic a little transmitter receptors that are gated by the neuro transmitter and the receptor is a itself and I and channel it's gated by the neurotransmitter.
Participant_1: All right, there are veggie protein couple receptors that change confirmation upon binding the neurotransmitter, and that makes the receptor be able to bind these G proteins, which are in the membrane.
Participant_1: Which are dry merrick and



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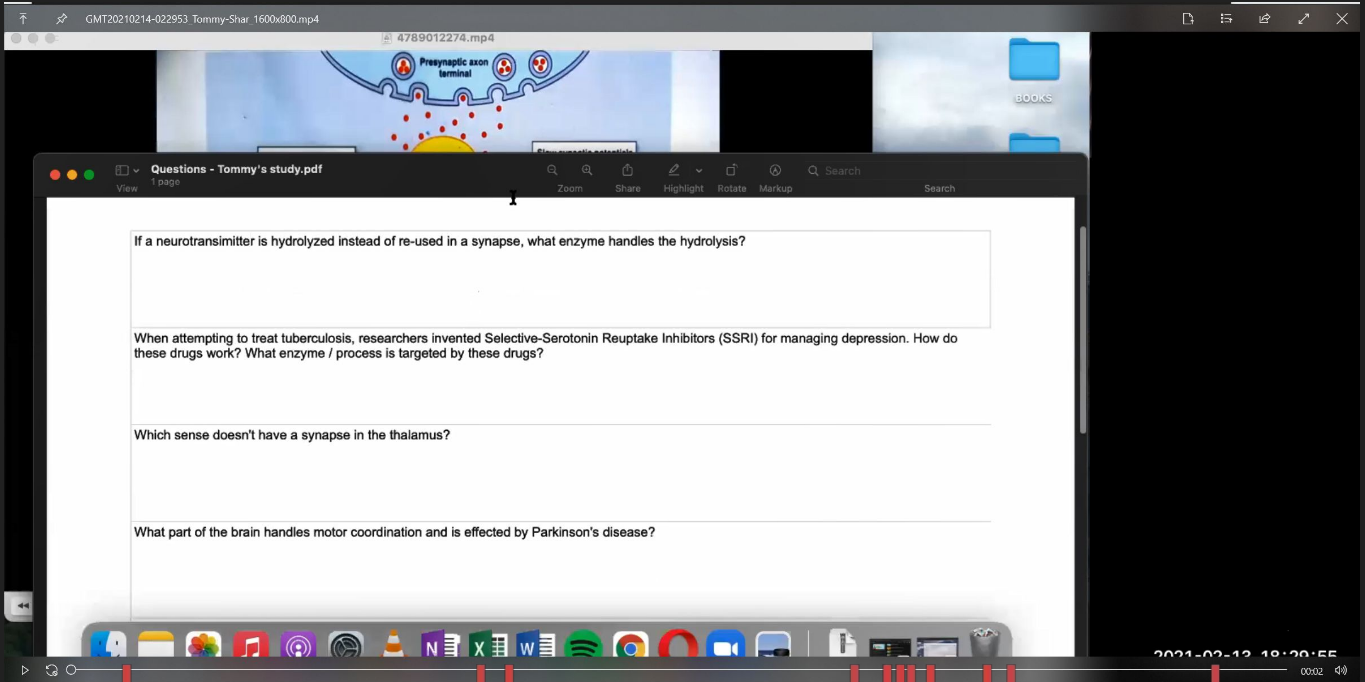
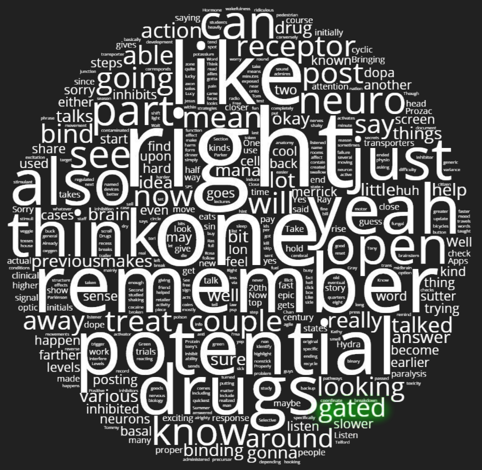
Participant_1: Which are dry merrick and

00:01:41.730 --> 00:01:44.100
And neurotransmitters.





