

VeasyGuide:

Personalized Visual Guidance for Low-vision Learners on Instructor Actions in Presentation Videos



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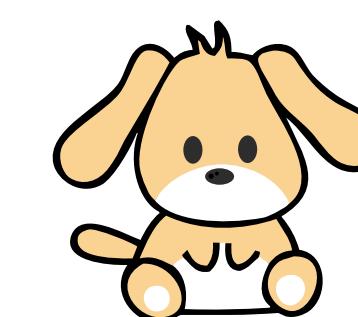
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Reichman
University



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The University of
California, Berkeley



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The University of
Tokyo



Online Learning with Videos

- Common in everyday life.
- Many videos incorporate slides.

Online learning platforms

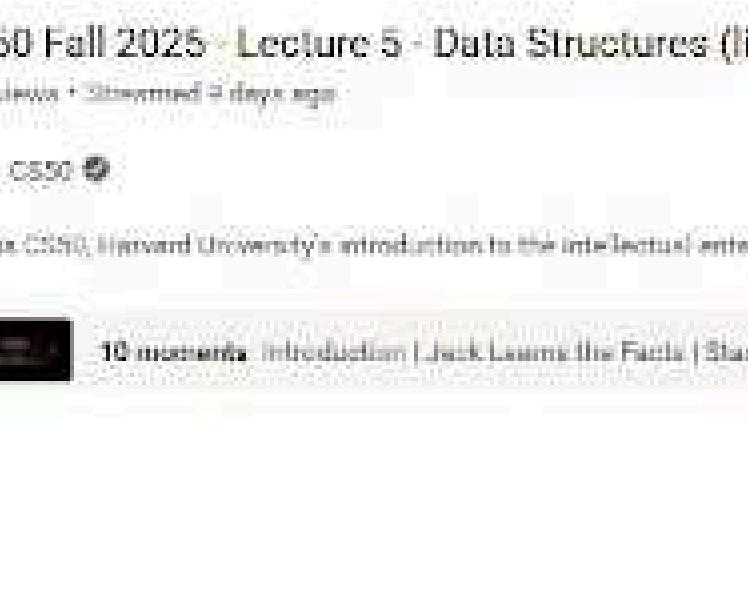
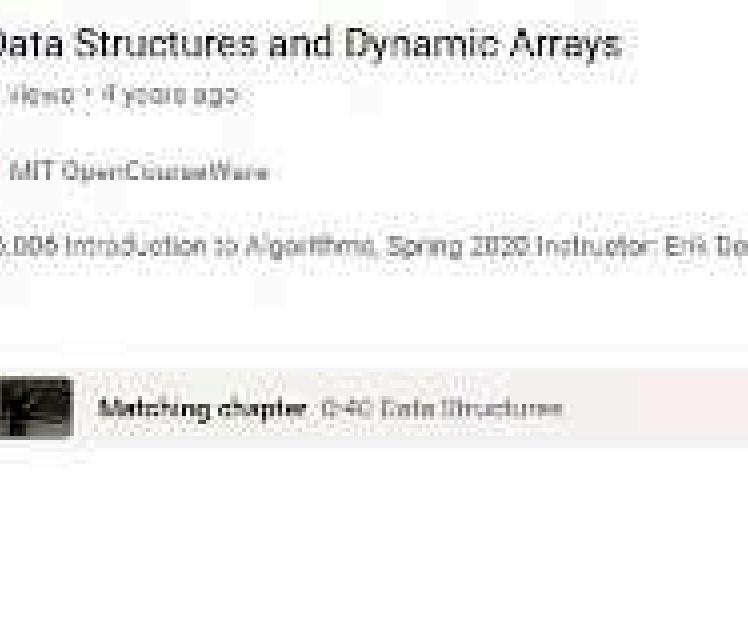
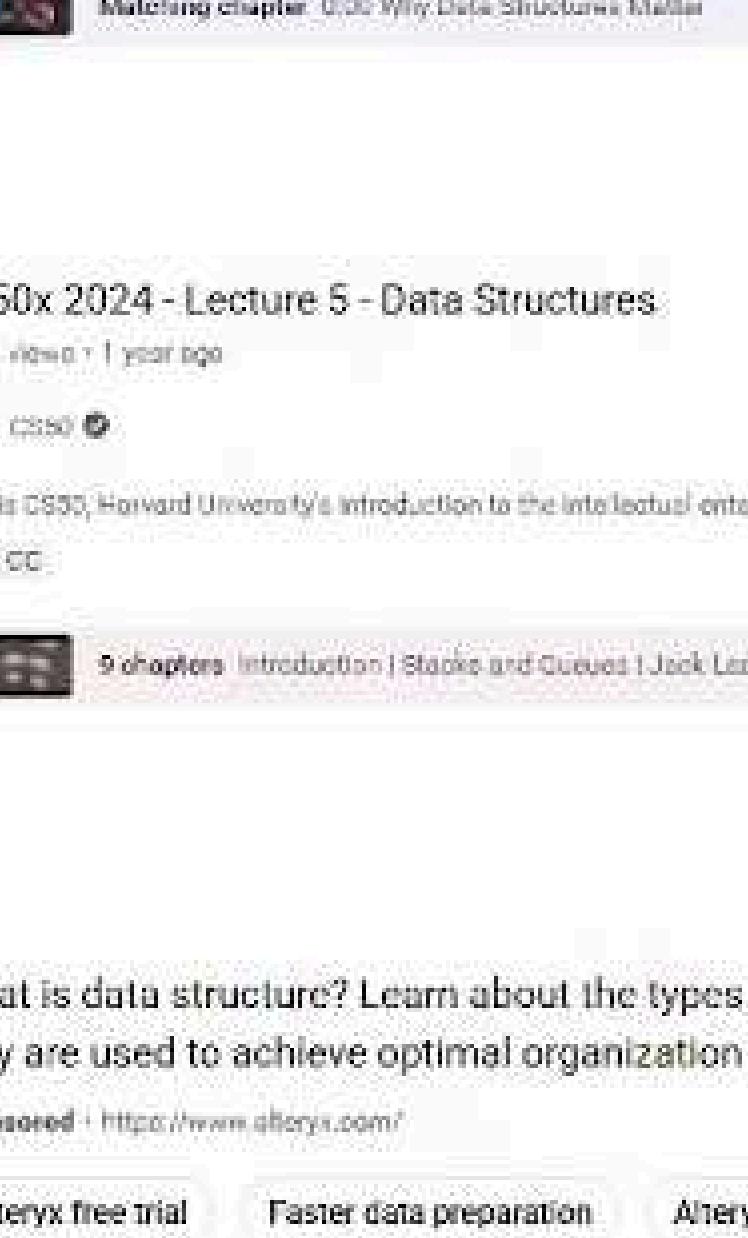
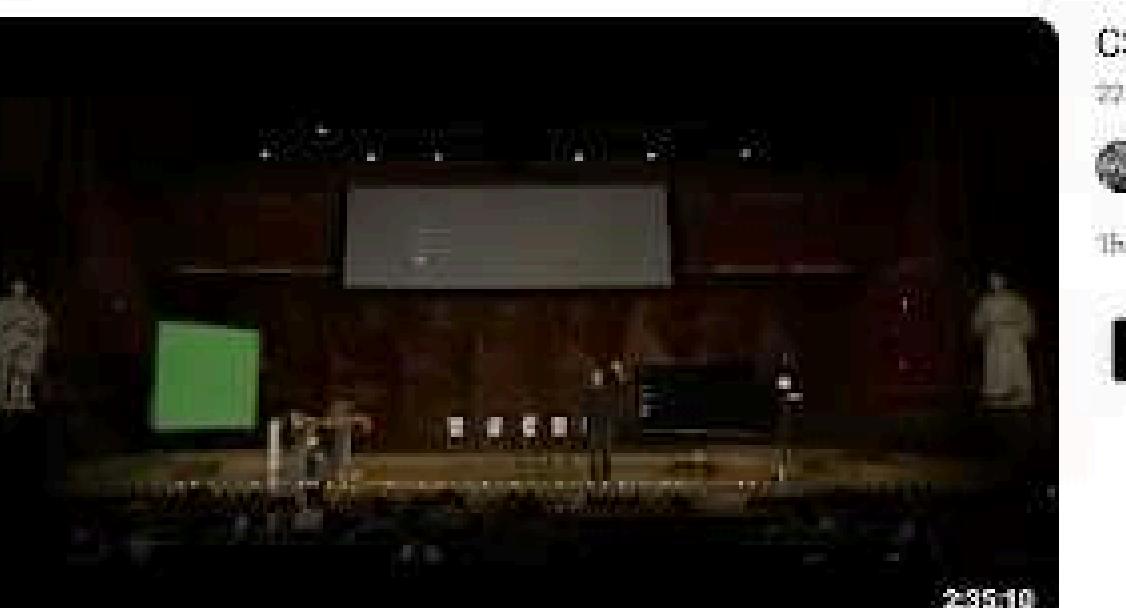
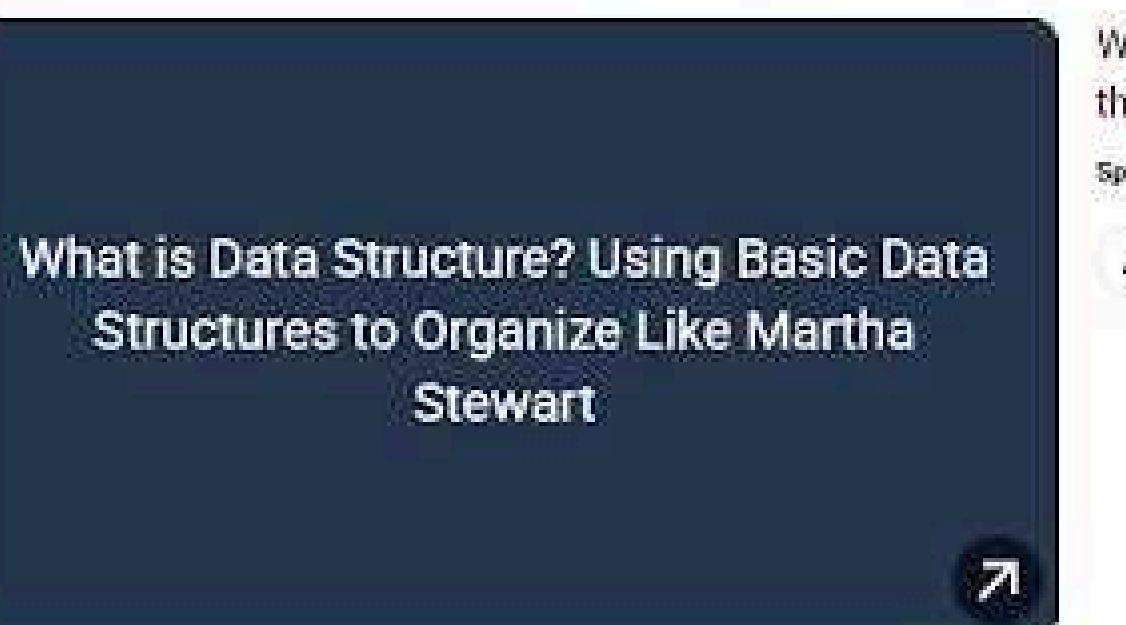


