

Exploring The Affordances of Game-Aware Streaming to Support Blind and Low Vision Viewers: A Design Probe Study

Noor Hammad, Frank Elavsky, Sanika Moharana, Jessie Chen, Seyoung Lee, Patrick Carrington, Dominik Moritz, Jessica Hammer, Erik Harpstead



Presented by Frank Elavsky, PhD Student



hcii.cmu.edu, axle-lab.com, dig.cmu.edu, cmu-ctp.github.io

Game accessibility is on the rise



<https://www.playstation.com/en-us/games/the-last-of-us-part-ii/accessibility/>

What about game streaming accessibility?

LOCAL TIME
00:32 PDT

coinbase WORLD FIRST PULL

Queen Anserek

QUEEN ANSUREK

LIQUID

1ST WORLD 1ST REGION

HONDA RAID PROGRESS

SECRET LAB

Watch Full Video Edit Share

19 days ago

Chat on Videos

0:19 shizukami97: sub 5% they started talking like the birds in finding Nemo hahaha

0:20 Khuzvhan: THD

THD!

0:20 BlackLabel2021:

0:21 reagsy: HATS OFF CLUTCH

What about game streaming accessibility?

The image displays a live stream of a World of Warcraft raid pull for Queen Anserek. The main screen shows the raid interface with various players' names and their damage output. A video player window in the bottom-left shows a streamer's face. The interface includes raid progress bars at the bottom, a sidebar with sponsor logos, and a chat log on the right.

Raid Progress:

- QUEEN ANSUREK
- LIQUID
- 1ST WORLD
- 1ST REGION
- HONDA RAID PROGRESS: 1 PULLS, 1 PULLS, 1 PULLS, 120 PULLS, 304 PULLS, 171 PULLS, 403 PULLS
- SECRET LAB

Chat Log (Partial):

- 0:19 shizukami97: sub 5% they started talking like the birds in finding Nemo hahaha
- 0:20 Khuzvhan: THD
- 0:20 BlackLabel2021: THD!
- 0:21 reagsy: HATS OFF CLUTCH

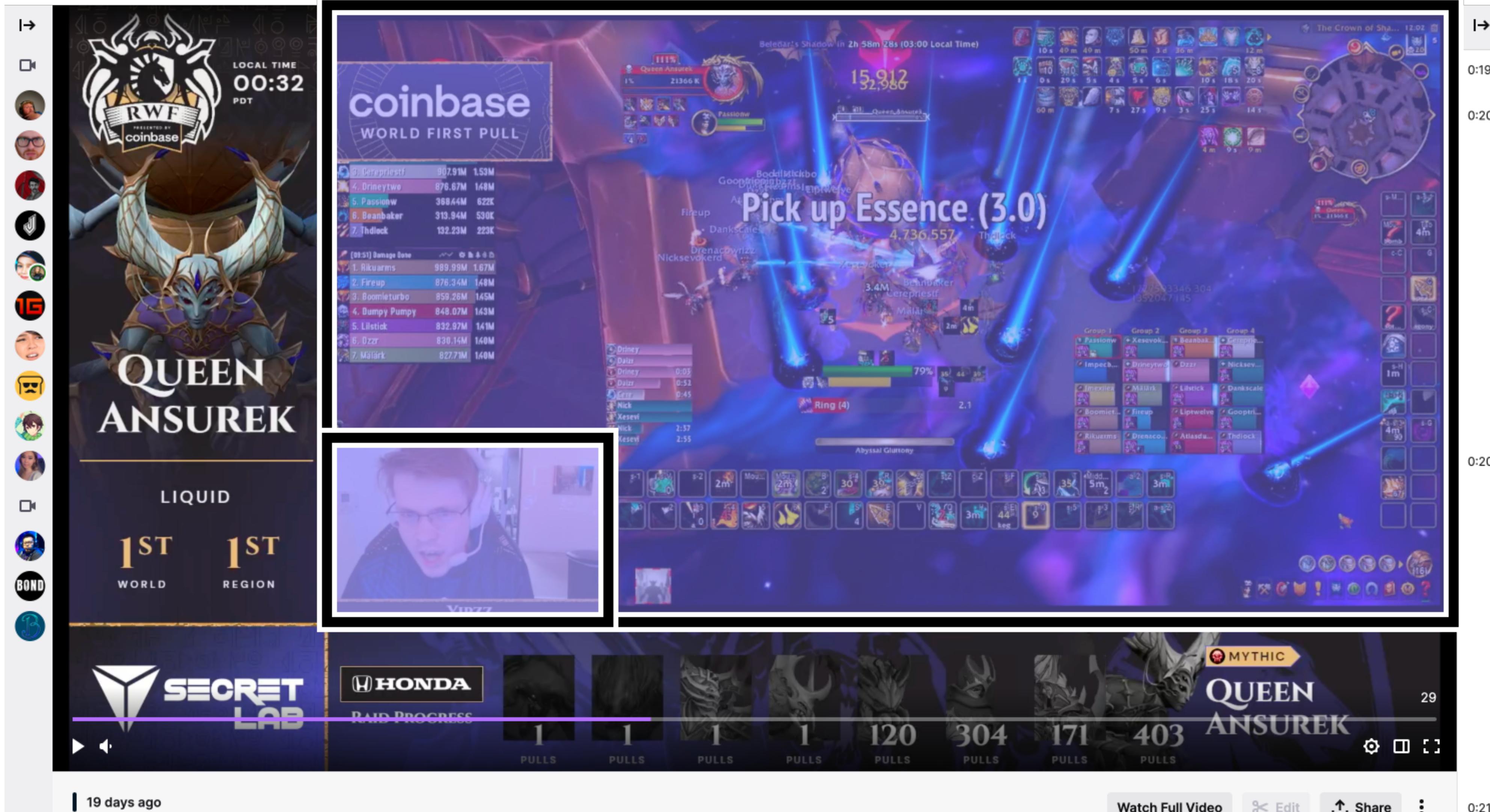
Bottom Bar:

- Watch Full Video
- Edit
- Share

Bottom Left:

- 19 days ago

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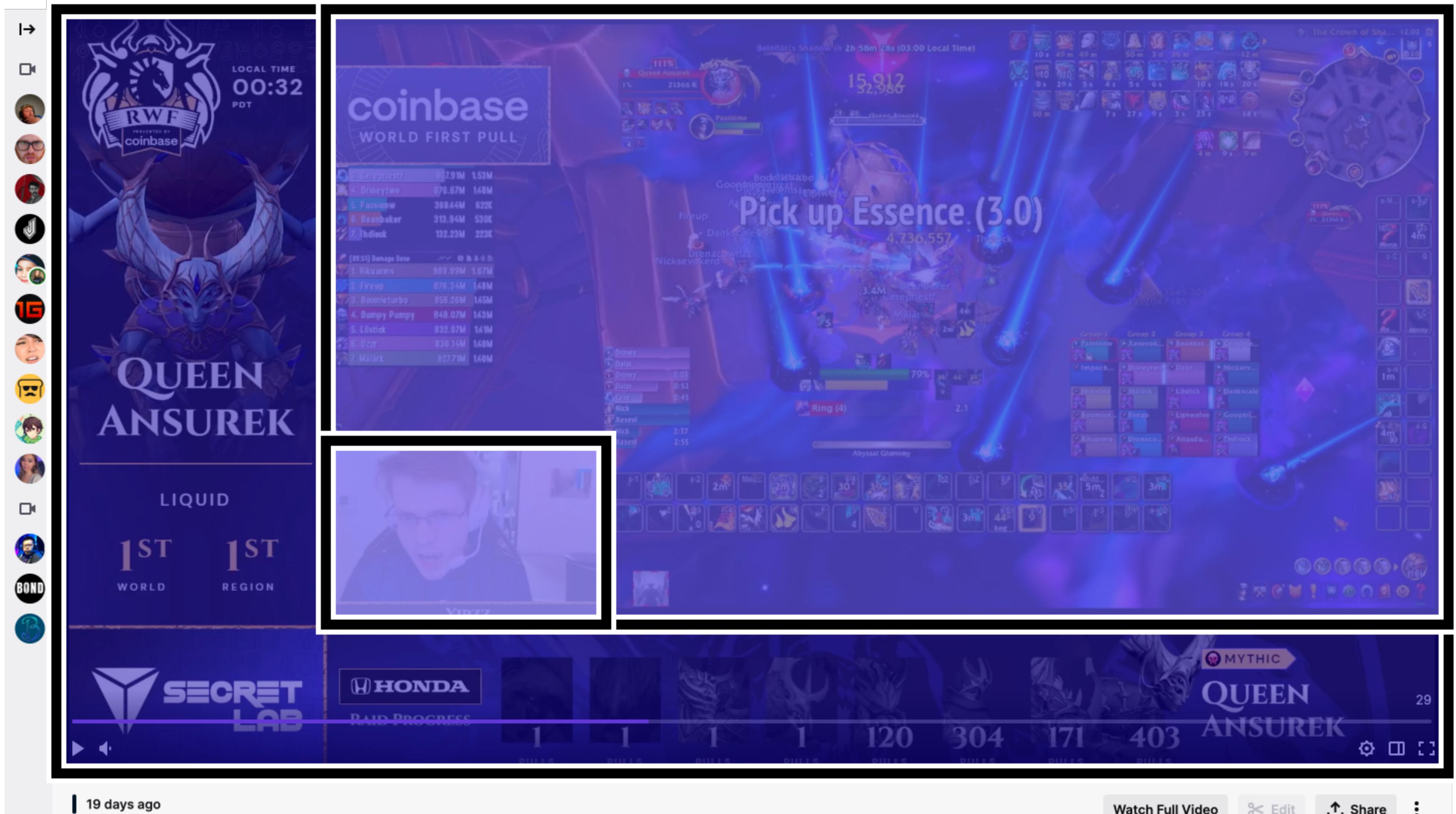
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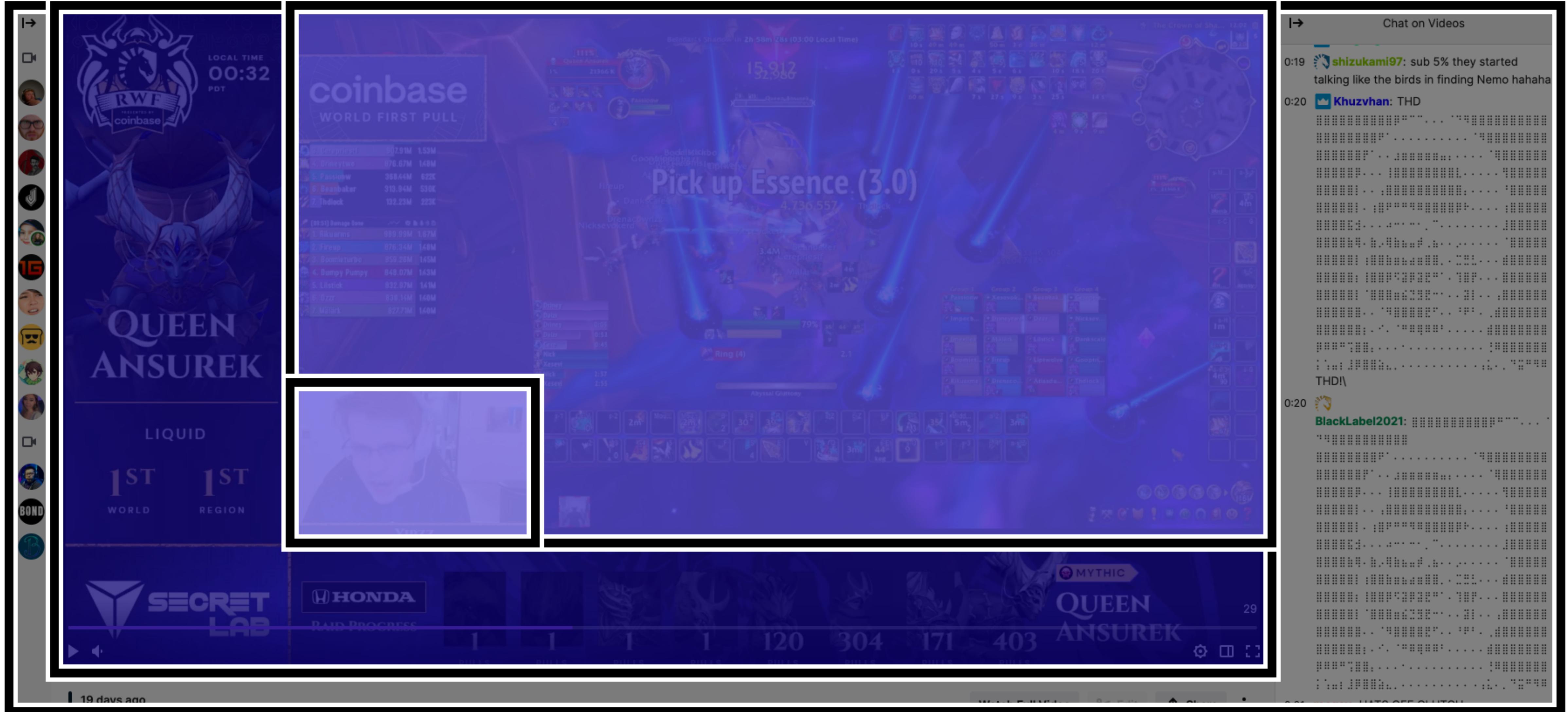
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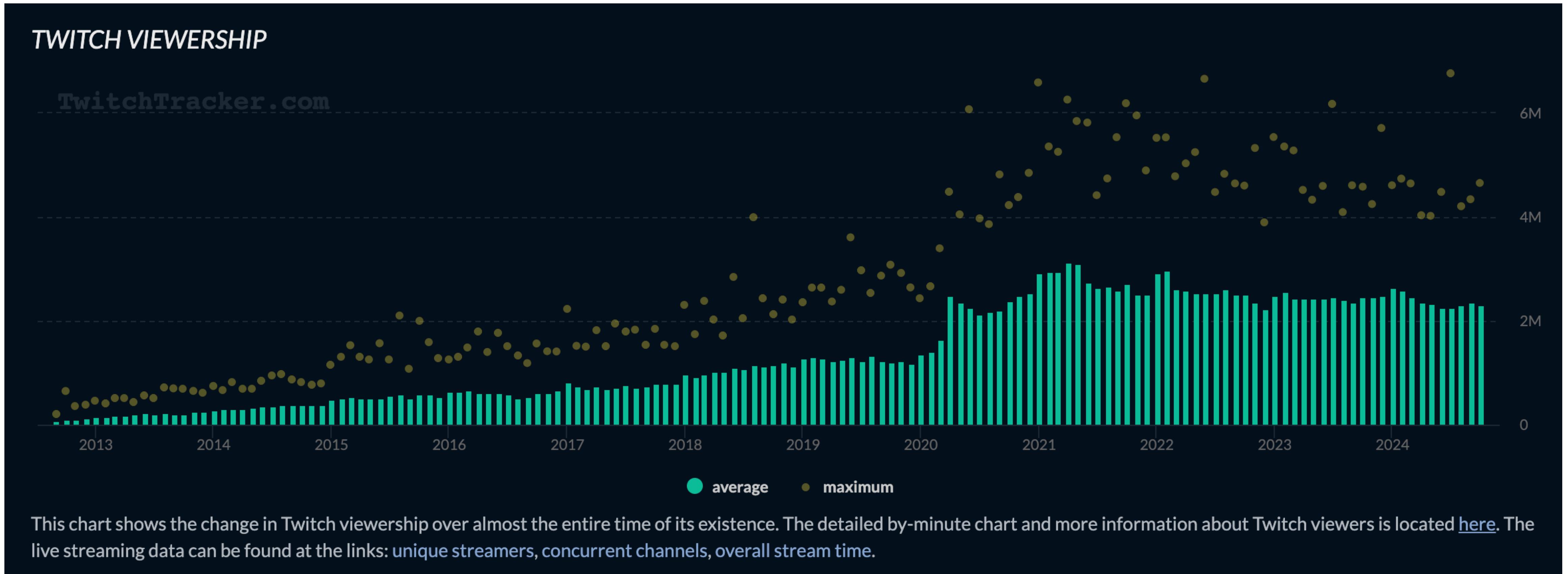
What about game streaming accessibility?