00:01:46.140 --> 00:01:48.720
Some handles enzyme.

Participant_1: Think.
Participant_1: To the part where I was he had just finished up talking about.
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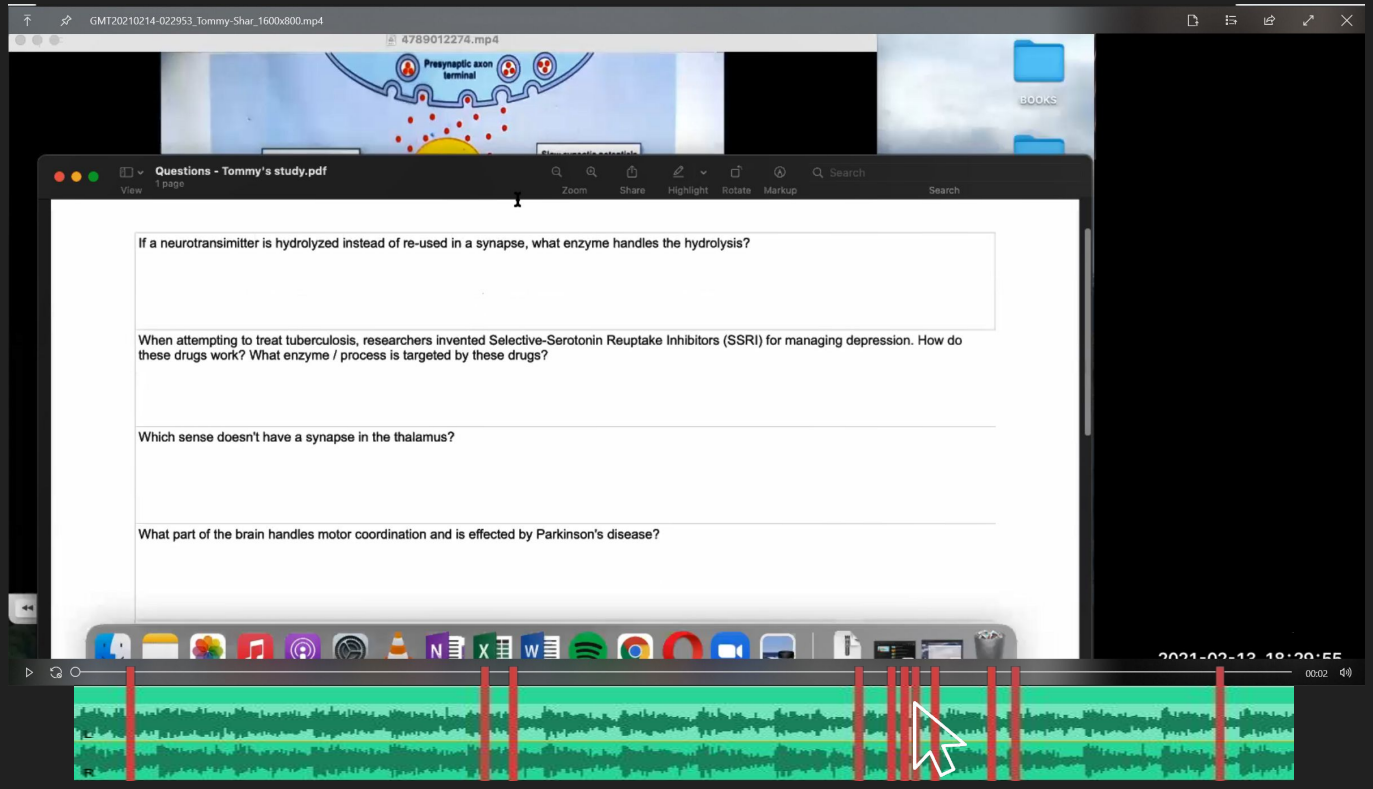