YouTube

Khan Academy

coursera

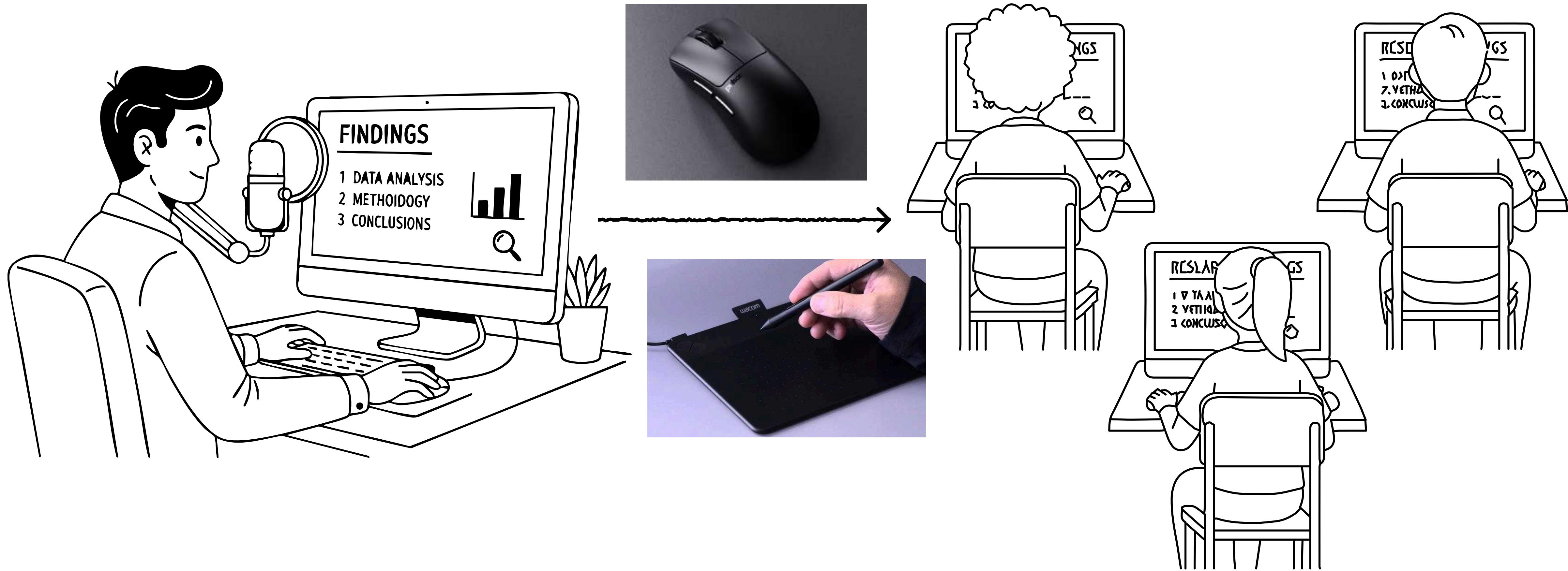
zoom



**For learning, communication between
instructors and students is important**

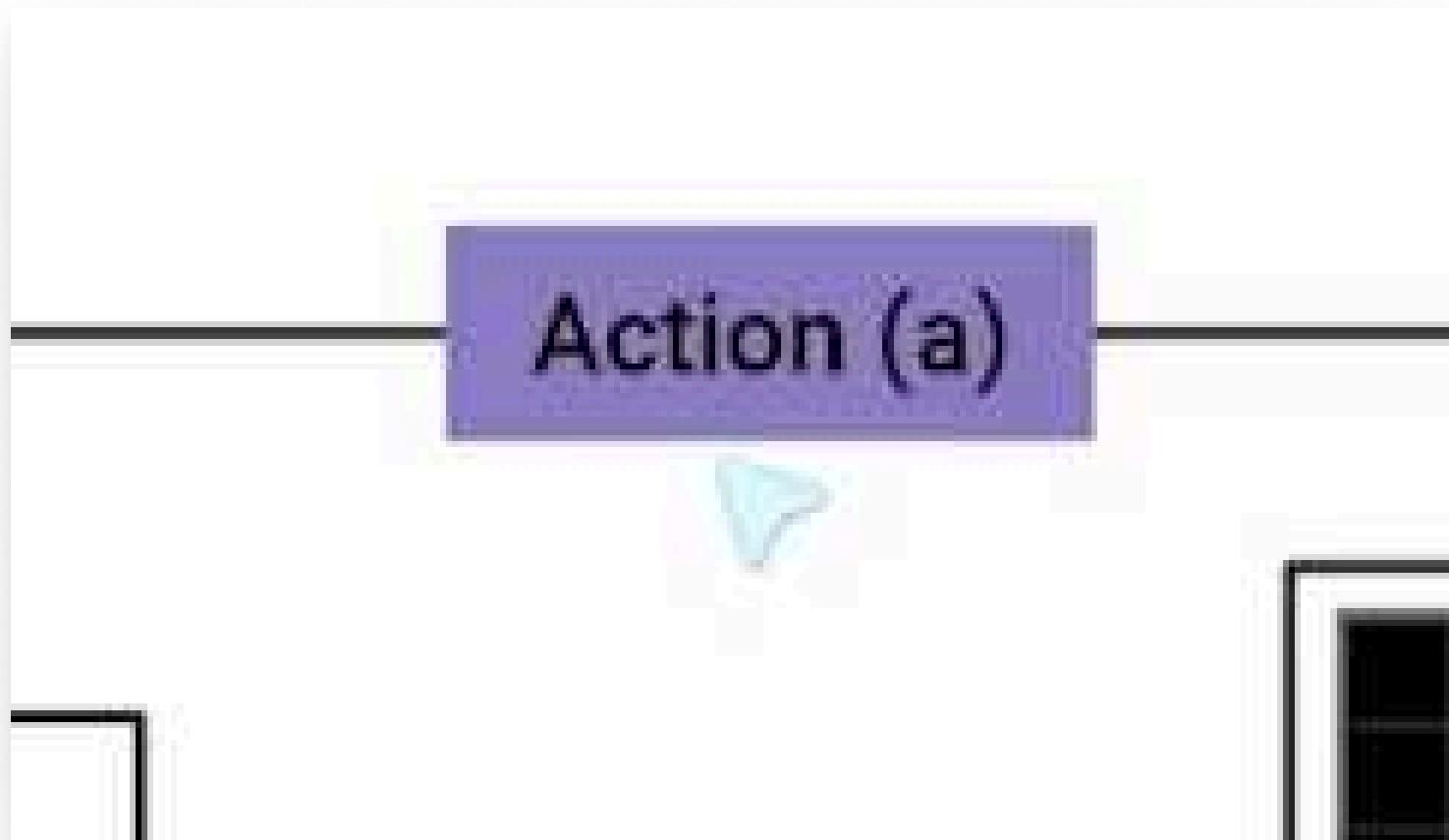
Slides-based Videos

- Instructors use pointers or digital pens.