What about game streaming accessibility?

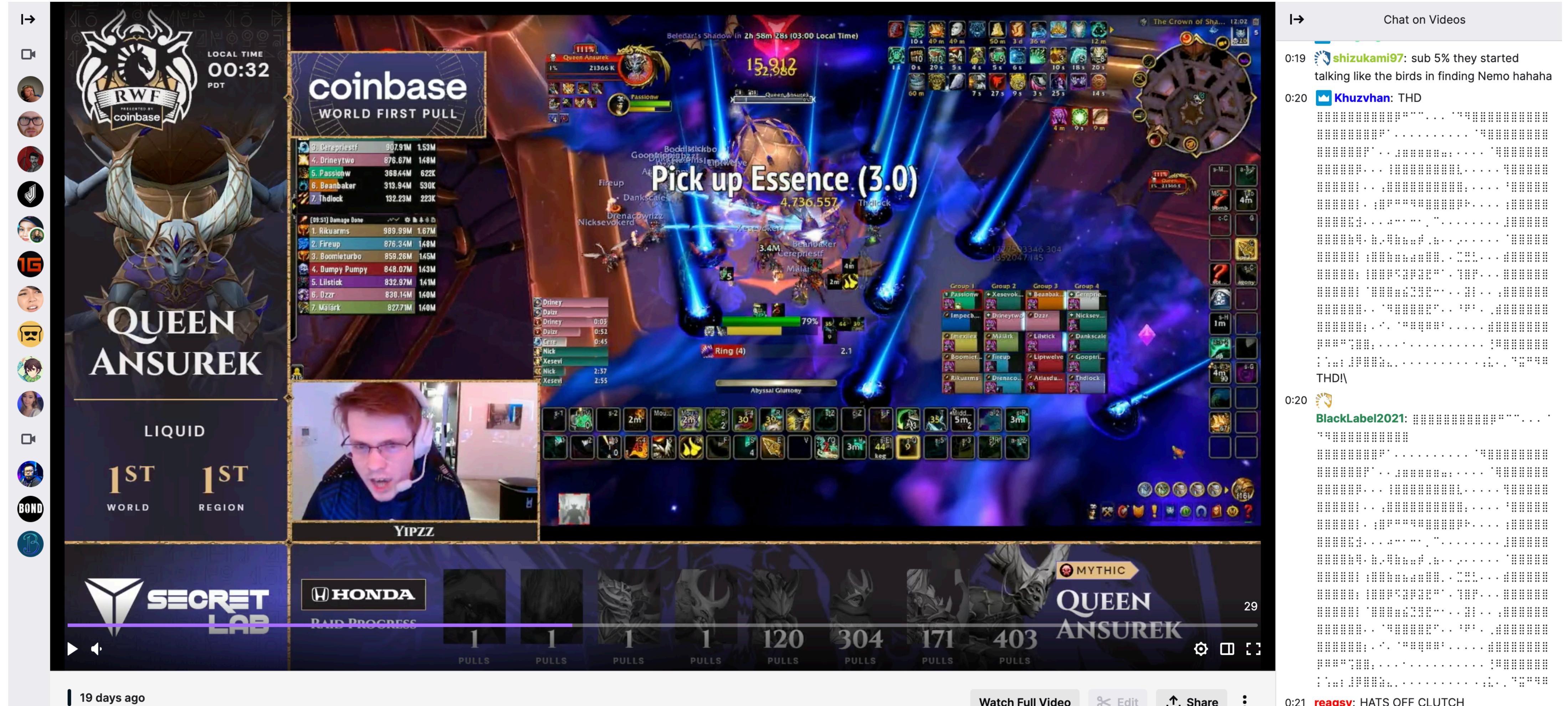


Many people watch streams



<https://twitchtracker.com/statistics>

Accessible stream descriptions are a hard problem! [1]



[1] Killough and Pavel, “Exploring Community-Driven Descriptions for Making Livestreams Accessible” (2023)

Descriptions are great, but what about sense-making?

QUEEN ANSUREK

LIQUID

1ST WORLD 1ST REGION

YIPZZ

HONDA RAID PROGRESS

PULLS PULLS PULLS PULLS PULLS PULLS PULLS

1 1 1 1 120 304 171 403

SECRET LAB

MYTHIC QUEEN ANSUREK

19 days ago

Watch Full Video Edit Share

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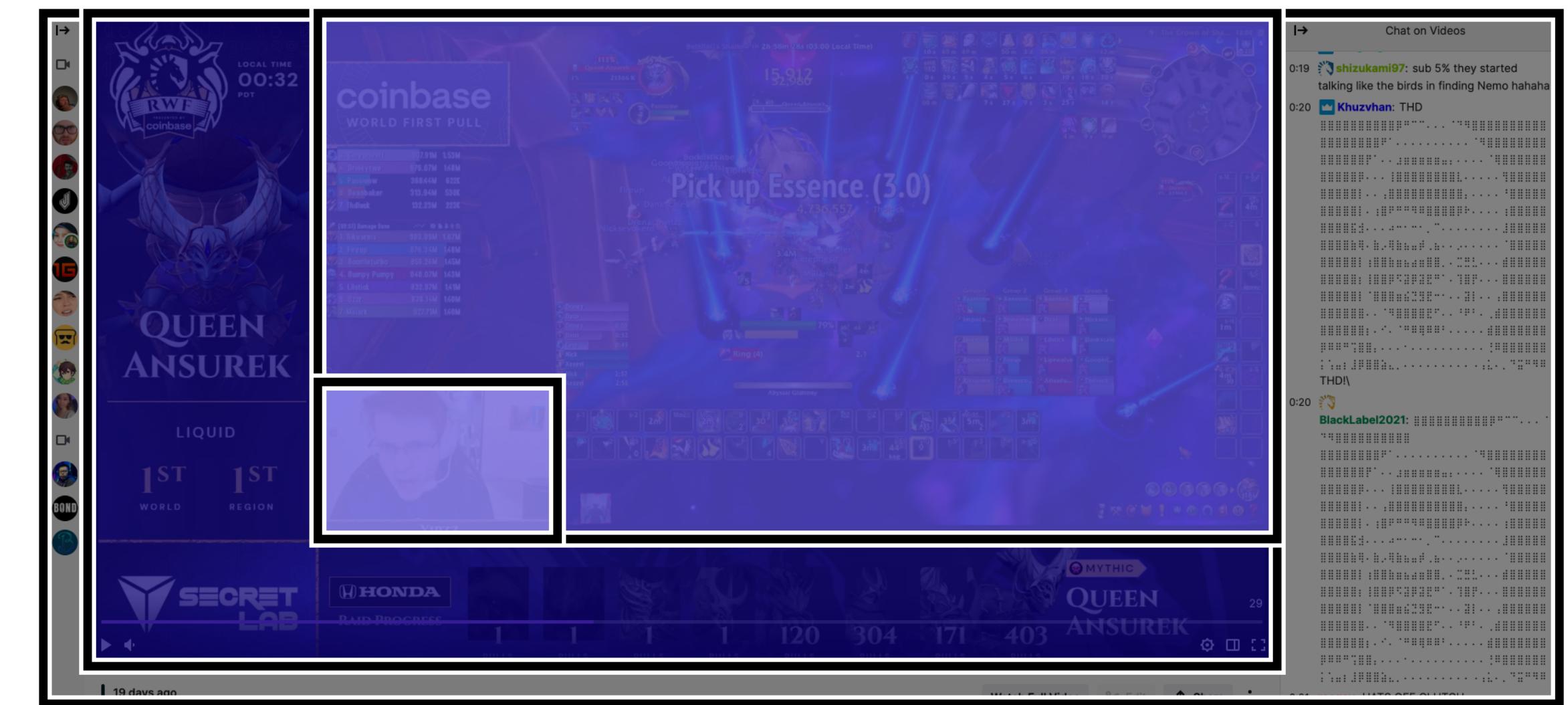
0:20 BlackLabel2021: THD