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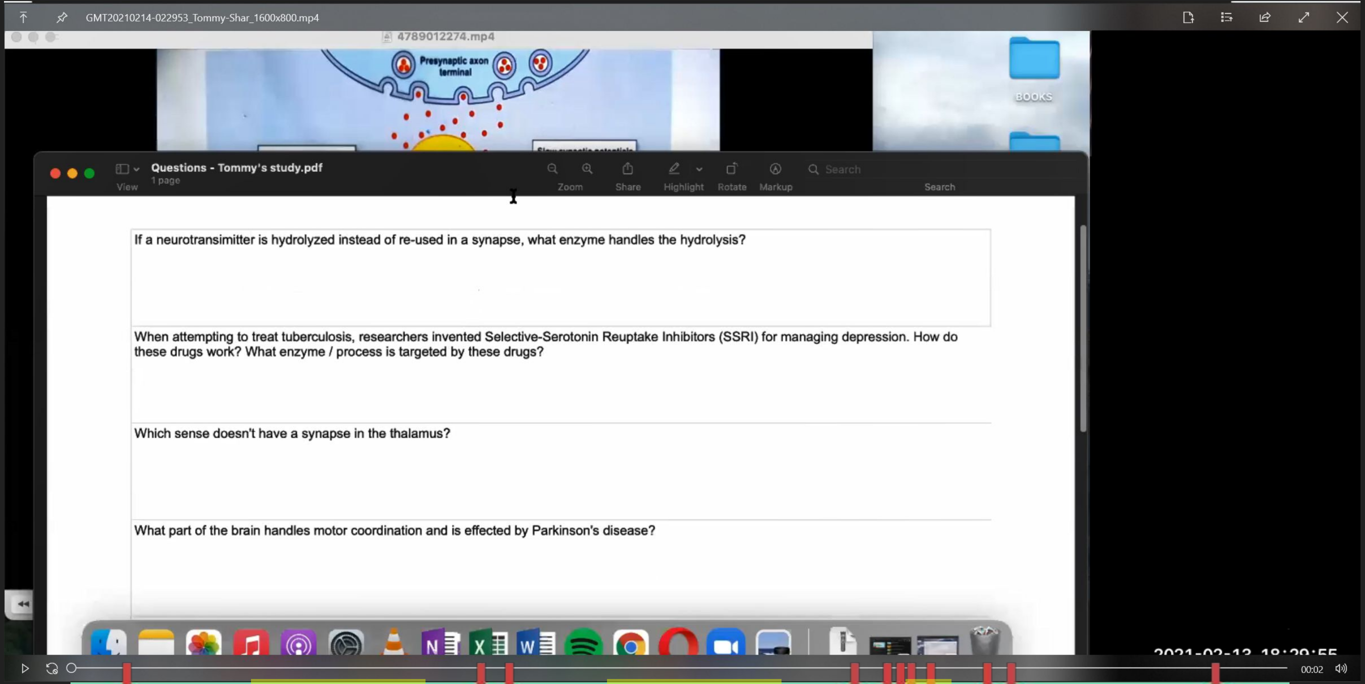
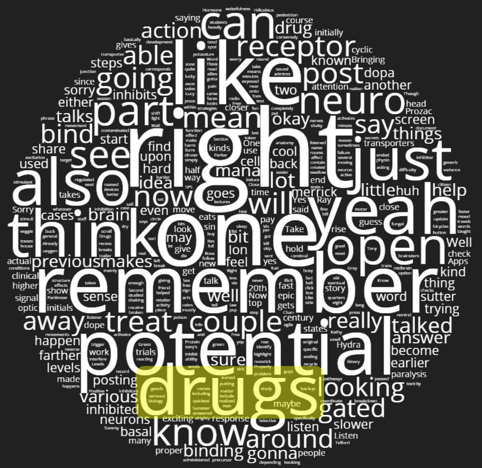
00:01:50.010 --> 00:01:54.720
mentioned a few enzymes, but I don't remember Oh, there it is.





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Critique: What would you change?