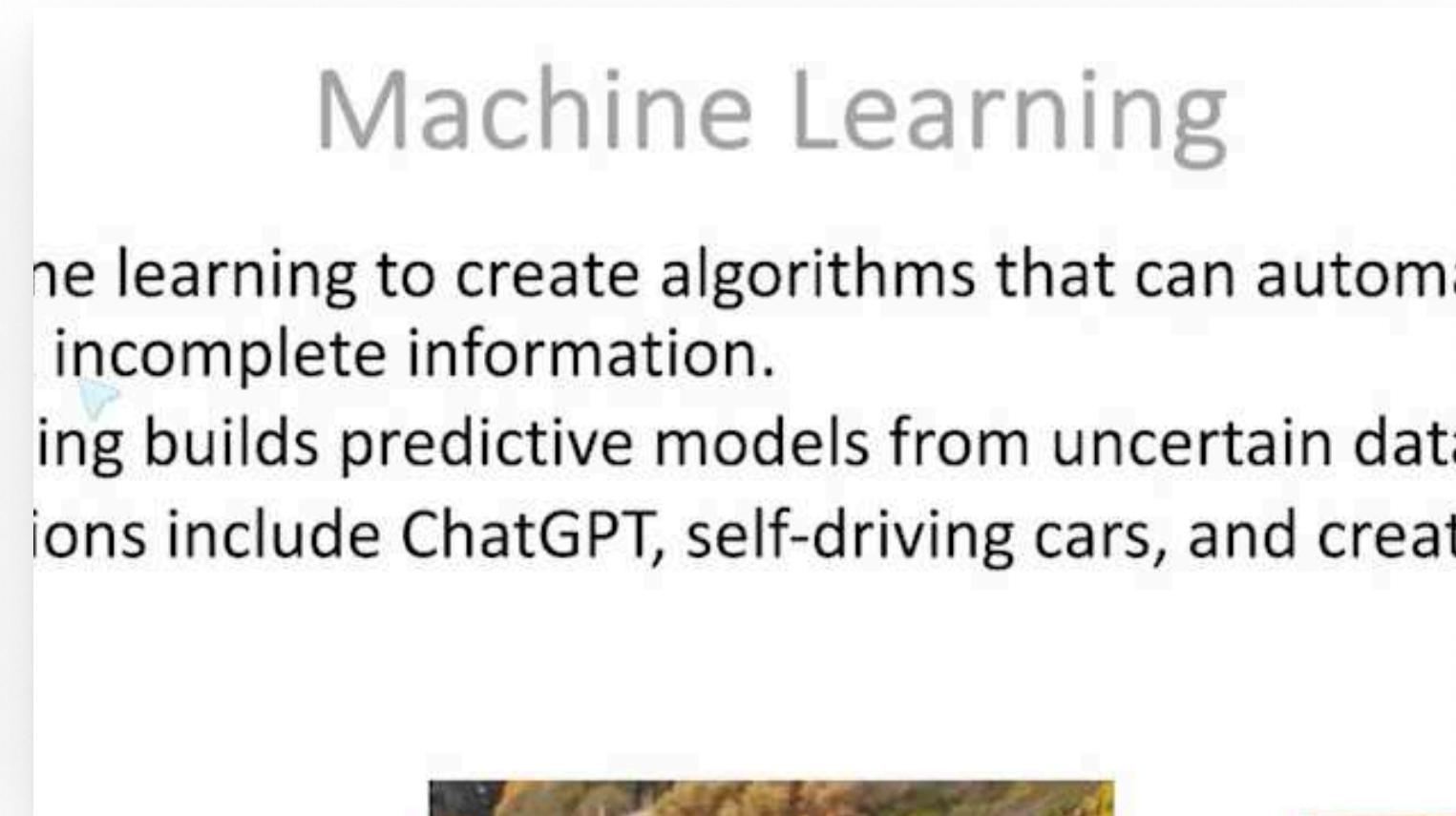
Interactions with Slides

(Visual activities)



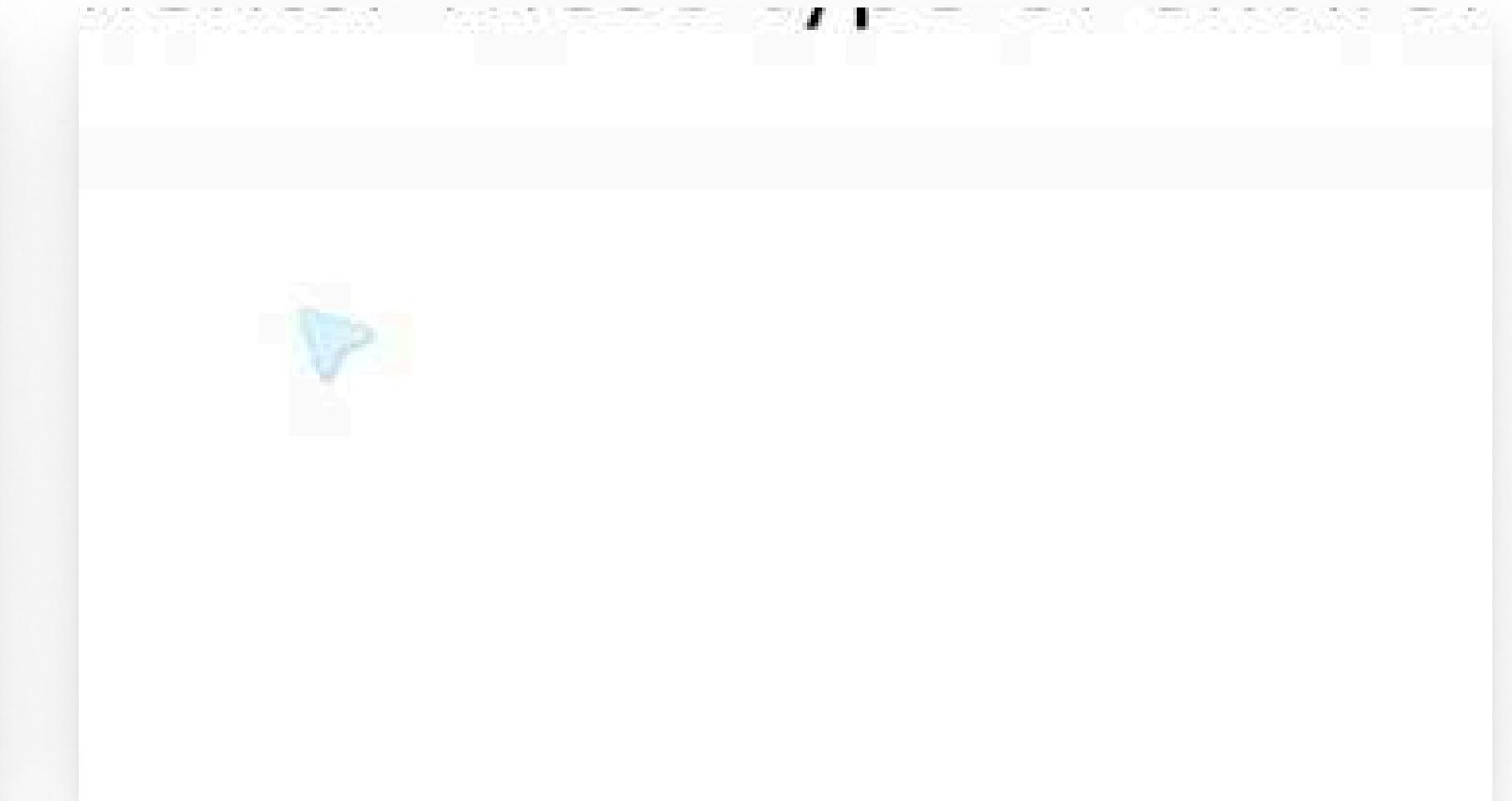
Pointing

Signals to the intent of instructors



Marking

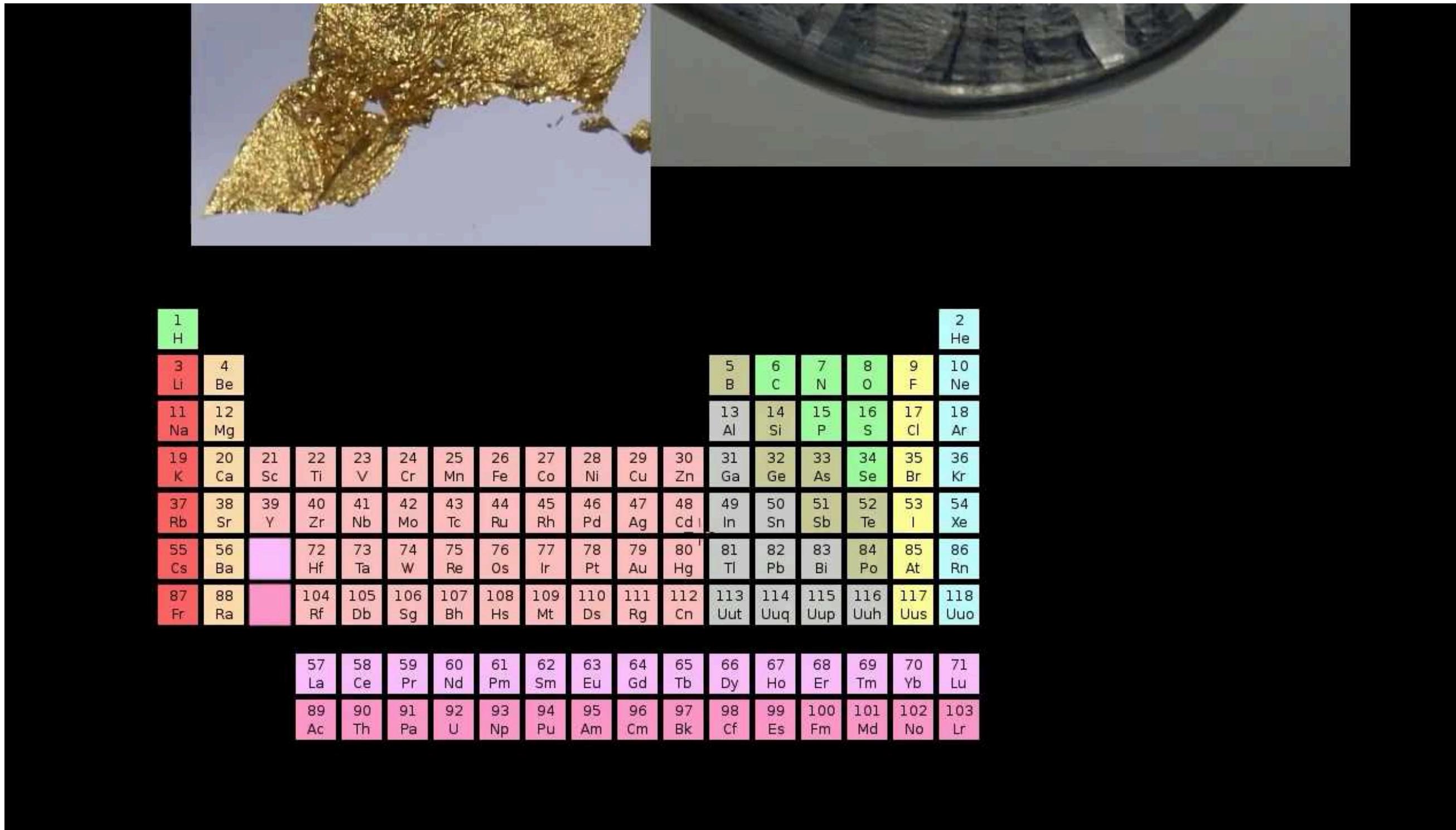
Emphasize or signal important content



Sketching

Add additional information or explanation

The Visual Search Problem



Following along can be challenging...