0:21 reagsy: HATS OFF CLUTCH

3 major problems

For stream accessibility

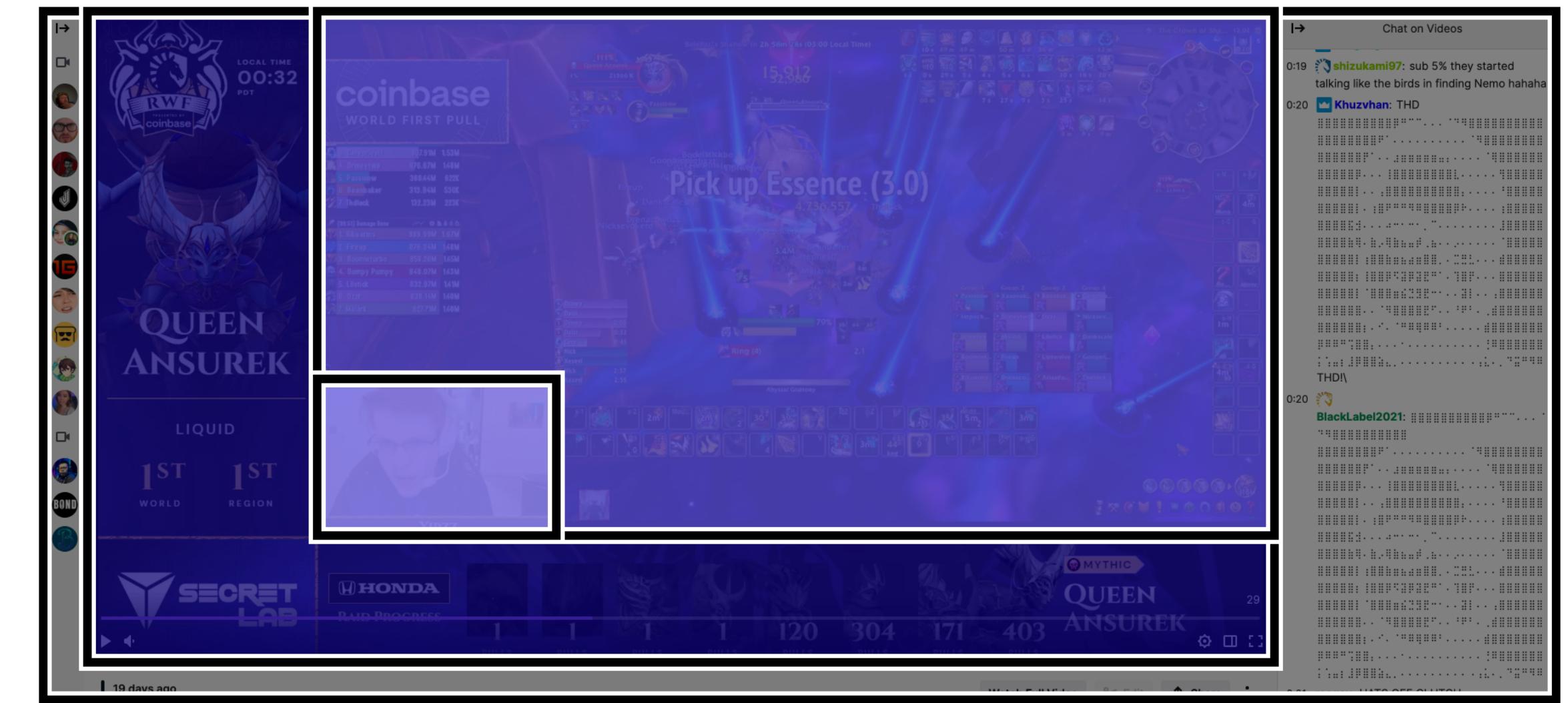
1. Existing customization and accessibility exists only for the gamer/streamer
2. Serial audio doesn't allow sensemaking/exploration of information and can become overwhelming
3. A serial video feed of an interface loses semantics and interactivity



3 major problems

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3 major problems

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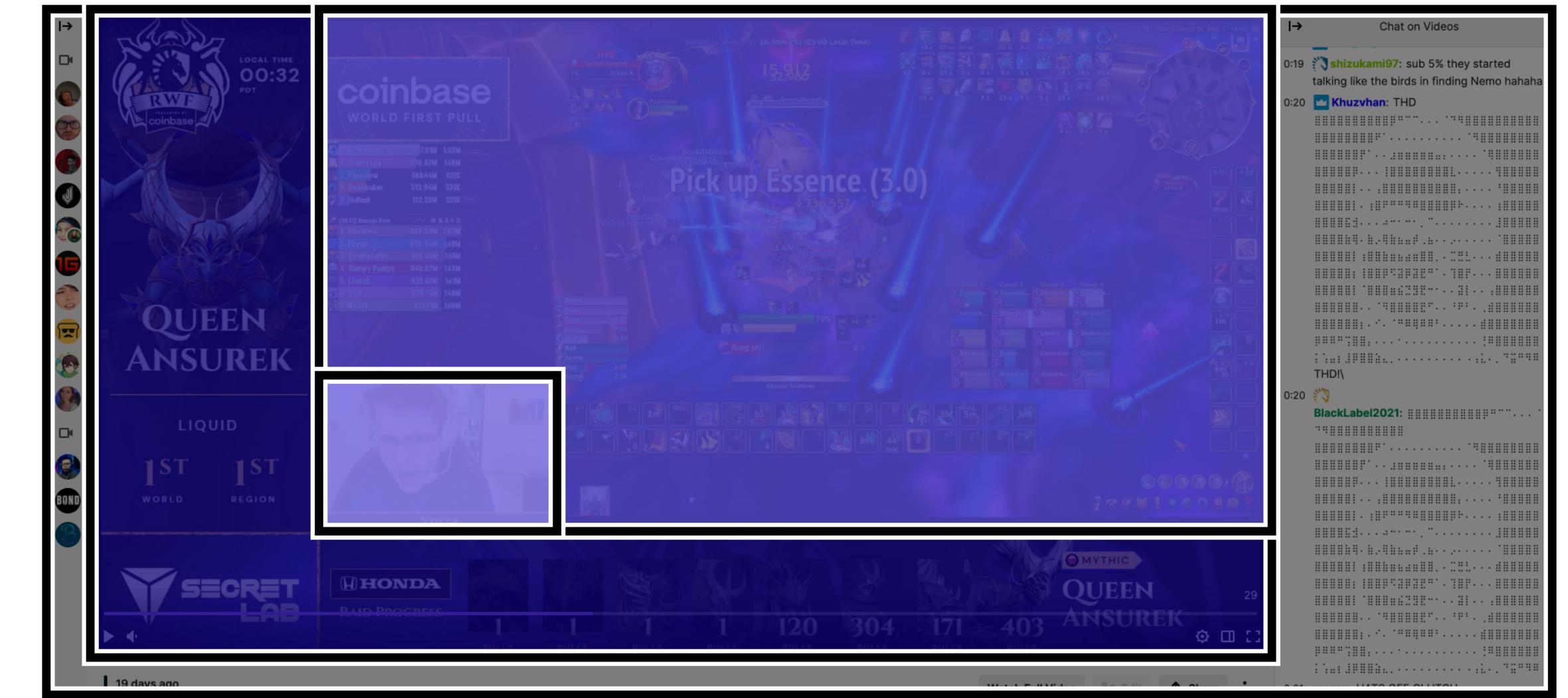
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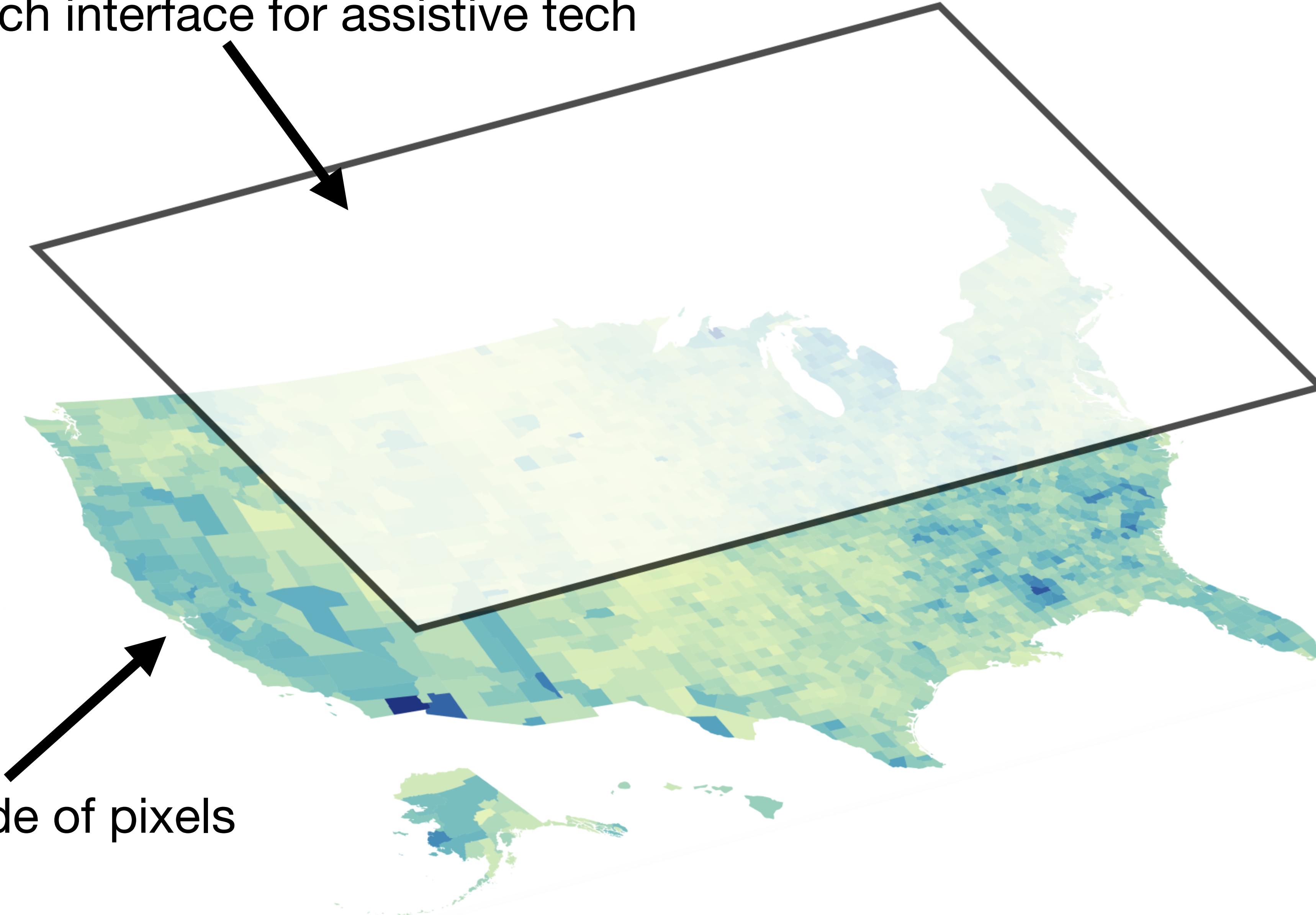
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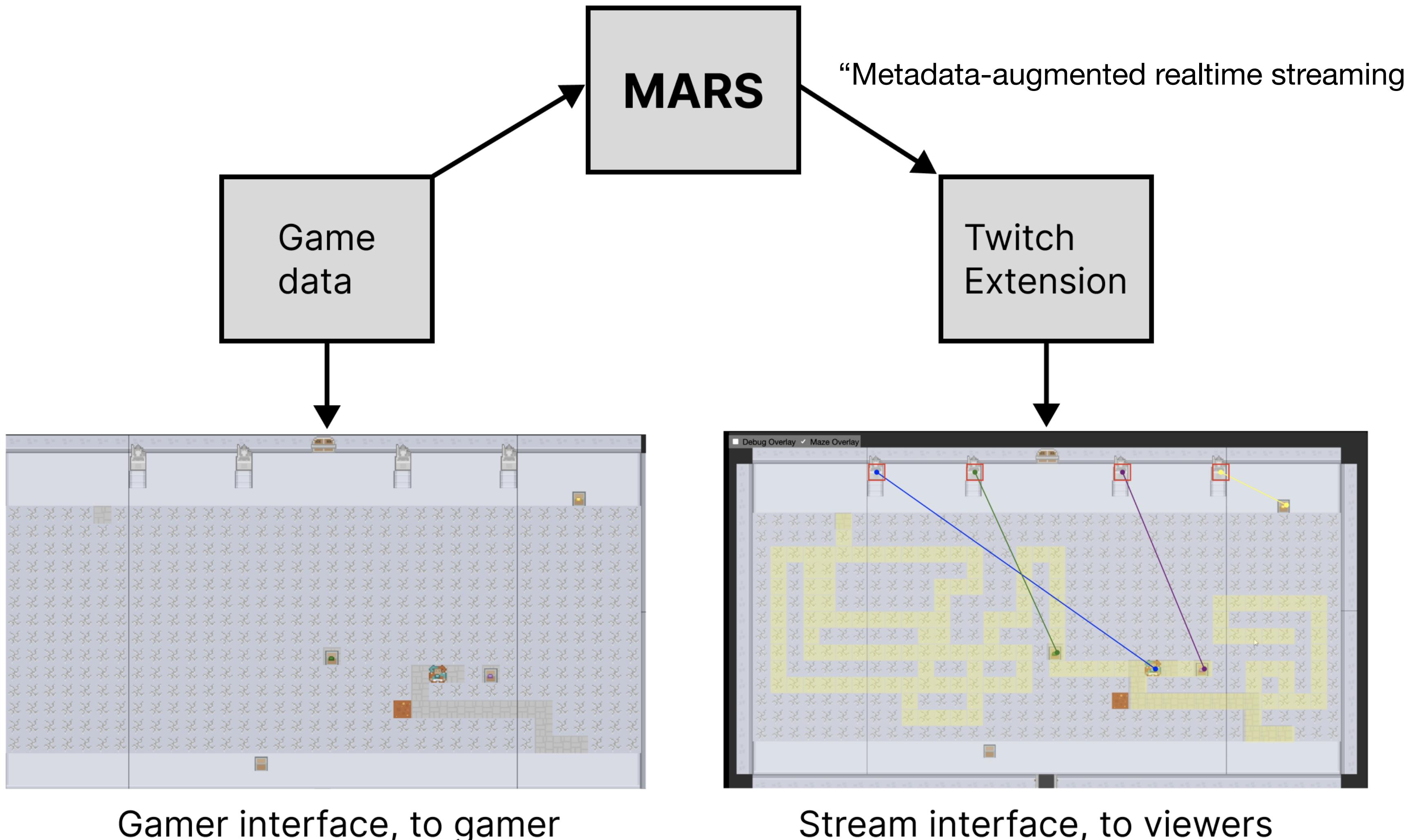