Highlights

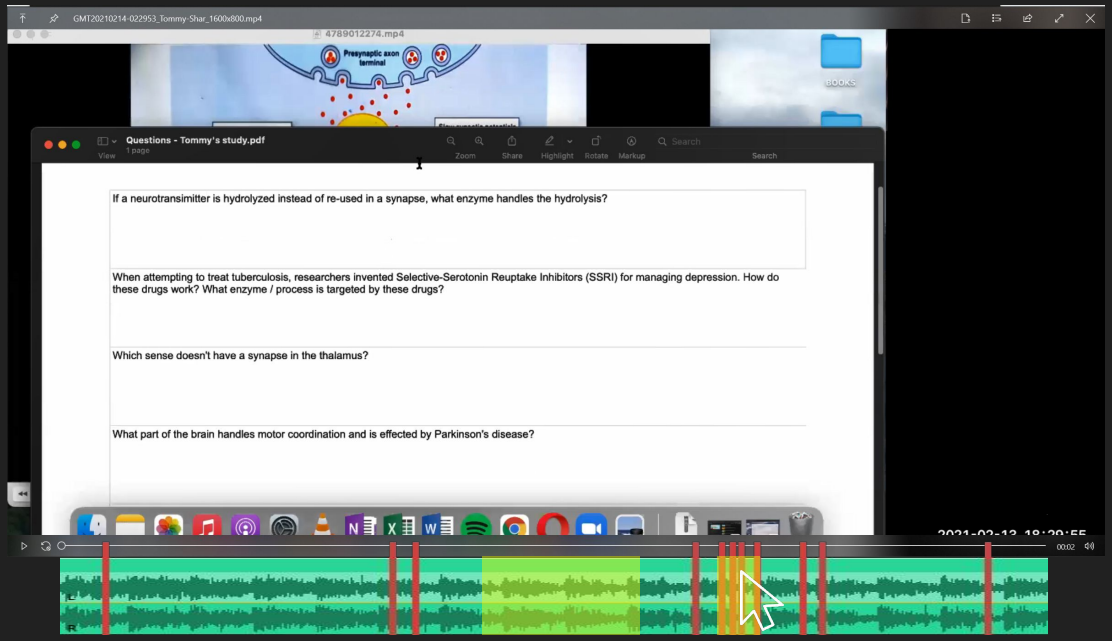
Areas of Interest

Word Cloud

Transcript

Speaker Info

...



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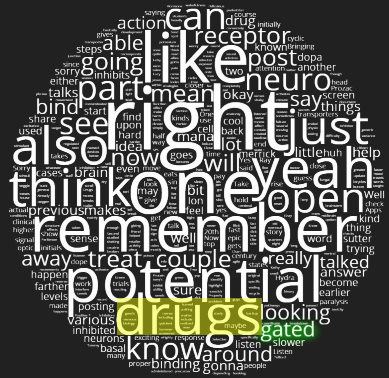

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Dru...

“L-DOPA is a drug used to increase Dopamine levels in Parkinson’s patients…”
Lecture 5
Feb 4, 2021

“This drug can inadvertently cause the patient to hallucinate...”
Lecture 5
Feb 4, 2021

“In the 80s and 90s numerous young people were diagnosed with Parkinson’s because of an illicit drug that poisoned the Basal Ganglia”
Lecture 6
Feb 11, 2021