Where to look?

What to look for?



Frustration

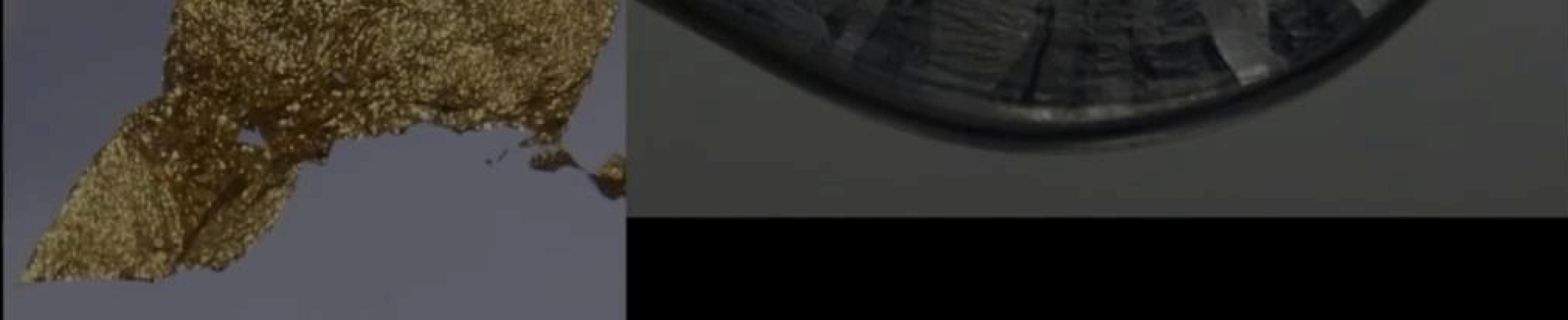
Exhausting

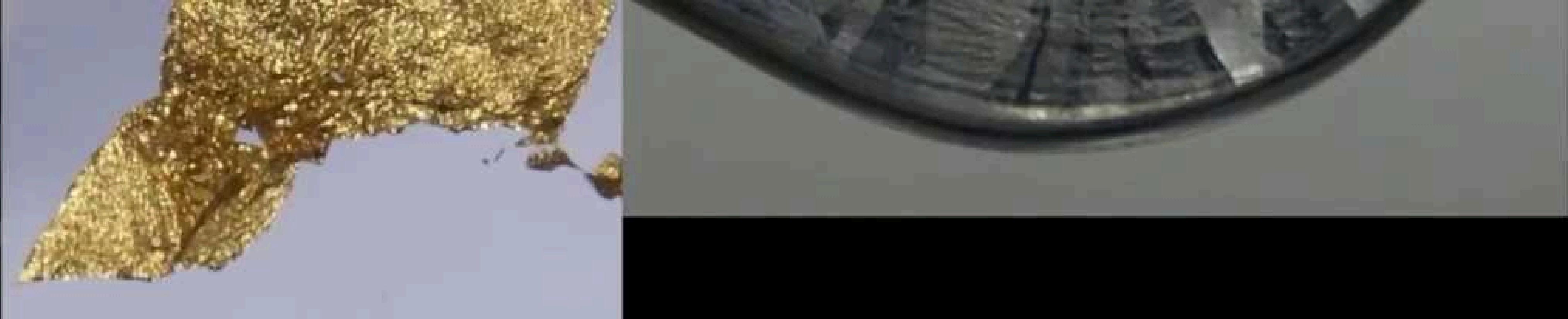
High Cognitive Effort

Low-vision individuals
often **give up.**

Research Question

What can we do to **improve this experience** for low-vision individuals?





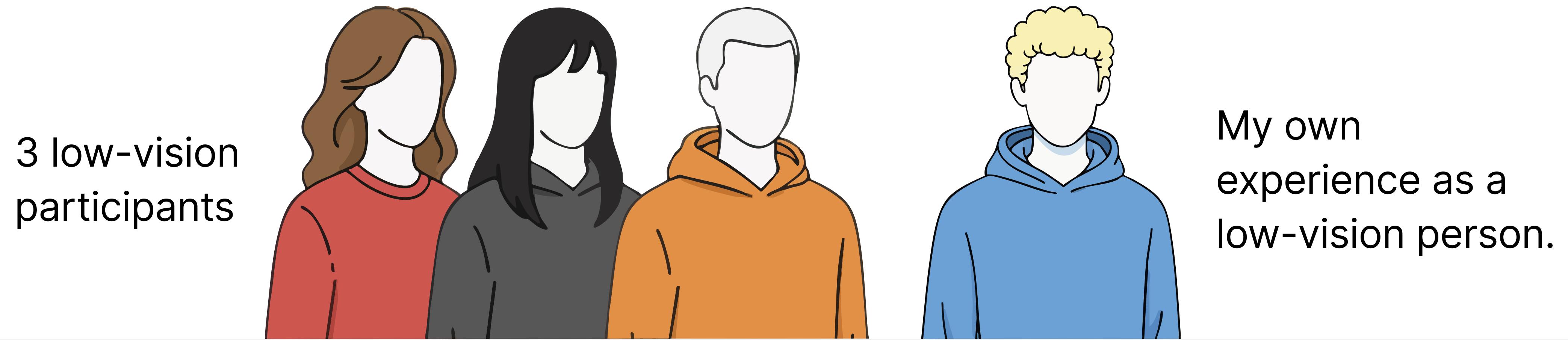
1	H														2	He		
3		4	Be															
11		12	Mg															
19		20	Ca															
37		38	Sr															
55	56			72	73	74	75	76	77	78	79	80	B1	82	83	84	85	86
Cs	Ba			Hf	Ta	W	Re	Os	If	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88			104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra			Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Uuq	Uup	Uuh	Uus	Uuo
				57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
				La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
				89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
				Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Ur

**Detect activities, highlight them,
and makes it simple to zoom!**



Co-design Process

- Iterative development, from prototype to VeasyGuide.



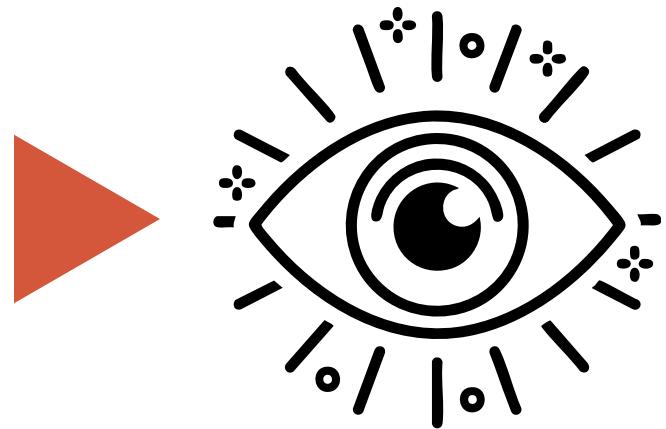
Co-design Questions

DQ1: How do low-vision **experience** visual activities?

DQ2: What **challenges** do visual activities introduce?

► **DQ3:** What makes visual activities **easier to detect** and follow?