This is a rich interface for assistive tech

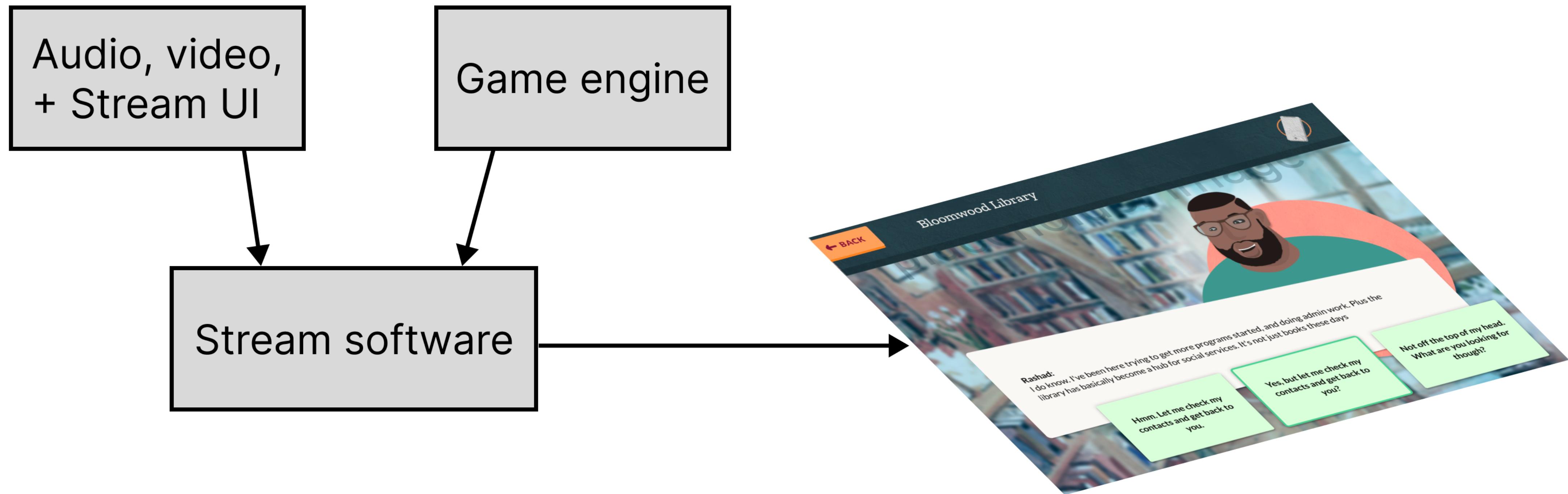


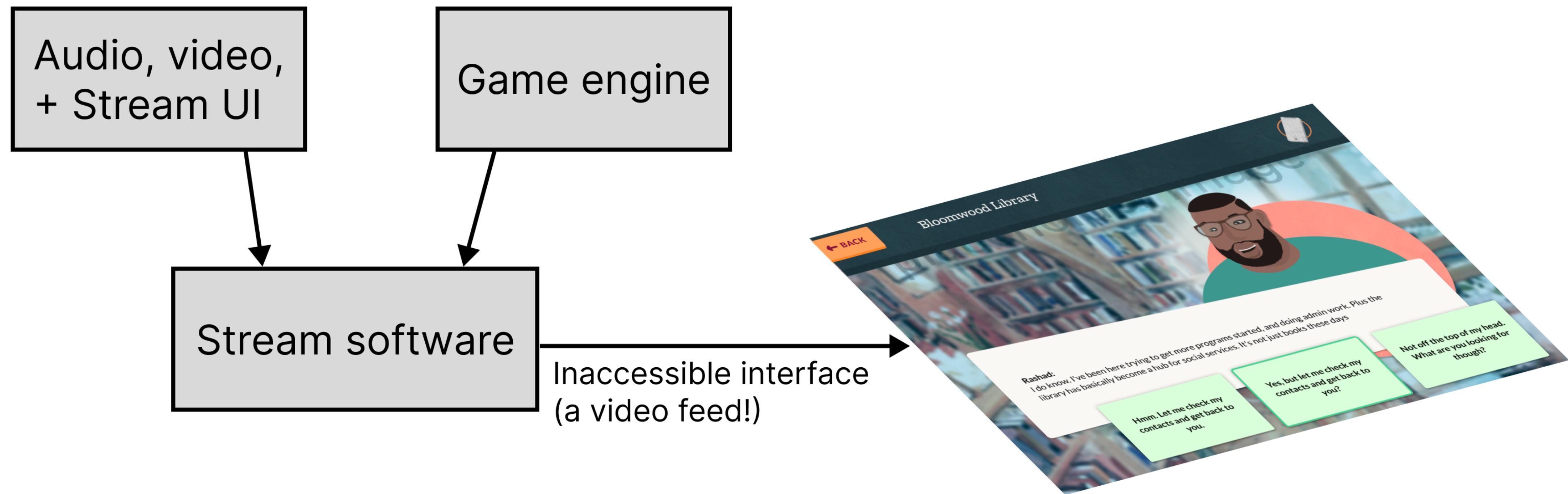
Elavsky et al, “Data Navigator” (2023)

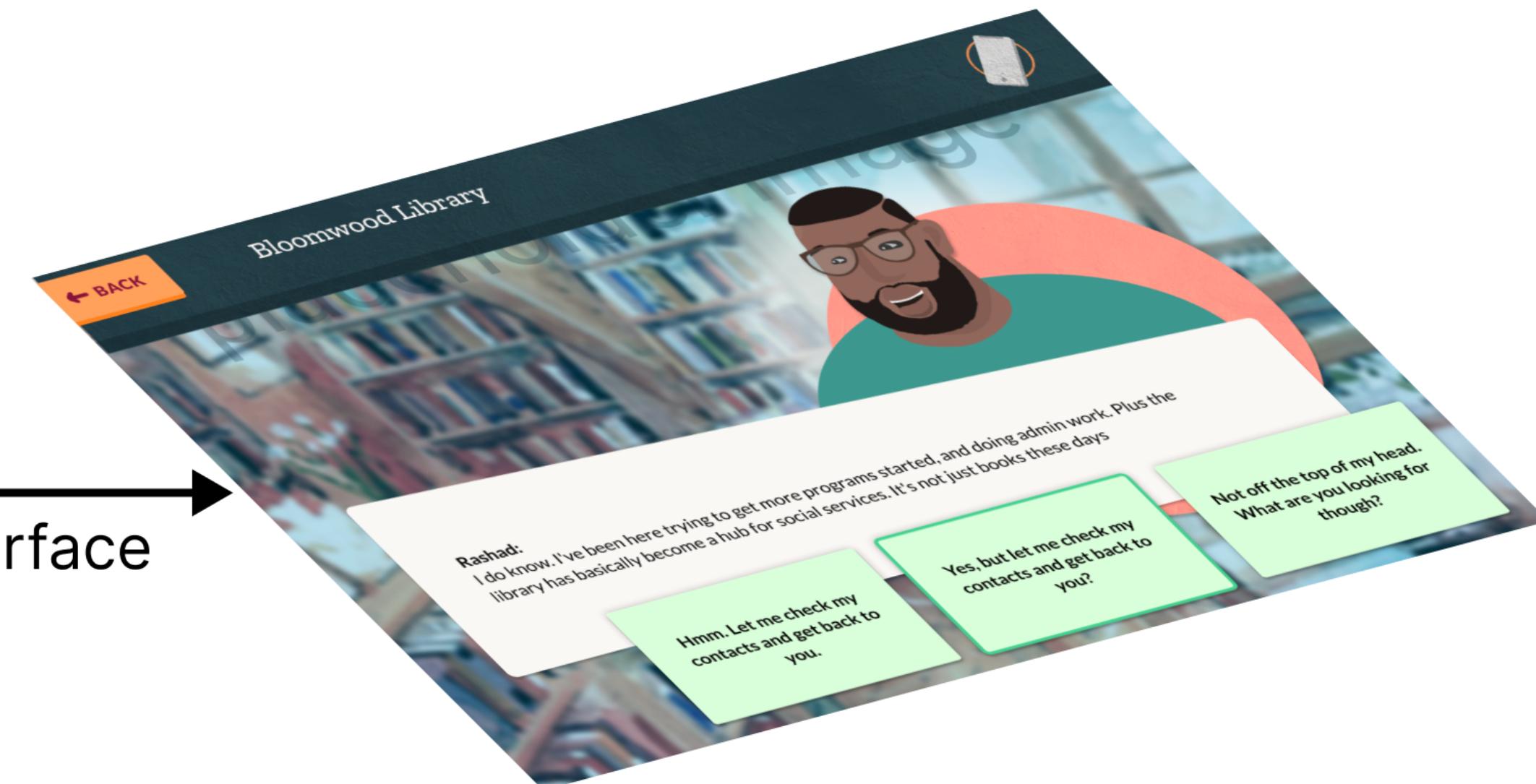
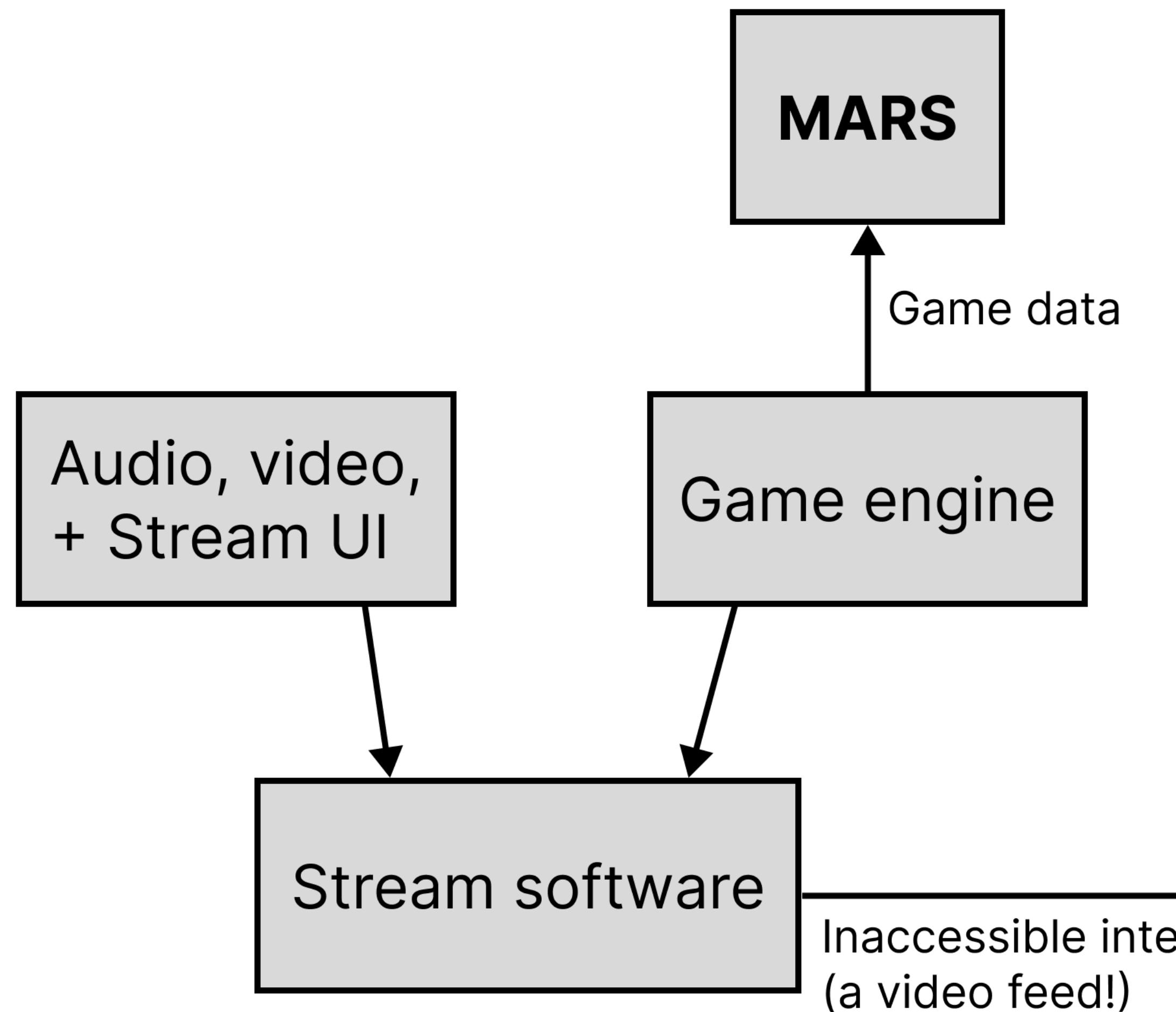
Game-aware streaming: potential?