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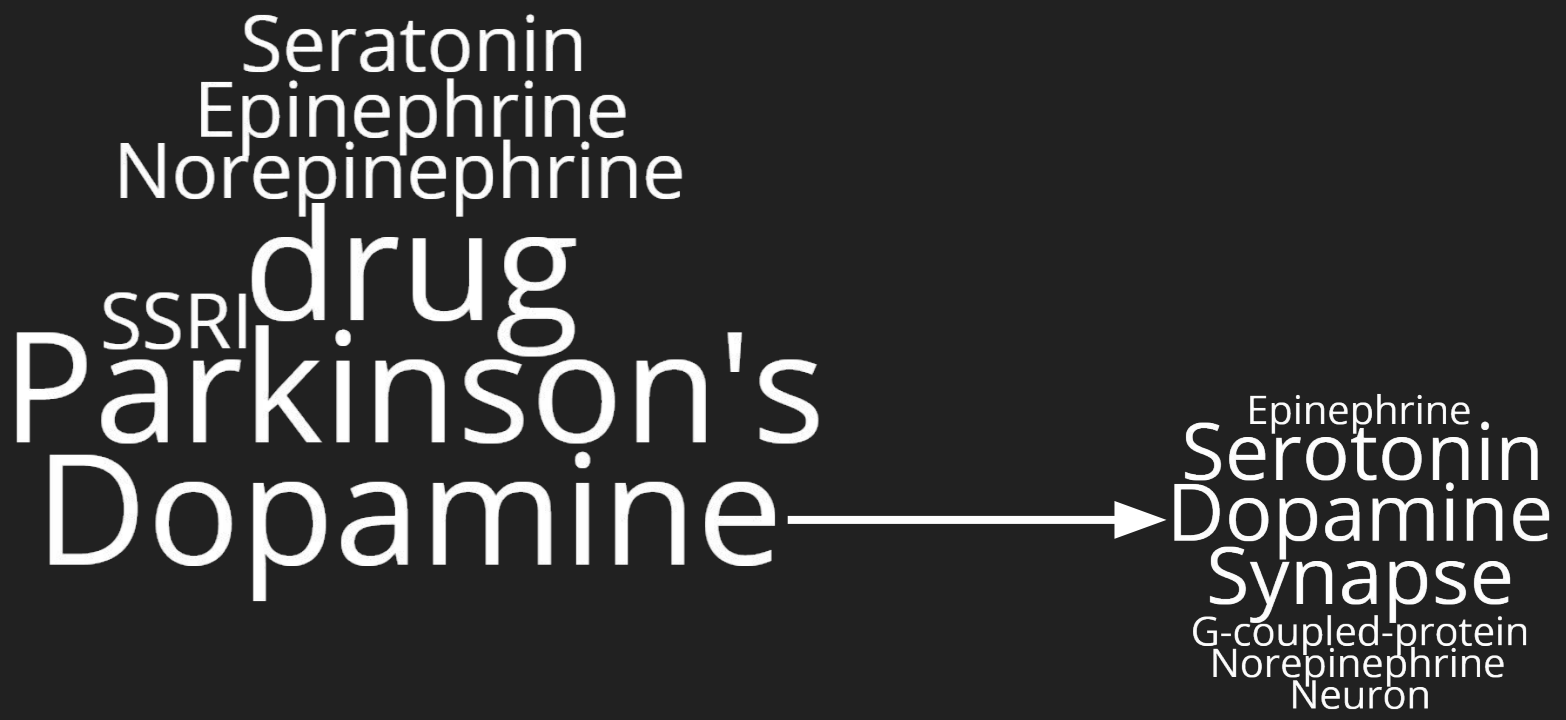
Dru...

Seratonin
Epinephrine
Norepinephrine
drug
SSRI
Parkinson's
Dopamine

Dru...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Epinephrine
Norepinephrine
drug
SSRI
Parkinson's
Dopamine
Epinephrine
Serotonin
Dopamine
Synapse
G-coupled-protein
Norepinephrine
Neuron

How to combine?

Can we switch between visuals?

Can we show both simultaneously?

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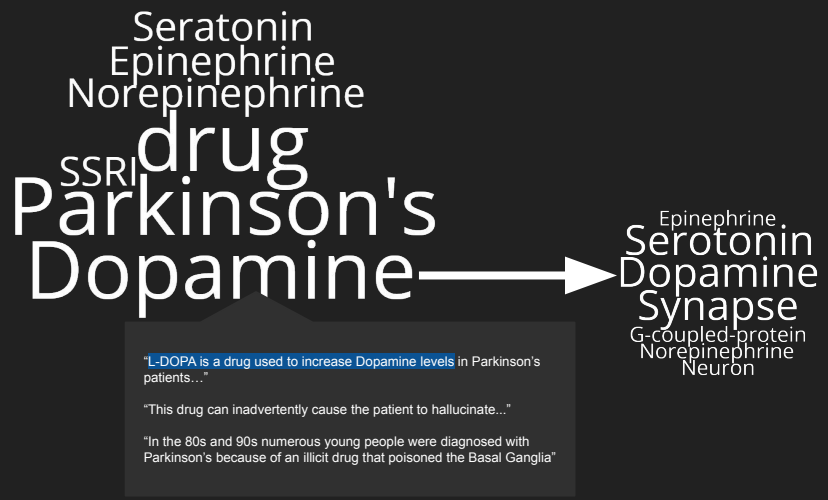