Design Implications

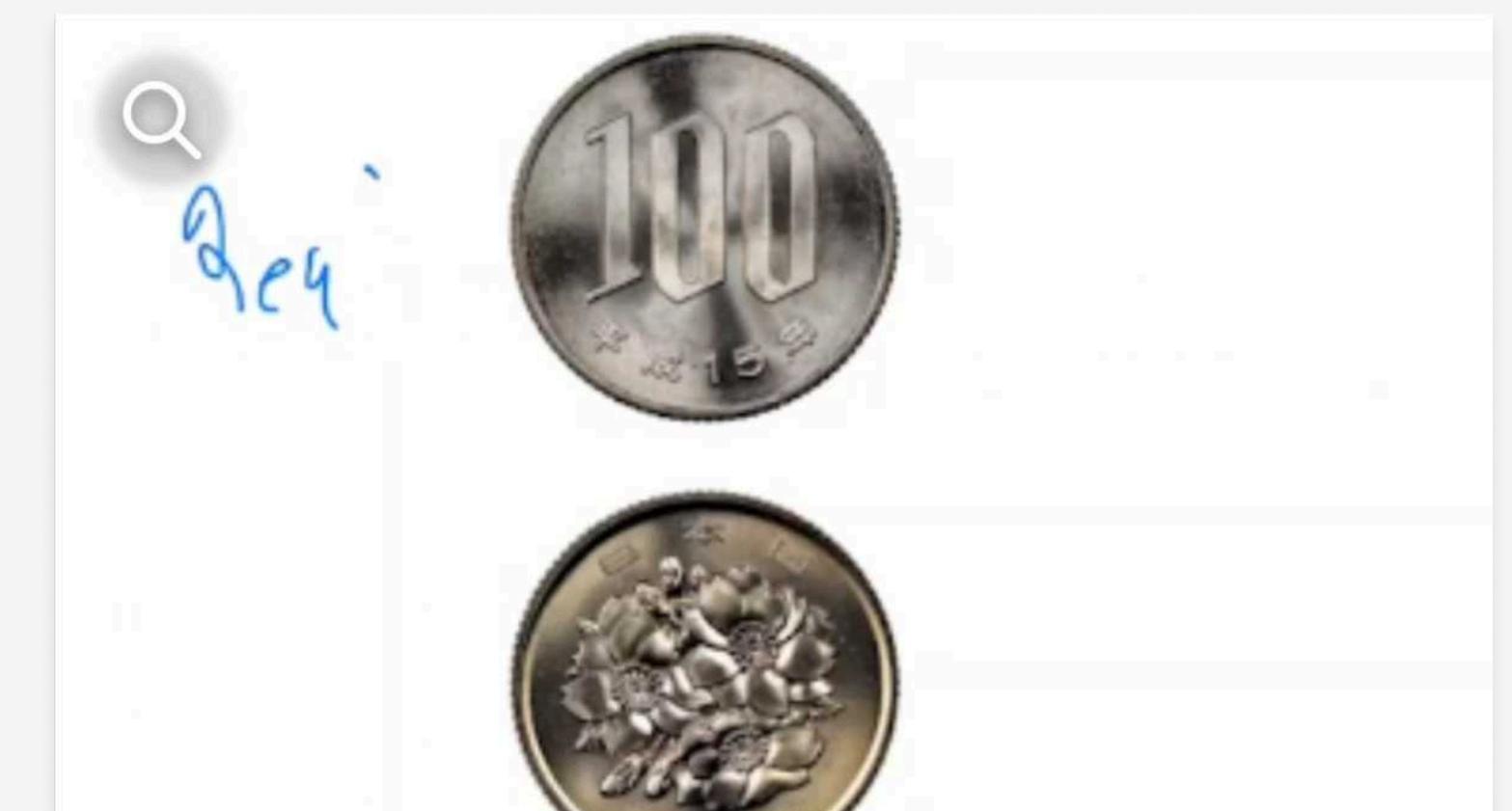


Providing **visual access** with less effort.

Highlights

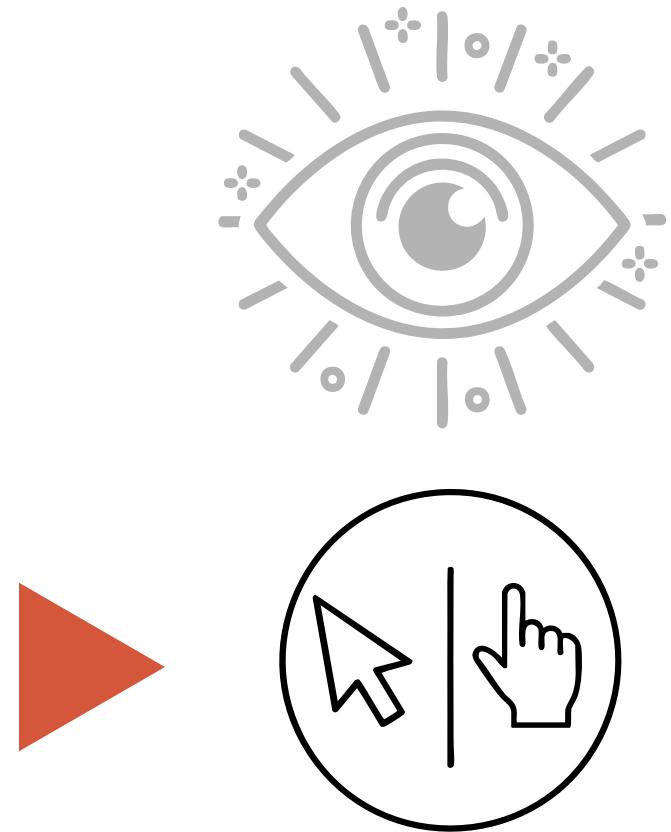
Probability

- We use probability to handle uncertainty which involves making decisions with incomplete information.
- Using probability, we can describe and quantify the likelihood of events in changing environments. These type of environments are often called stochastic.



Magnification

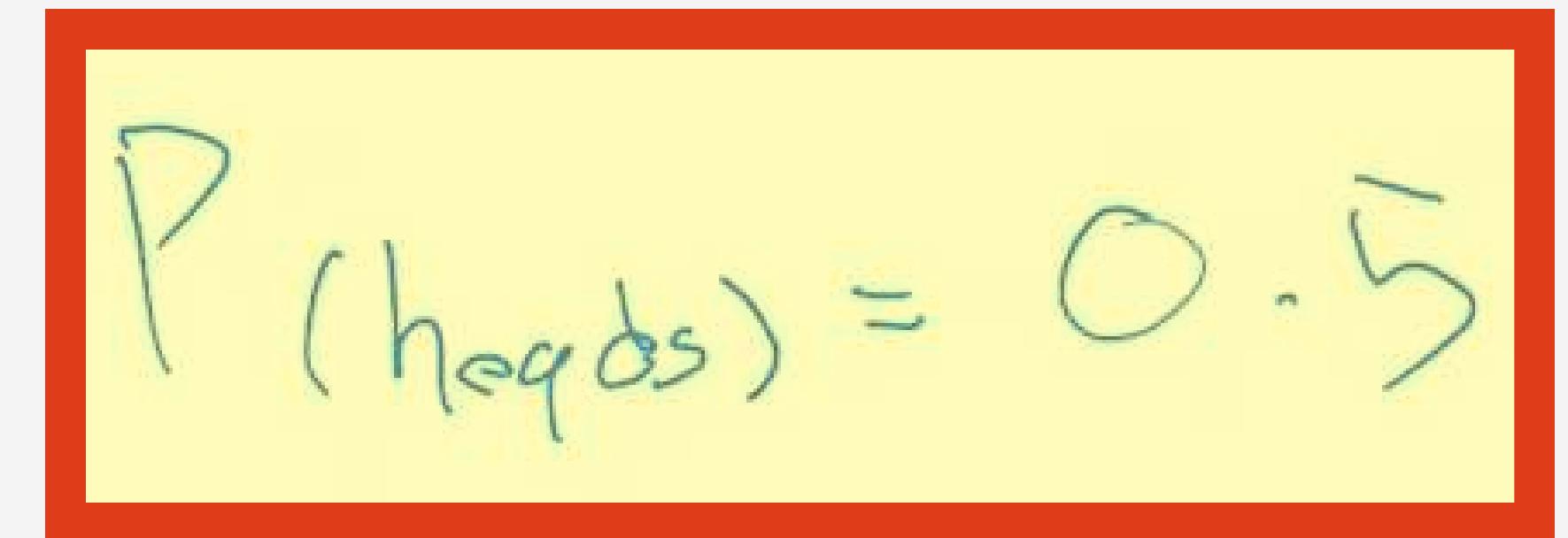
Design Implications



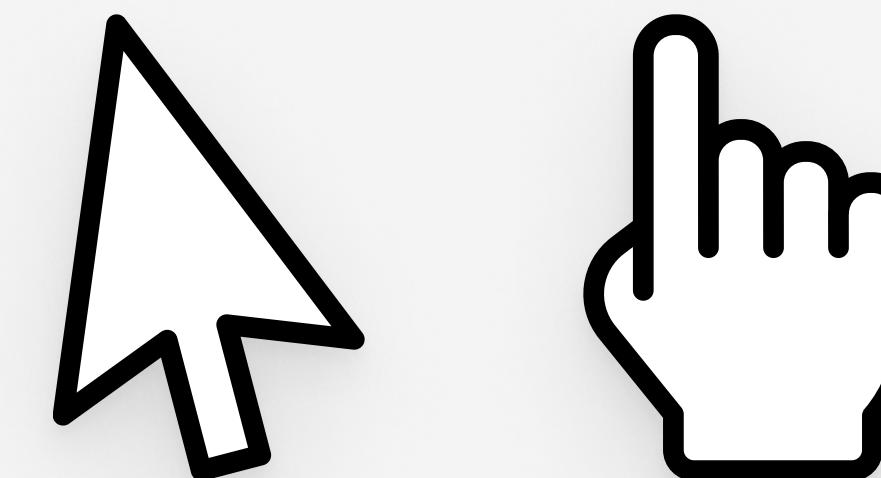
Providing **visual access** with less effort.

Visual styles should be **familiar** to users.

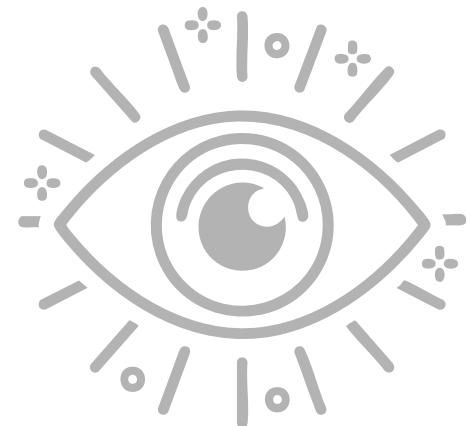
Consistent style



Familiar indicators



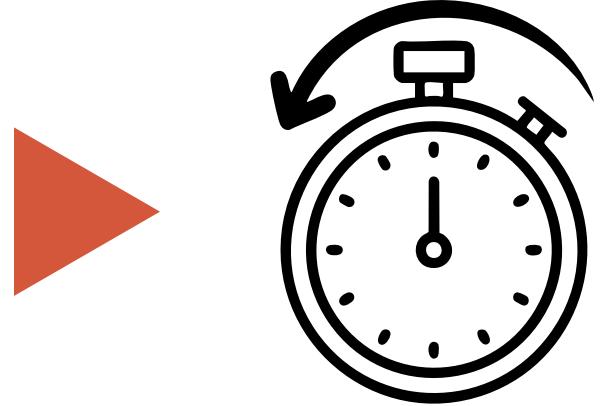
Design Implications



Providing **visual access** with less effort.