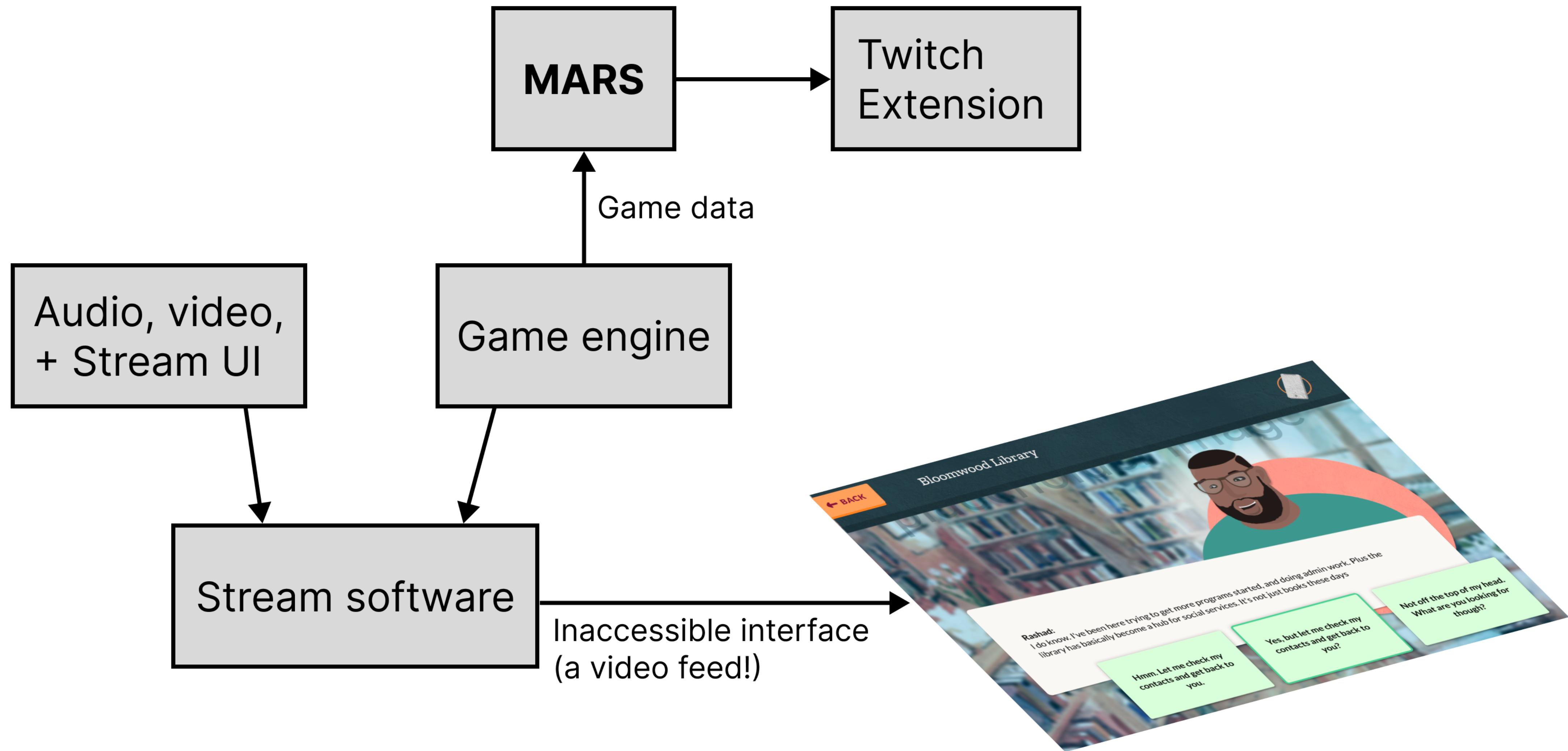


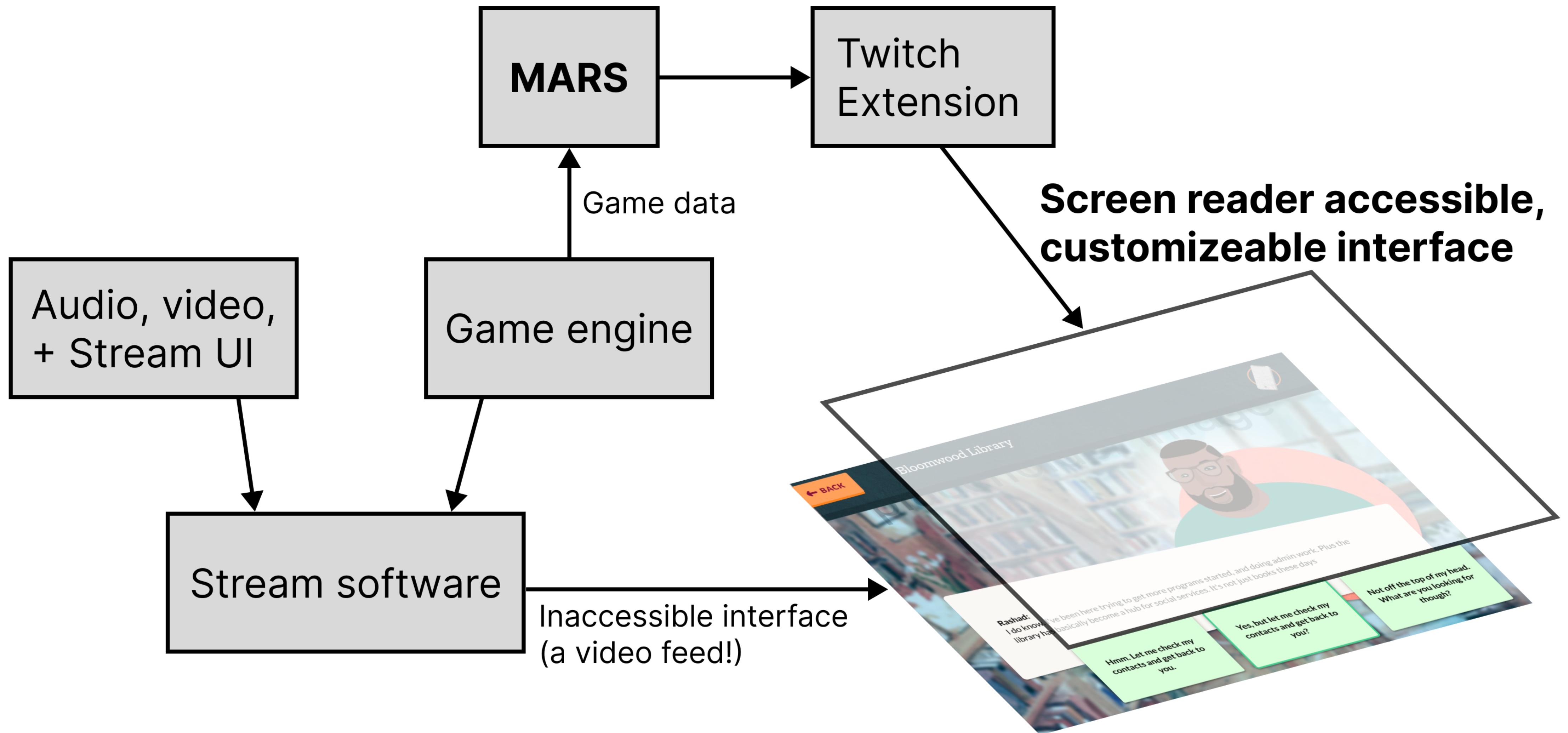
Hammad et al, “The View from MARS” (2023)











Research questions

- How do existing game-aware streaming technologies support, or fail to support, game stream viewing for blind and low vision (BLV) viewers?
- What qualities, challenges, and design opportunities do BLV viewers envision for game-aware streaming technologies?