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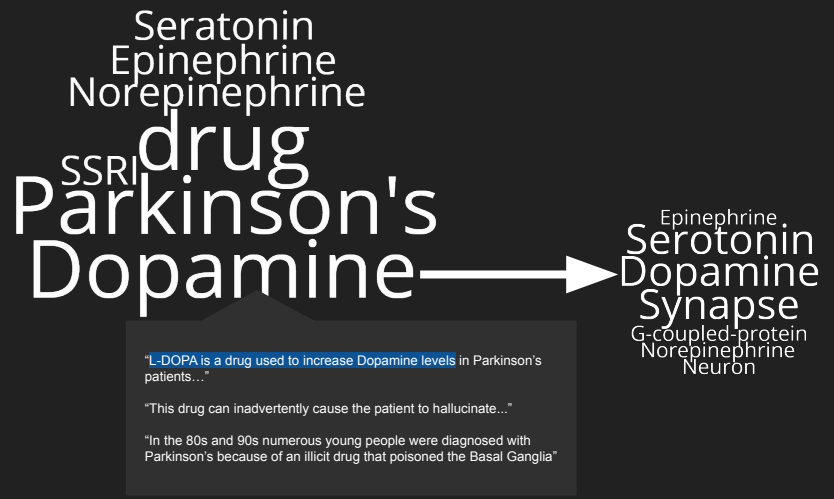

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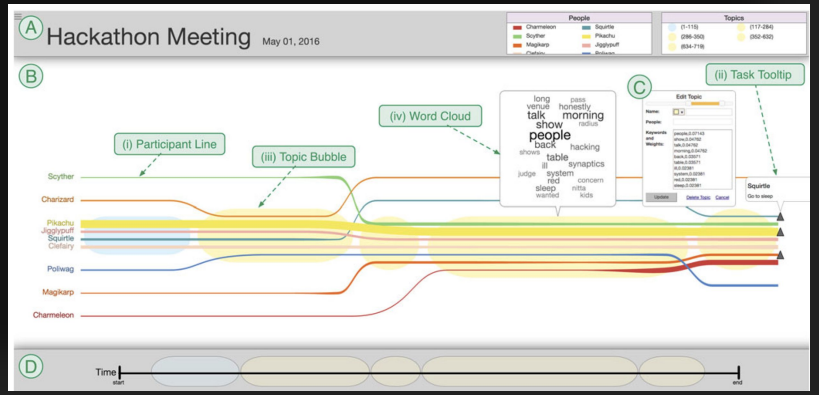
Identifiable Visualizations?

How to make a uniquely recognizable (icon) preview?

Identifiable Visualizations?

MeetingVis

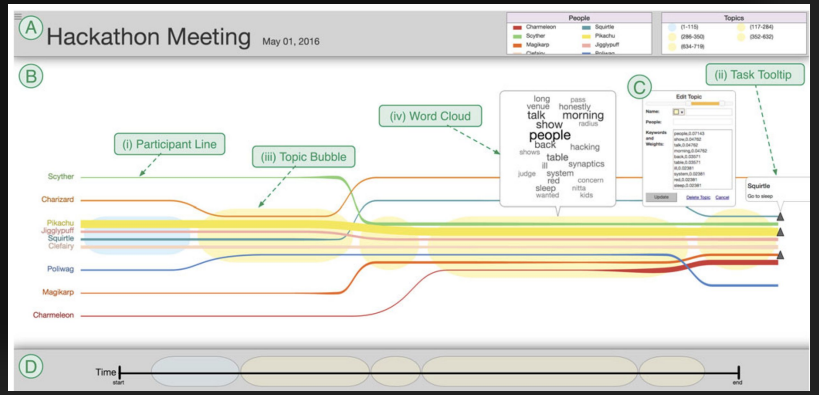
- Identifiable
- But Decision-Oriented recordings

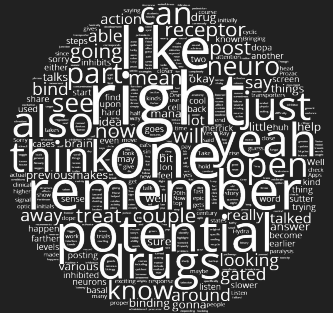


Identifiable Visualizations?

MeetingVis

Simplify the Word Cloud?