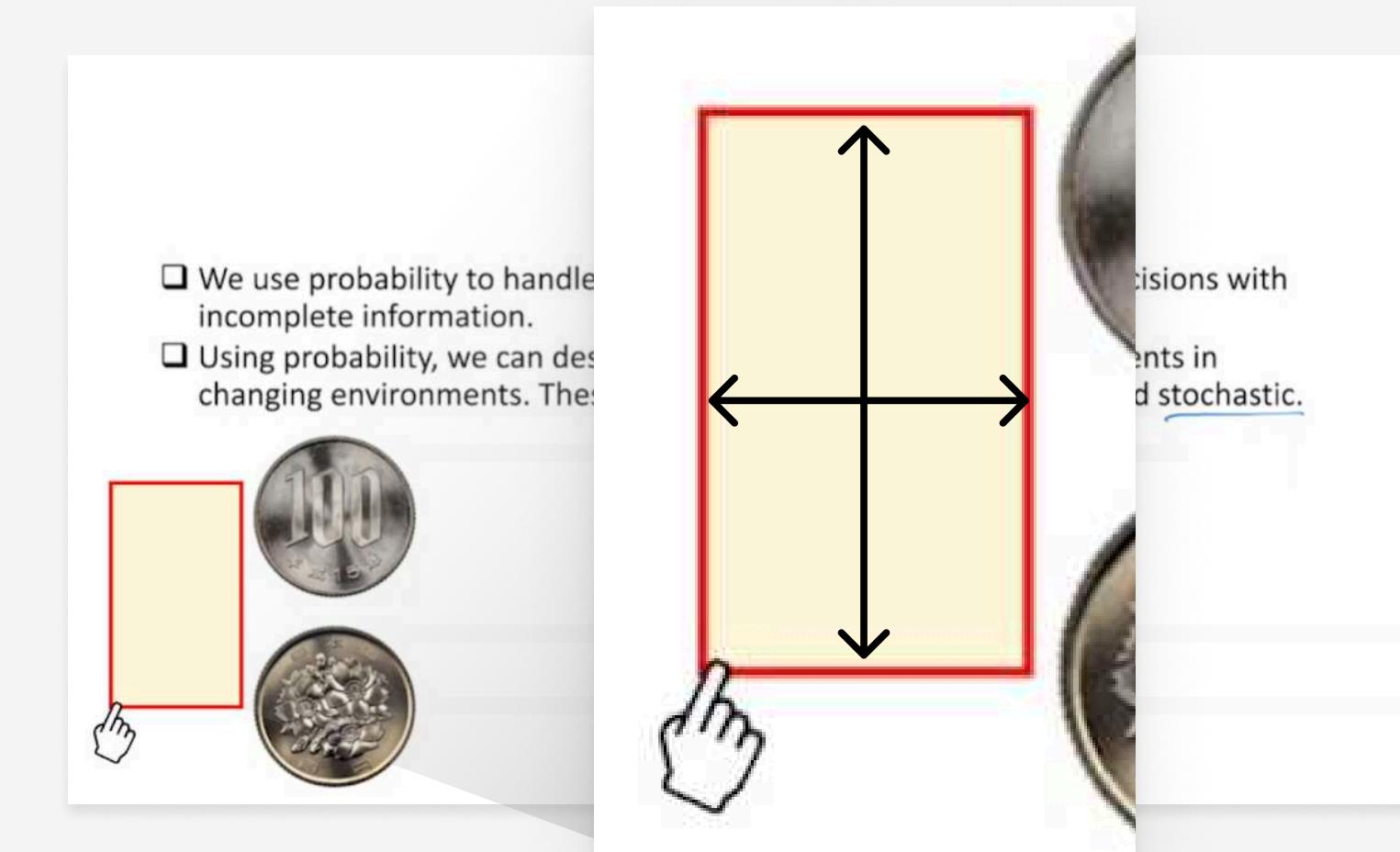
Visual styles should be **familiar** to users.



Predictability of what, when, and where.

1.5 seconds

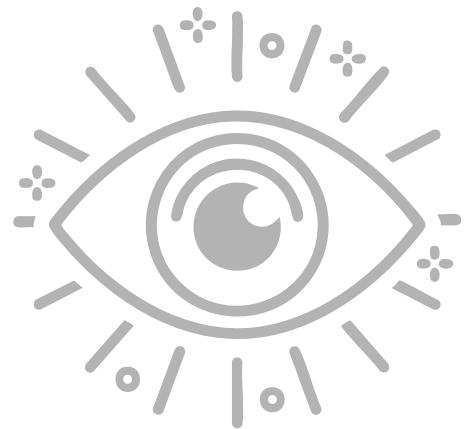
Activity start



"[the box] tells me exactly **where and on what** to look at."

(C1)

Design Implications



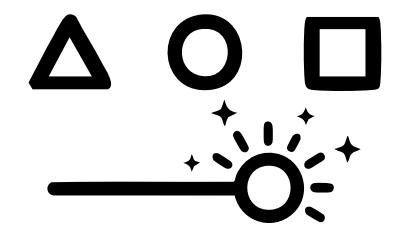
Providing **visual access** with less effort.



Visual styles should be **familiar** to users.



Predictability of what, when, and where.



Personalization for different visual abilities

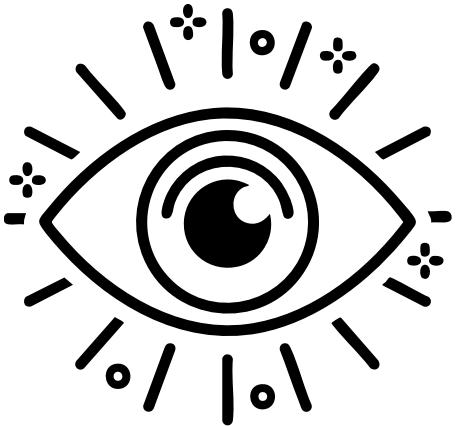


Probability

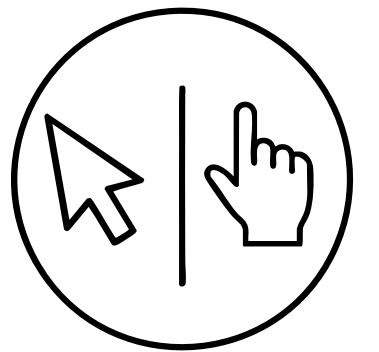
- We use probability to handle uncertainty which involves making decisions with incomplete information.
- Using probability, we can describe and quantify the likelihood of events in changing environments. These type of environments are often called stochastic.

$P(\text{heads}) = 0.5$

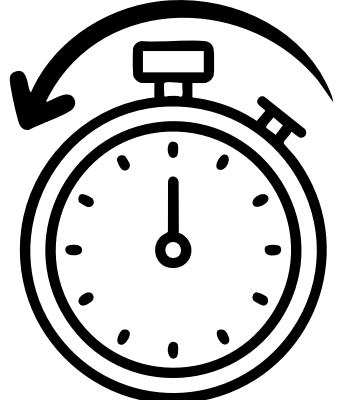
Design Implications



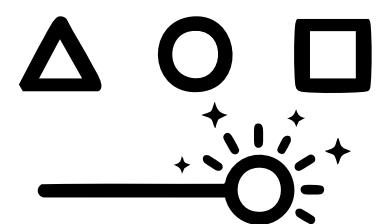
Providing **visual access** with less effort.



Visual styles should be **familiar** to users.