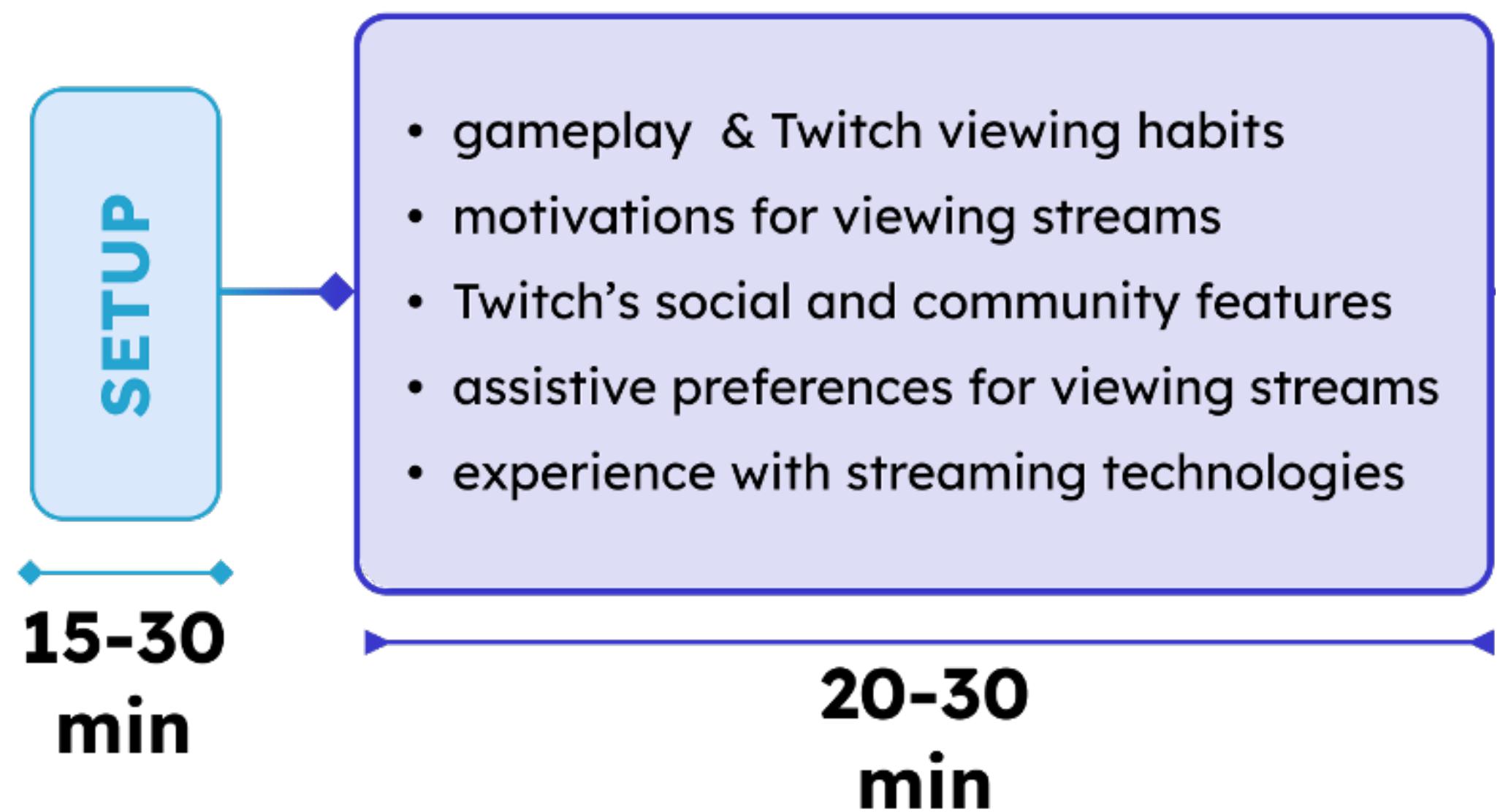
Research questions

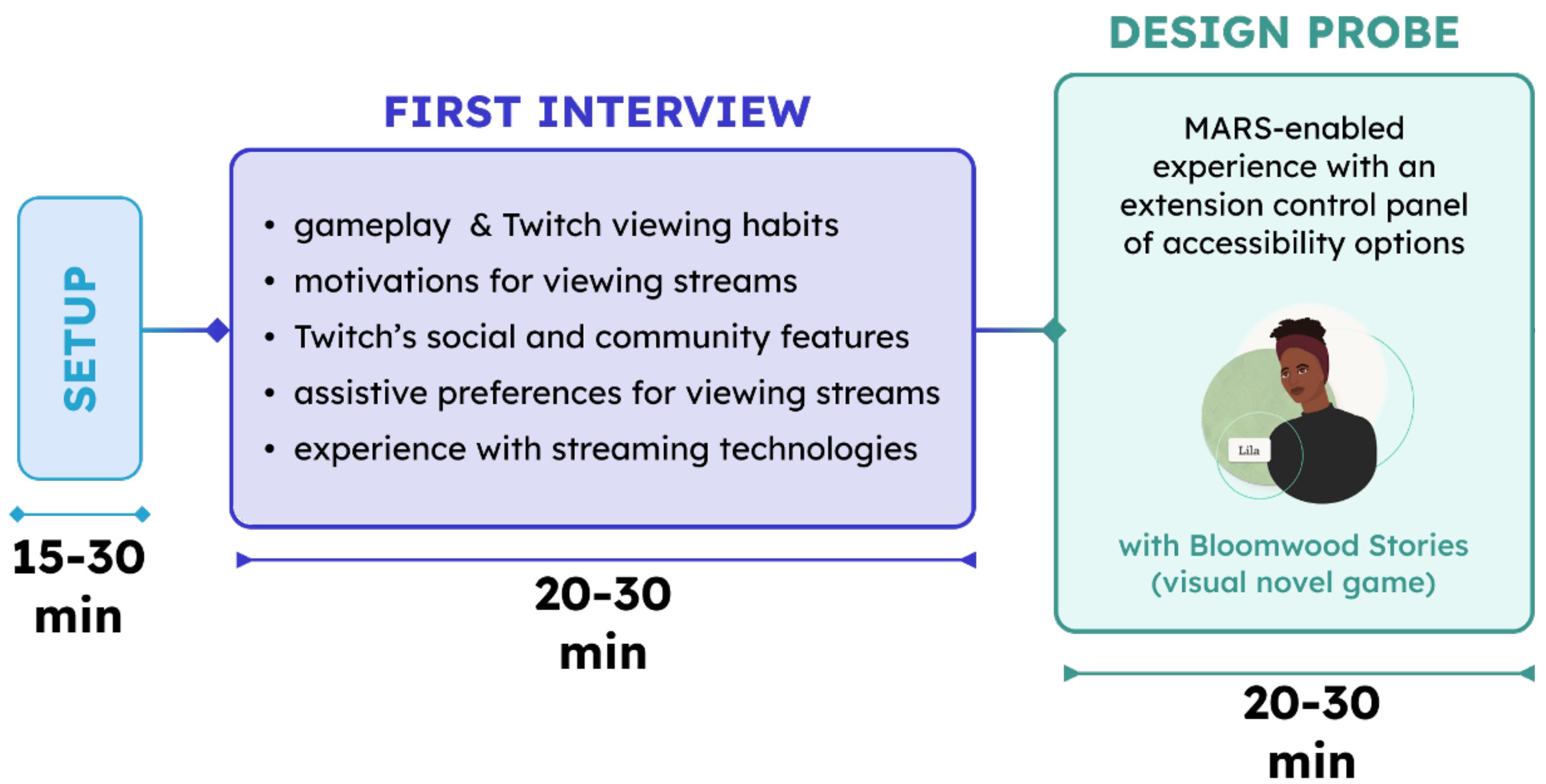
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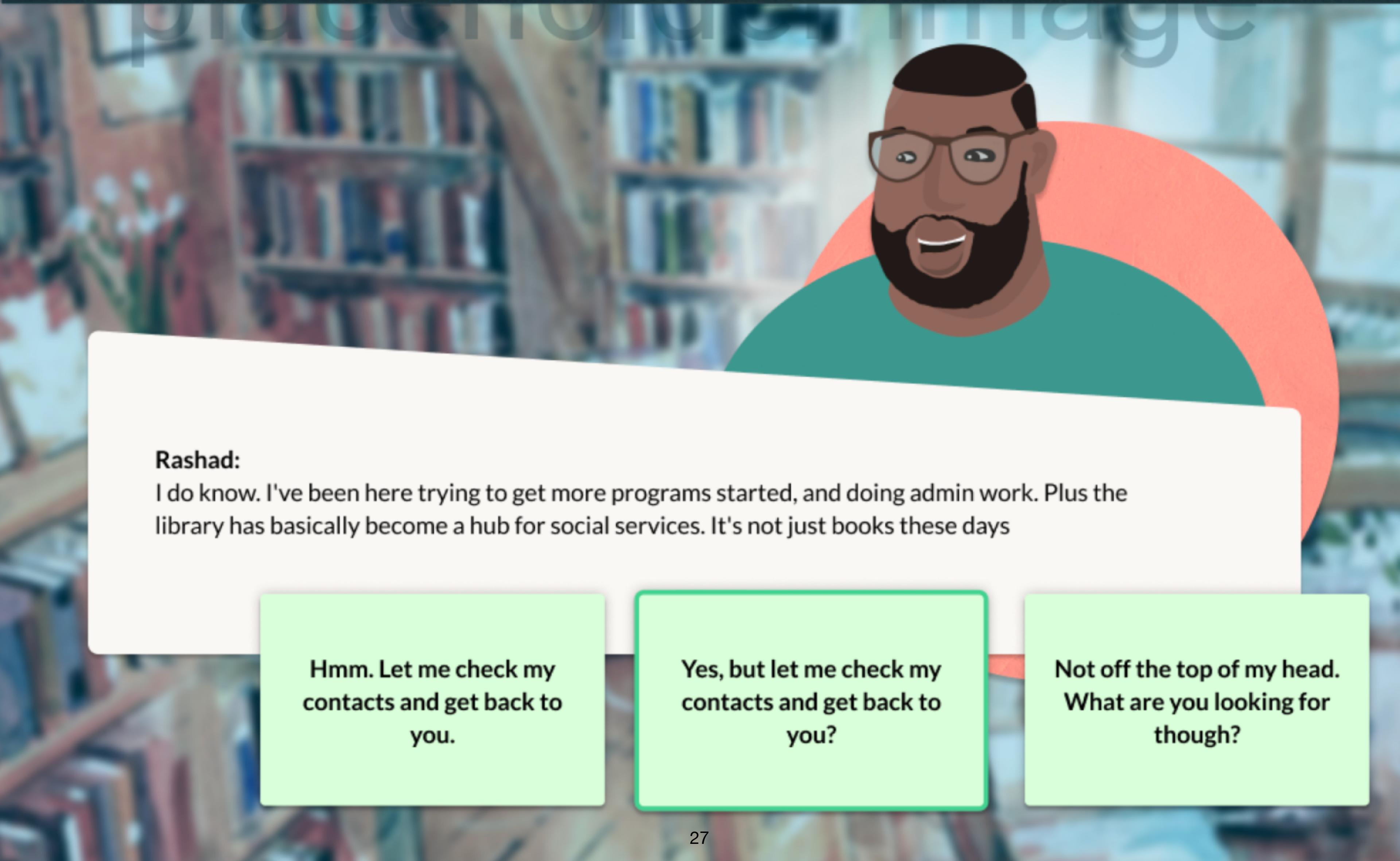
FIRST INTERVIEW



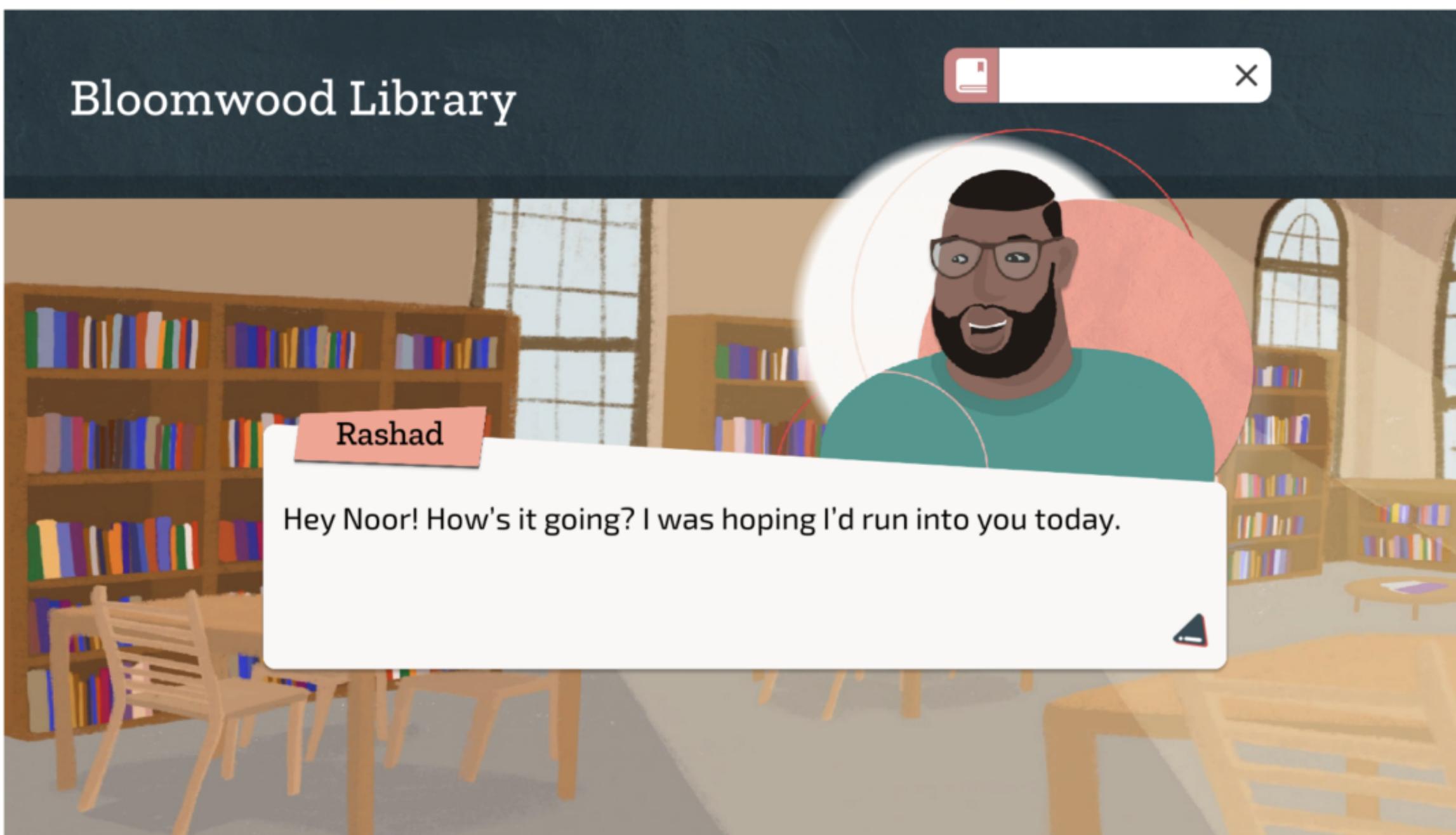


 BACK

Bloomwood Library



Our prototype and design probe



Gamer interface, to gamer

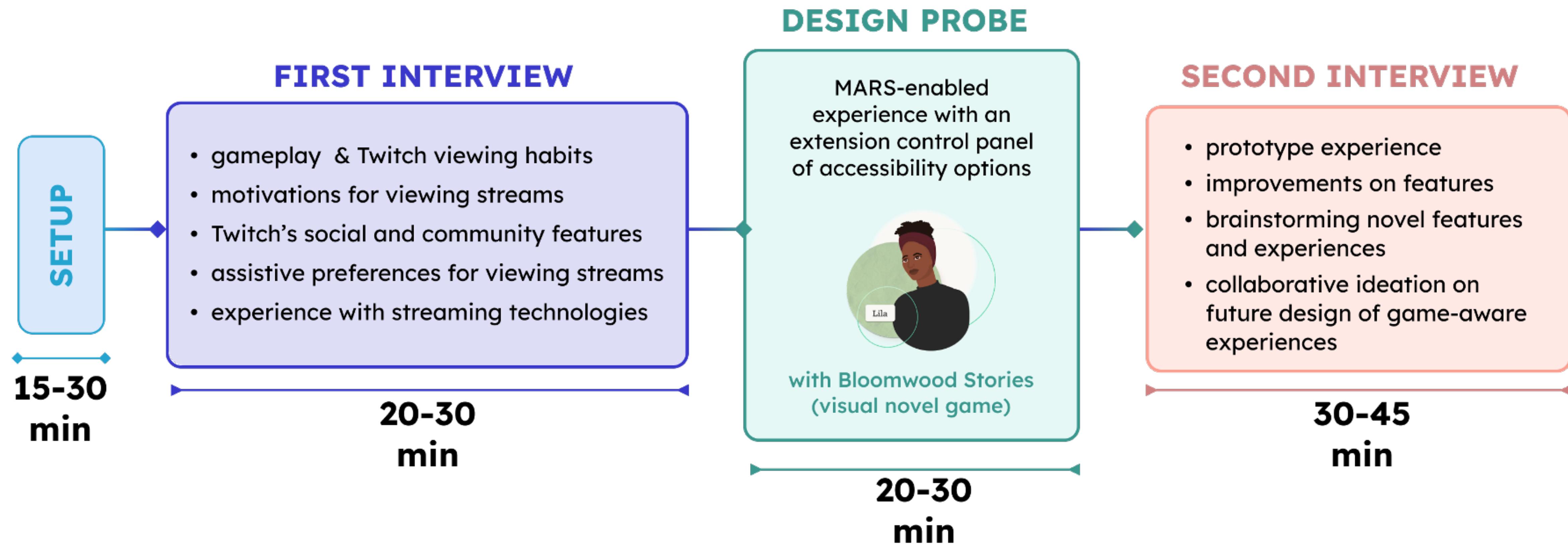


Stream interface, to viewers

Enabled by accessible HTML, under the hood

```
1 <h2>Dialogue Navigation</h2>
2   <div id="dialogue-browsing-buttons">
3     <button id="previous-dialogue-button" aria-label="Previous dialogue">&#x25C0;</button>
4     <button id="next-dialogue-button" aria-label="Next dialogue">&#x25B6;<div></div></button>
5   </div>
6   <div>
7     <label>
8       <input id="keyboard" type="checkbox" name="dialog" value="keyboard">Enable Keyboard Nav Shortcuts
9     </label>
10   </div>
11 <h2>Accessibility Options</h2>
12 <button id="increase-font-size-button">Font Size (+)</button>
13 <button id="decrease-font-size-button">Font Size (-)</button>
14 <div class="dropdowns">
15   <label for="font-color-select">Font Color:</label>
16   <select id="font-color-select">
17     <option value="black">Black</option>
18     <option value="red">Red</option>
19     <option value="blue">Blue</option>
20   </select>
21 </div>
```