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MeetingVis

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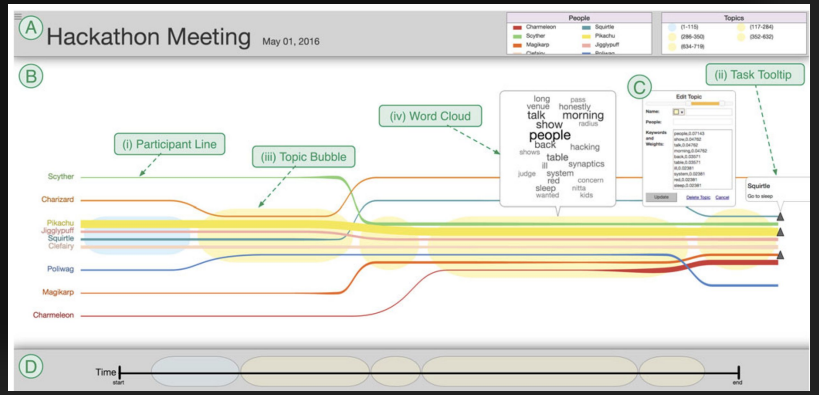
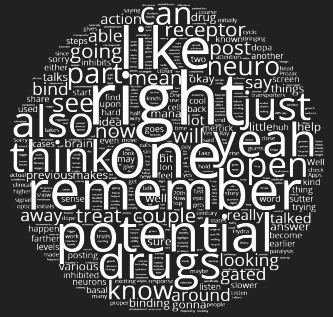




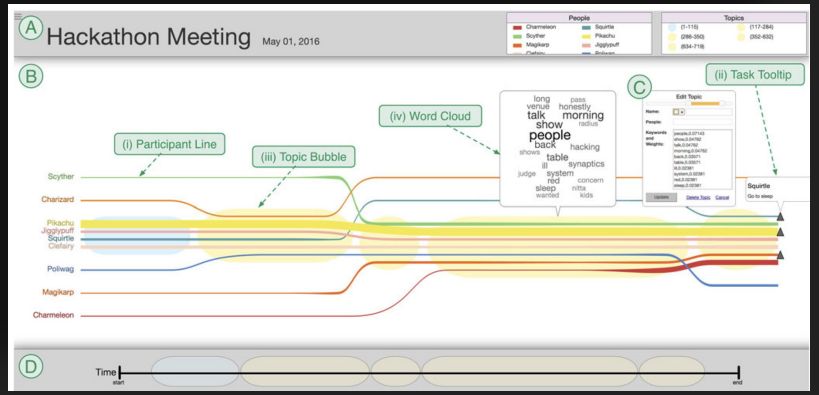
Epinephrine
Serotonin
Dopamine
Synapse
G-coupled-protein
Norepinephrine
Neuron

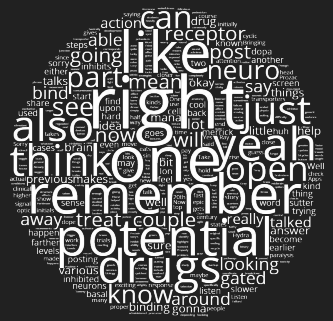
Identifiable Visualizations?

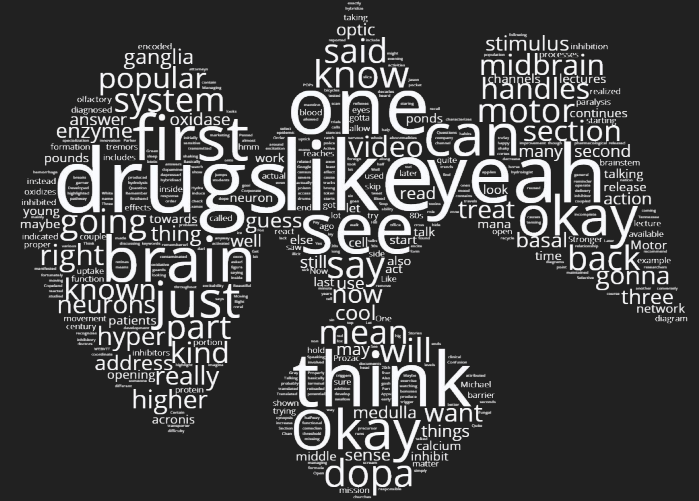
MeetingVis

Simplify the Word Cloud?

Give form to the Word Cloud?







Discussion

- Long lecture videos often have sections. How should these be broken up (visually and technically)?
- How to harness user attention/engagement?
  - Visualization?
    - File / Folder
  - Navigation?
    - Explore / Search
  - Word cloud shape?
    - Breaking up lecture into sections of attention?