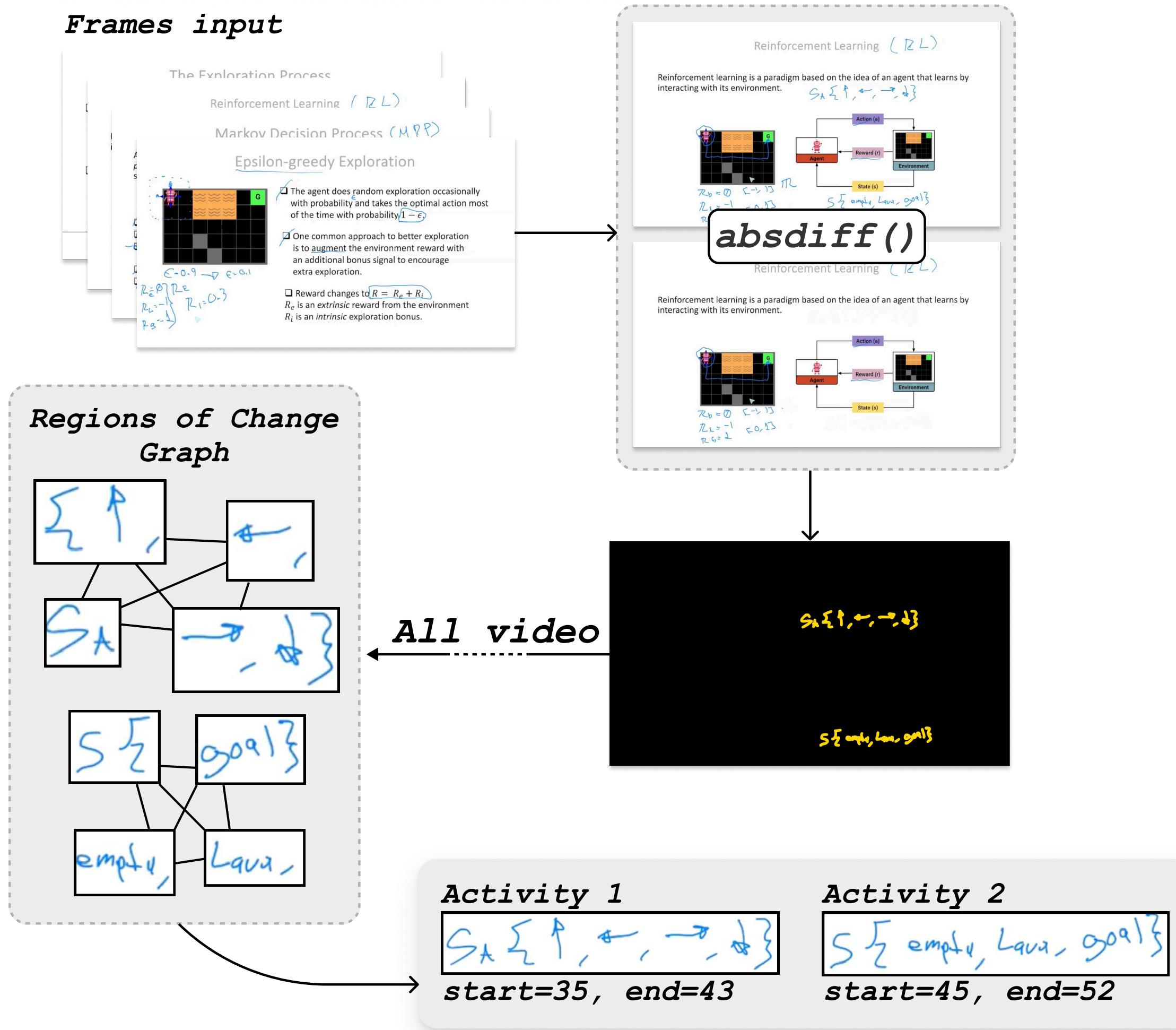


Predictability of what, when, and where.