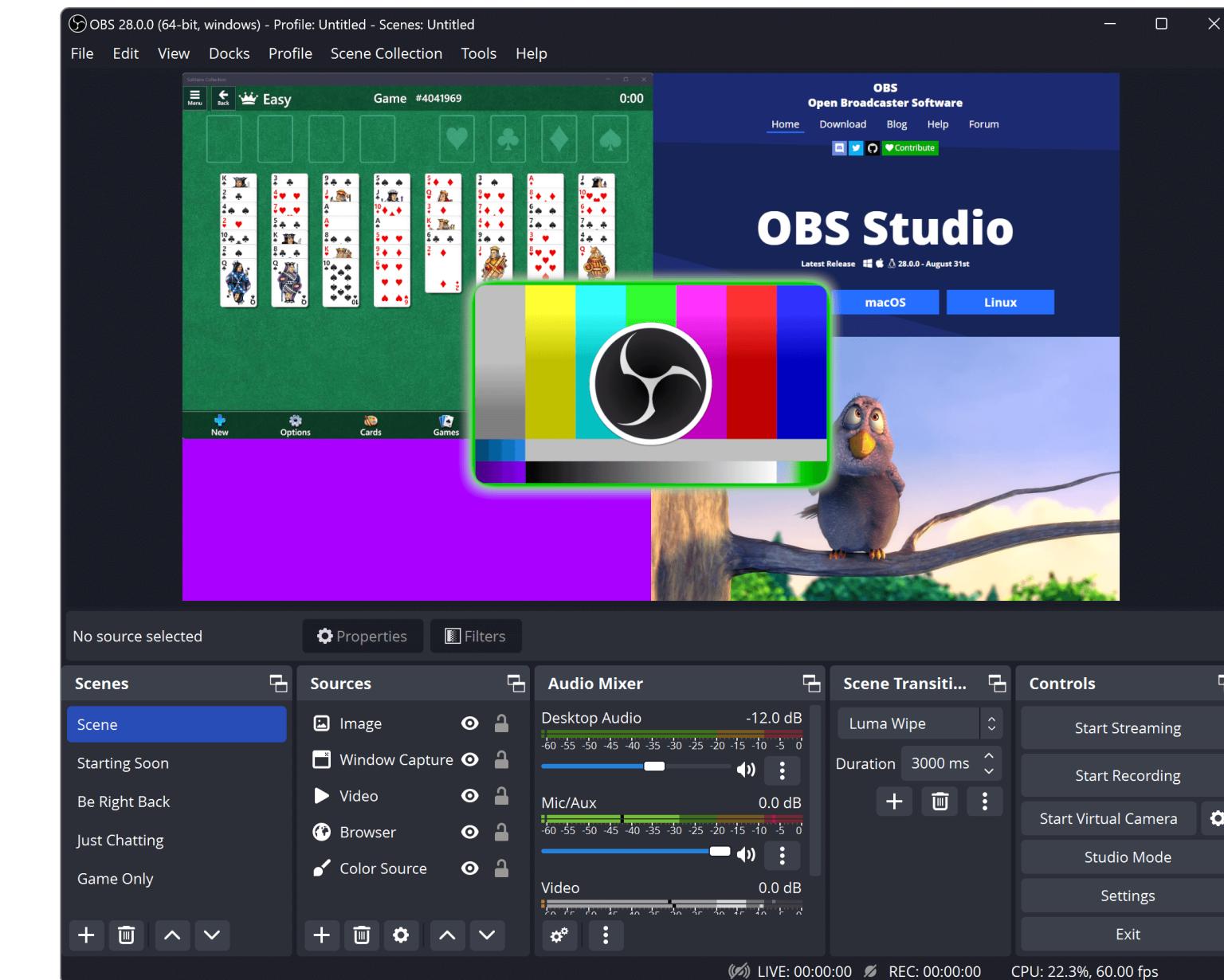
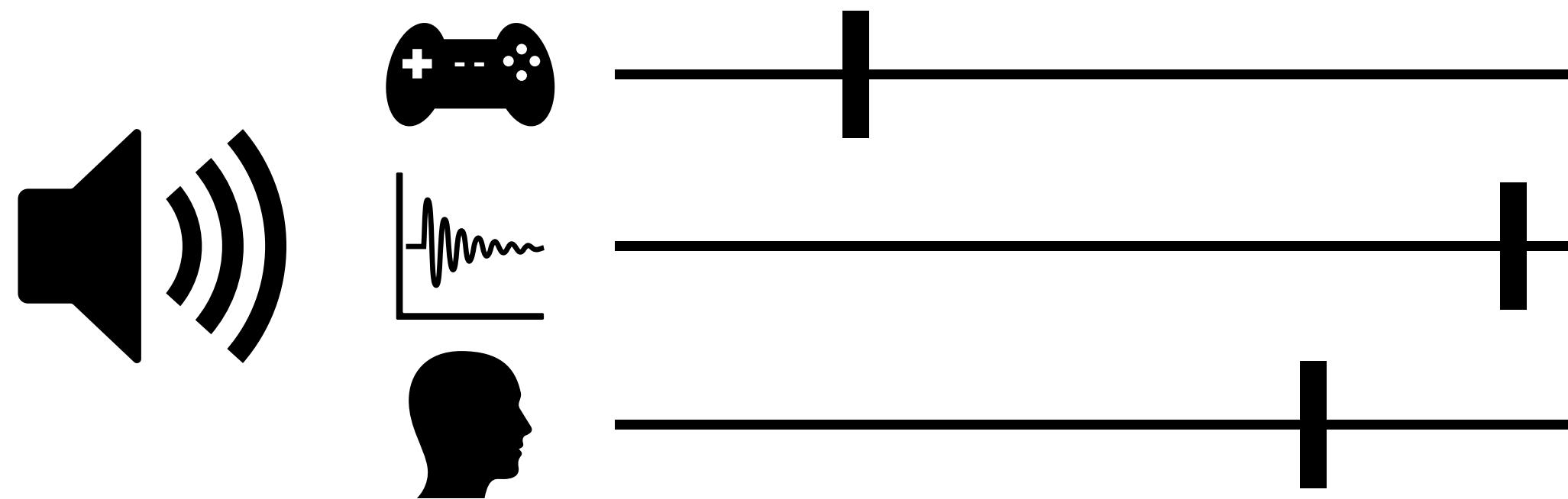


Results I think are the most awesome:
**Dreaming of customization and imagining
what access to game data can enable**

Dreaming of customization

“I’d love to have full control of stream audio”

Idea: stream viewer access to streaming software data



<https://obsproject.com/>

Dreaming of customization

Idea: Cross-ecosystem preset and preferences transfer



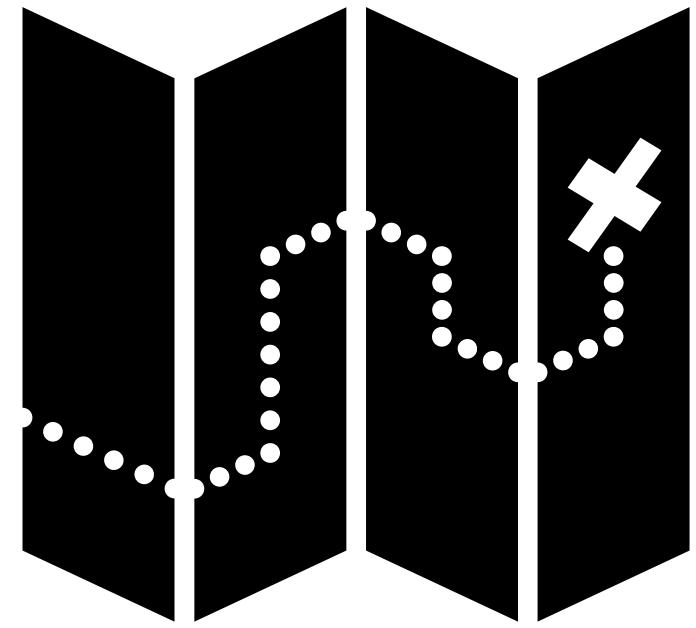
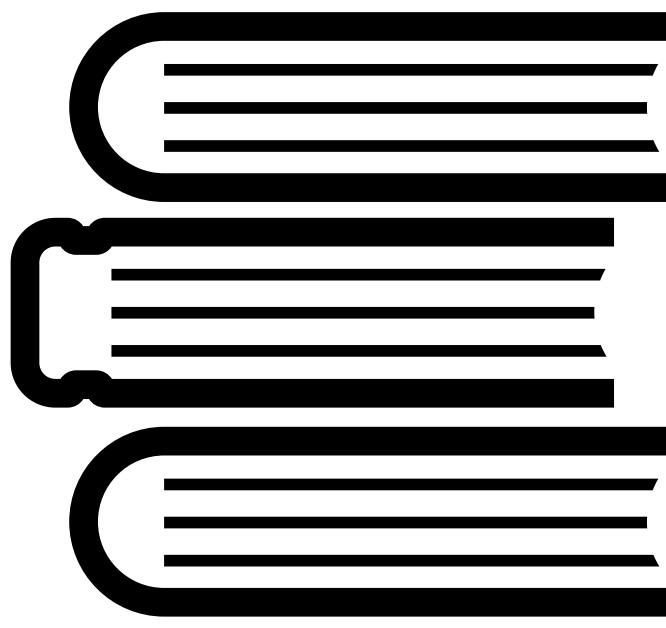
Apply vision accessibility preset

Configures all the recommended settings designed for players who are blind or have low vision. This will enable settings across multiple menus, such as:

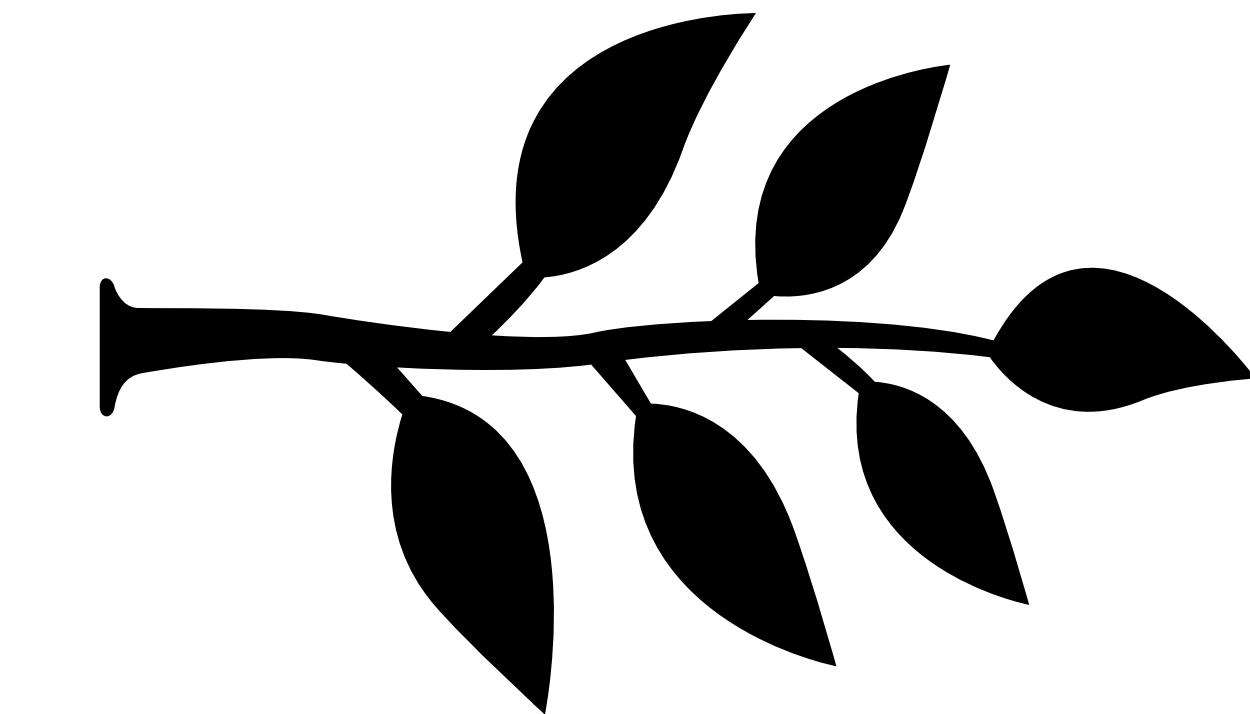
- **Options:** On or Off
- Text-to-Speech
- High Contrast Display
- HUD Scale > Large
- Lock-On Aim > Auto-Target
- Traversal and Combat Audio Cues
- Navigation and Traversal Assistance
- Ledge Guard
- Enhanced Listen Mode
- Invisible While Prone > Unlimited
- Skip Puzzle Option
- Various adjustments in the **Combat Accessibility** menu

What if presets and preferences from games could be easily loaded in streams or even into other games?

Imagining what access to game data can *enable*



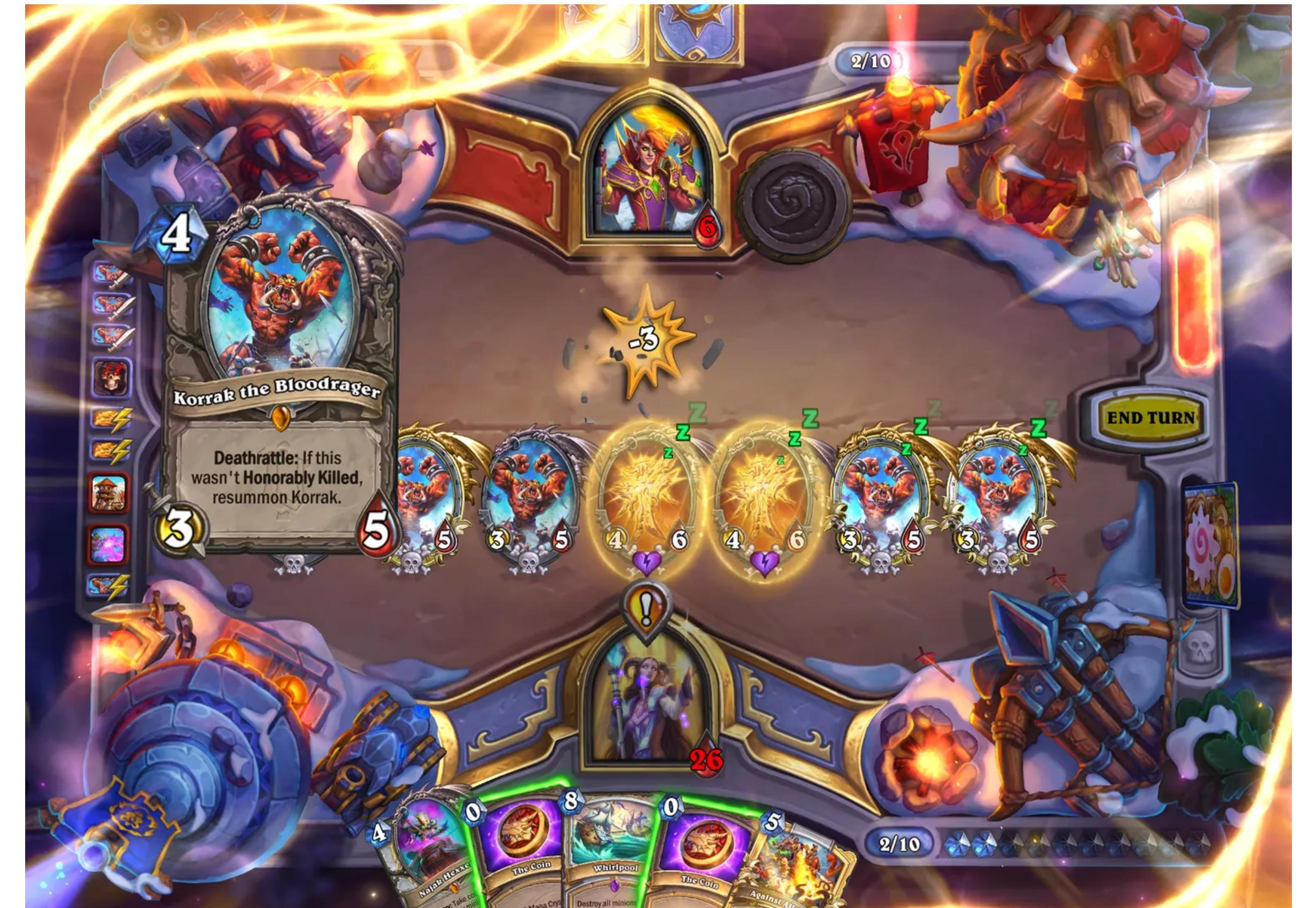
Explore a game's menus, world,
and interface



Discover different, possible paths

Imagining what access to game data can enable

Exploratory sense-making:
“I would love to explore on my own.”



<https://hearthstoneaccess.github.io/>

Imagining what access to game data can enable

Idea: Asymmetrical collaboration, using game data access



Streamer is inside a haunted school

The image shows a digital interface for the game Phasmophobia. At the top, there are tabs for "Evidence" and "Info", with "EN" selected. Below the tabs, the word "Evidence" is written in a yellow, hand-drawn style font. A section titled "Ghost Types" lists 24 ghost types from 1 to 24. To the right of the ghost types is a section titled "Evidence" with several checkboxes. Below these sections is a note stating, "Using the evidence we're found, we believe the ghost is a". A grid below the note lists various ghost types under categories like Spirit, Wraith, Phantom, etc. The entire interface has a yellowed paper texture.

Ghost Type	Evidence
1. Spirit	<input type="checkbox"/> EMF Level 5
2. Wraith	<input checked="" type="checkbox"/> Fingerprints
3. Phantom	<input checked="" type="checkbox"/> Ghost Writing
4. Poltergeist	<input type="checkbox"/> Freezing Temperatures
5. Banshee	<input type="checkbox"/> DOTS Projector
6. Jinn	<input type="checkbox"/> Ghost Orb
7. Mare	<input type="checkbox"/> Spirit Box
8. Revenant	
9. Shade	
10. Demon	
11. Yurei	
12. Oni	
13. Yokai	
14. Hantu	
15. Goryo	
16. Myling	
17. Onryo	
18. The Twins	
19. Raiju	
20. Obake	
21. The Mimic	
22. Moroi	
23. Deogen	
24. Thaye	

Using the evidence we're found, we believe the ghost is a

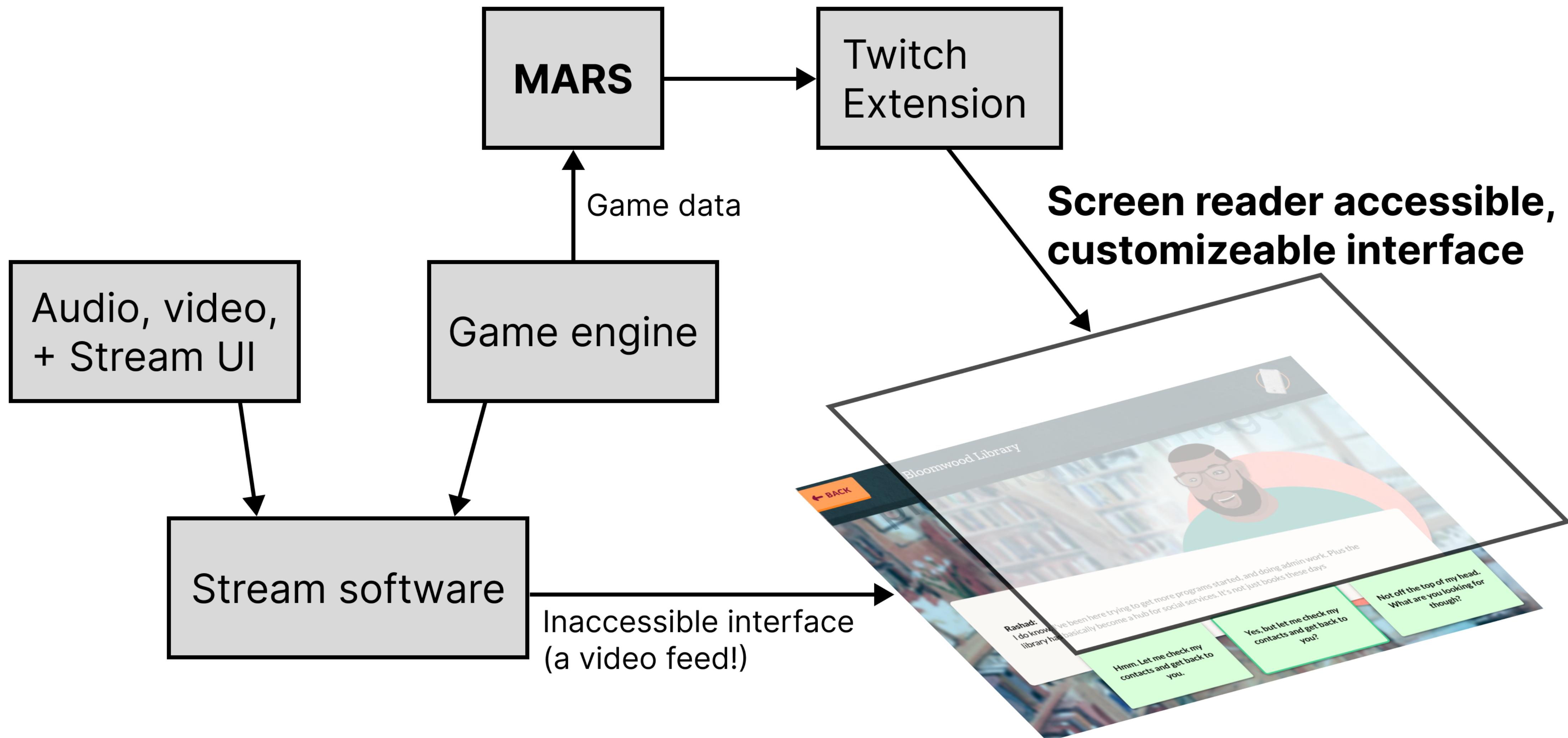
Spirit	Wraith	Phantom
Poltergeist	Banshee	Jinn
Mare	Revenant	Shade
Demon	Yurei	Oni
Yokai	Hantu	Goryo
Myling	Onryo	The Twins
Raiju	Obake	The Mimic
Moroi	Deogen	Thaye

Streamer is inside a haunted school

Stream viewer has access to the evidence journal

<https://phasmophobia.vercel.app/>

Paving the Way for Accessible Streaming



Game-Aware Streaming as a New Frontier for Accessibility

A call for action!

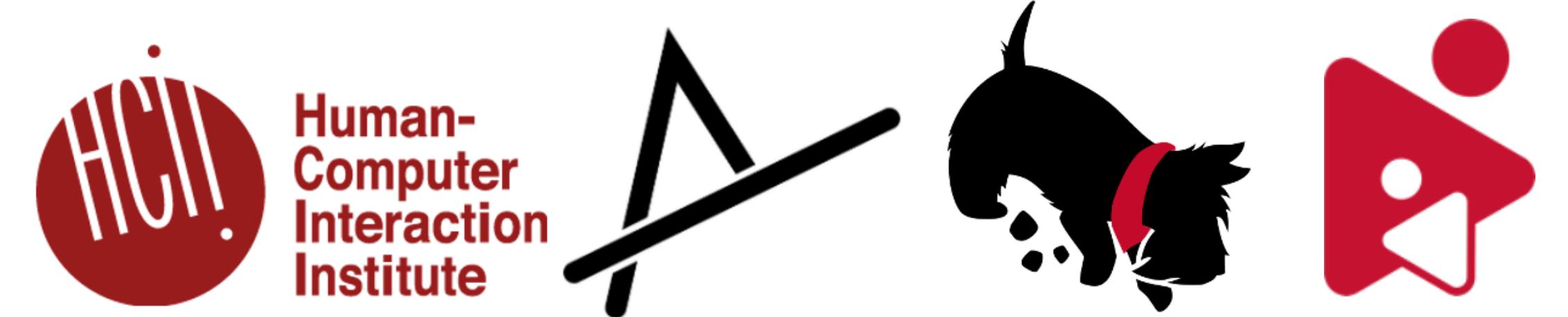
- What kinds of prototypes and new systems can we imagine? What problems could this technology solve?
- What if we took every accessibility feature of a game and made those same options available to stream viewers?
- What can we do with game data to enable new kinds of interactivity between streamers and viewers?
- Could game aware technology change how we imagine designing new games?

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