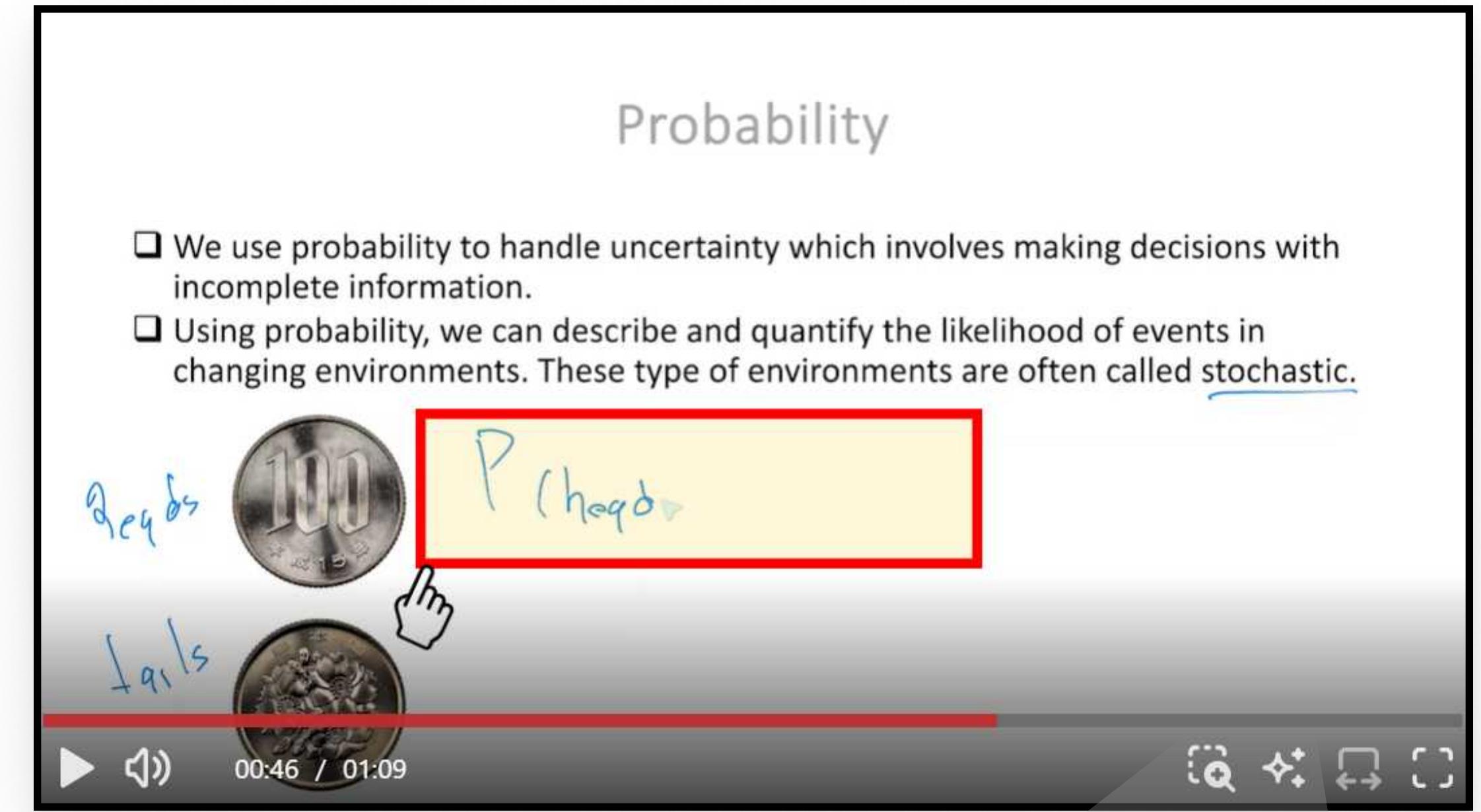


Personalization for different visual abilities

Activity Recognition Pipeline



Activity Visualization

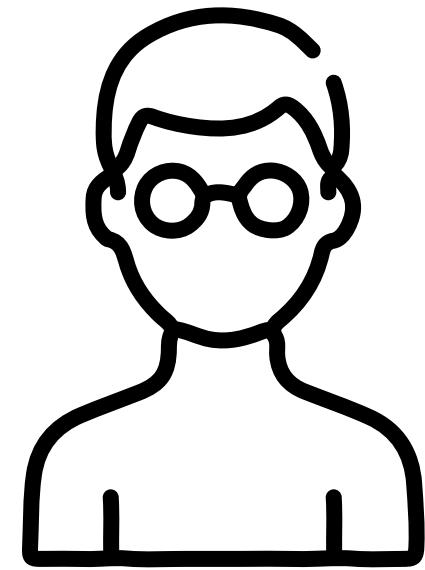
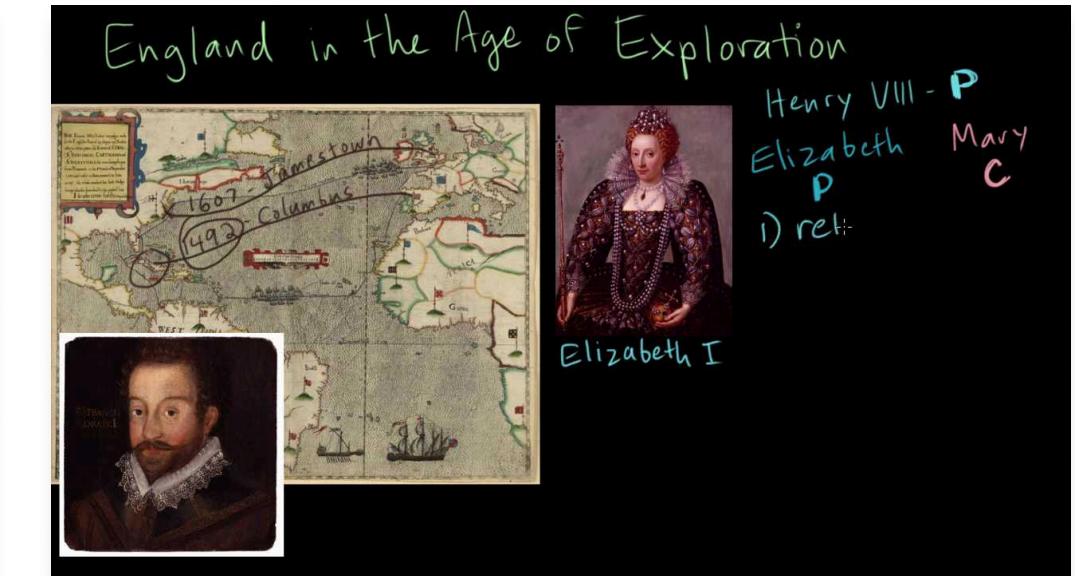
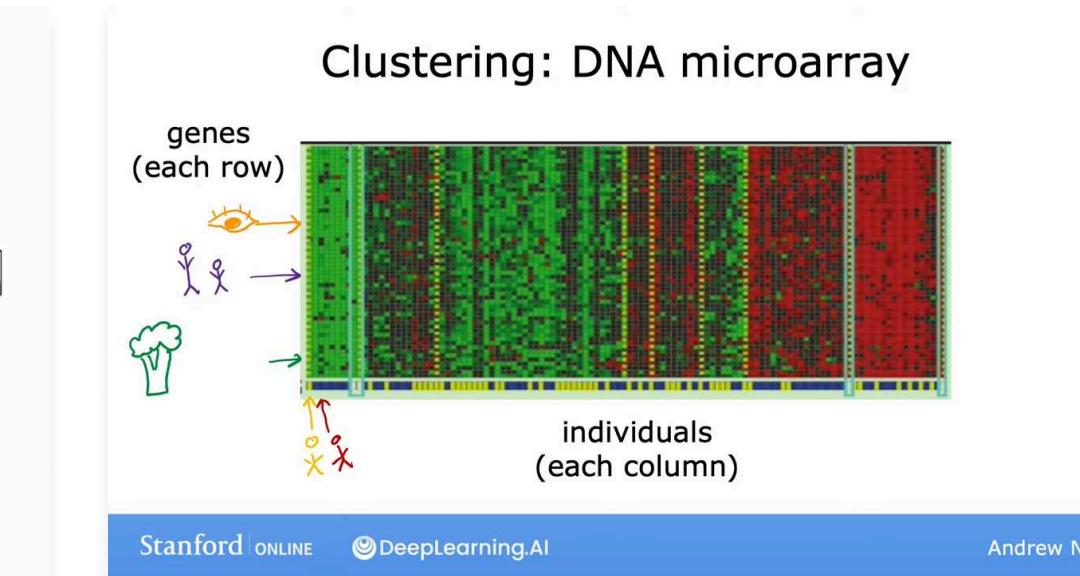
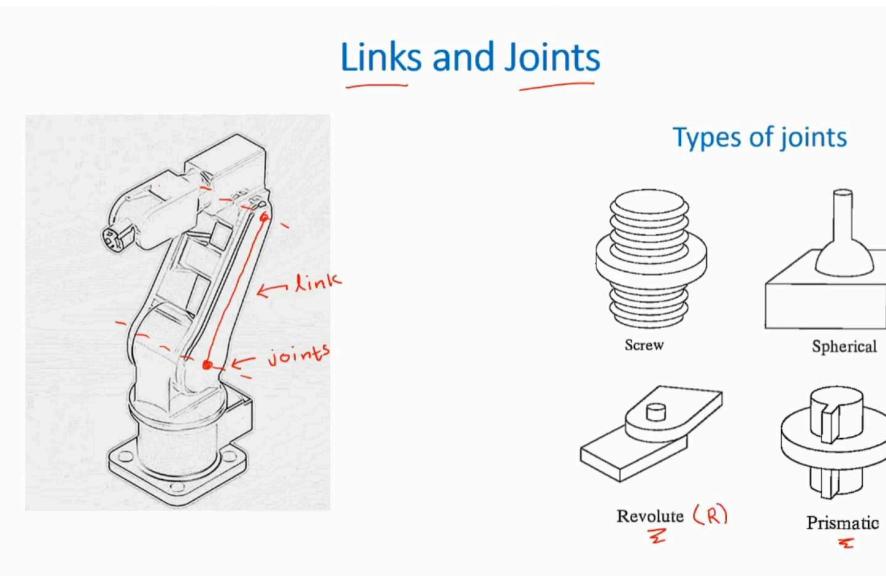
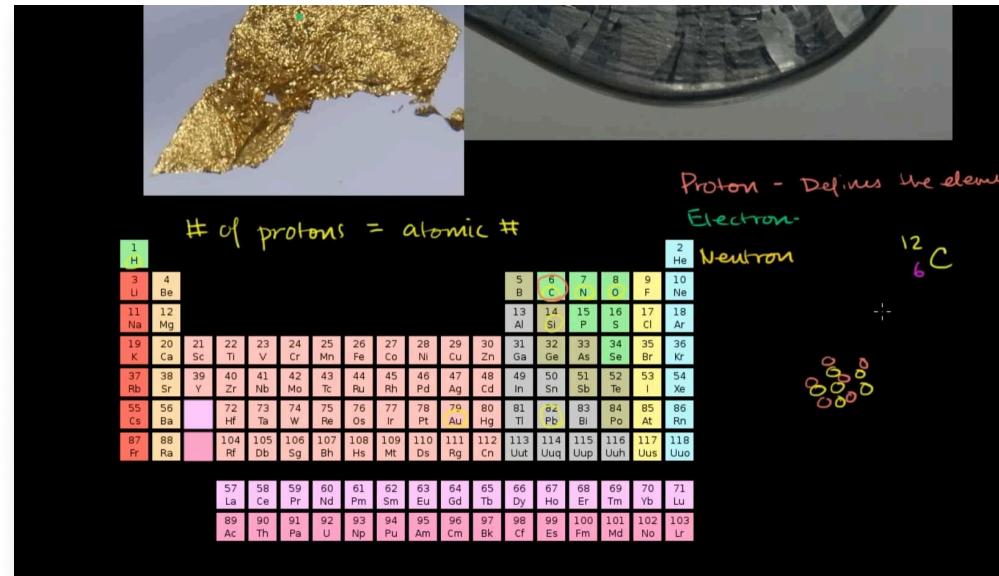


Personalization
menu panels

**Will VeasyGuide improve the
experience of low-vision people?**

User Evaluation

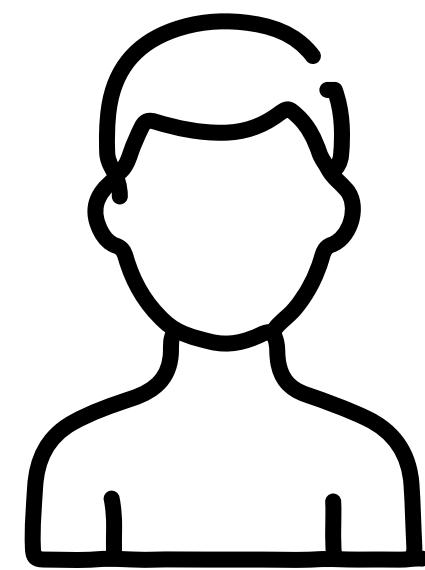
- Using **real-world** presentation videos.



8 Low-vision
participants



Low-vision **access to visual activities?**



8 Sighted
participants



Impact on sighted users?

Localization task

Focus on **visual search**.

- Two 1-minute clips.
- Self reported detection.
- Freedom to pause.
- Highlight style is fixed.

Viewing task

Focus on the **experience** of learning.

- One 6-minutes learning video.
- Watch, interact, and learn.

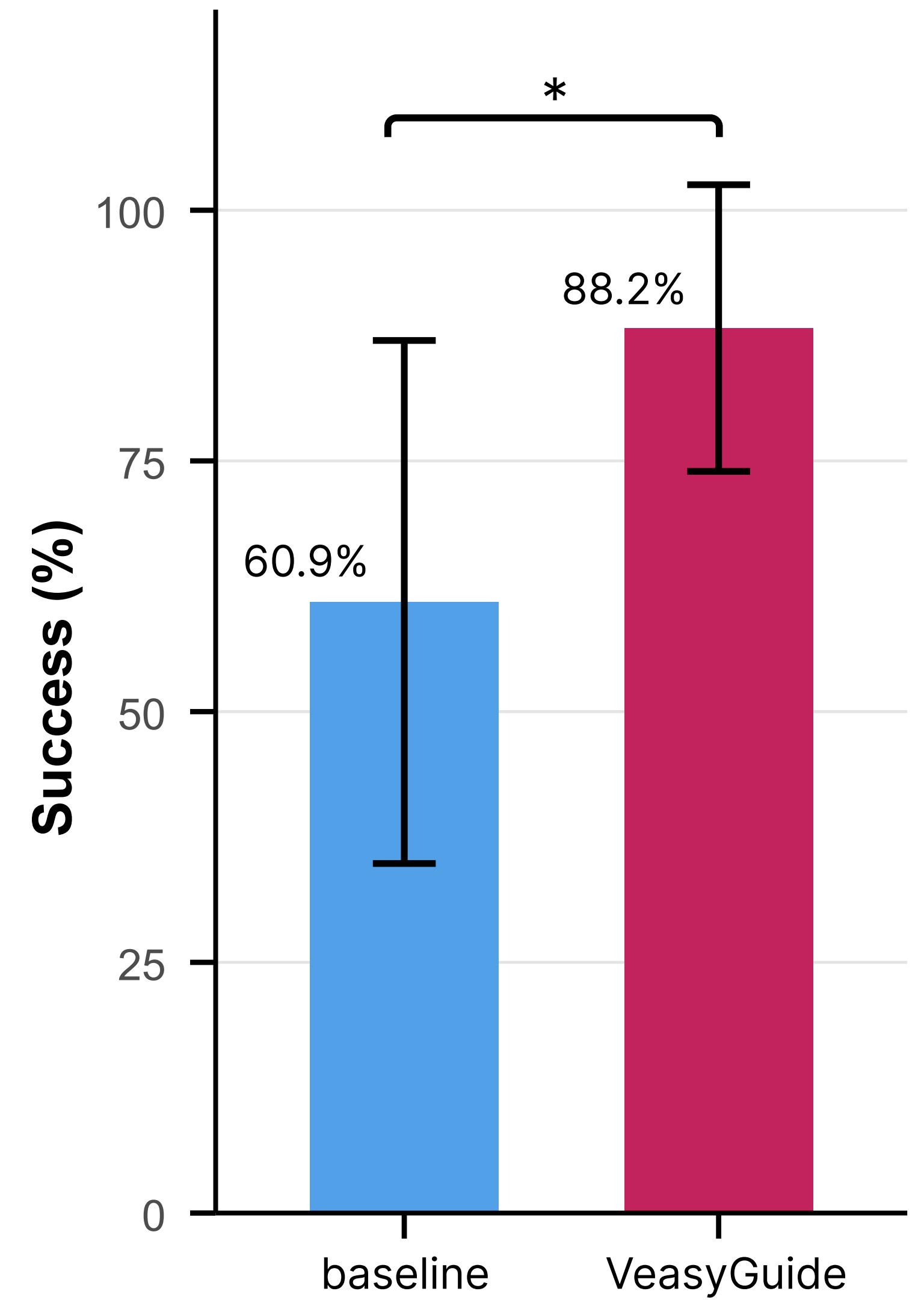
We prioritize **external validity**, and allow participants to use any of their assistive technology and tools.

Results

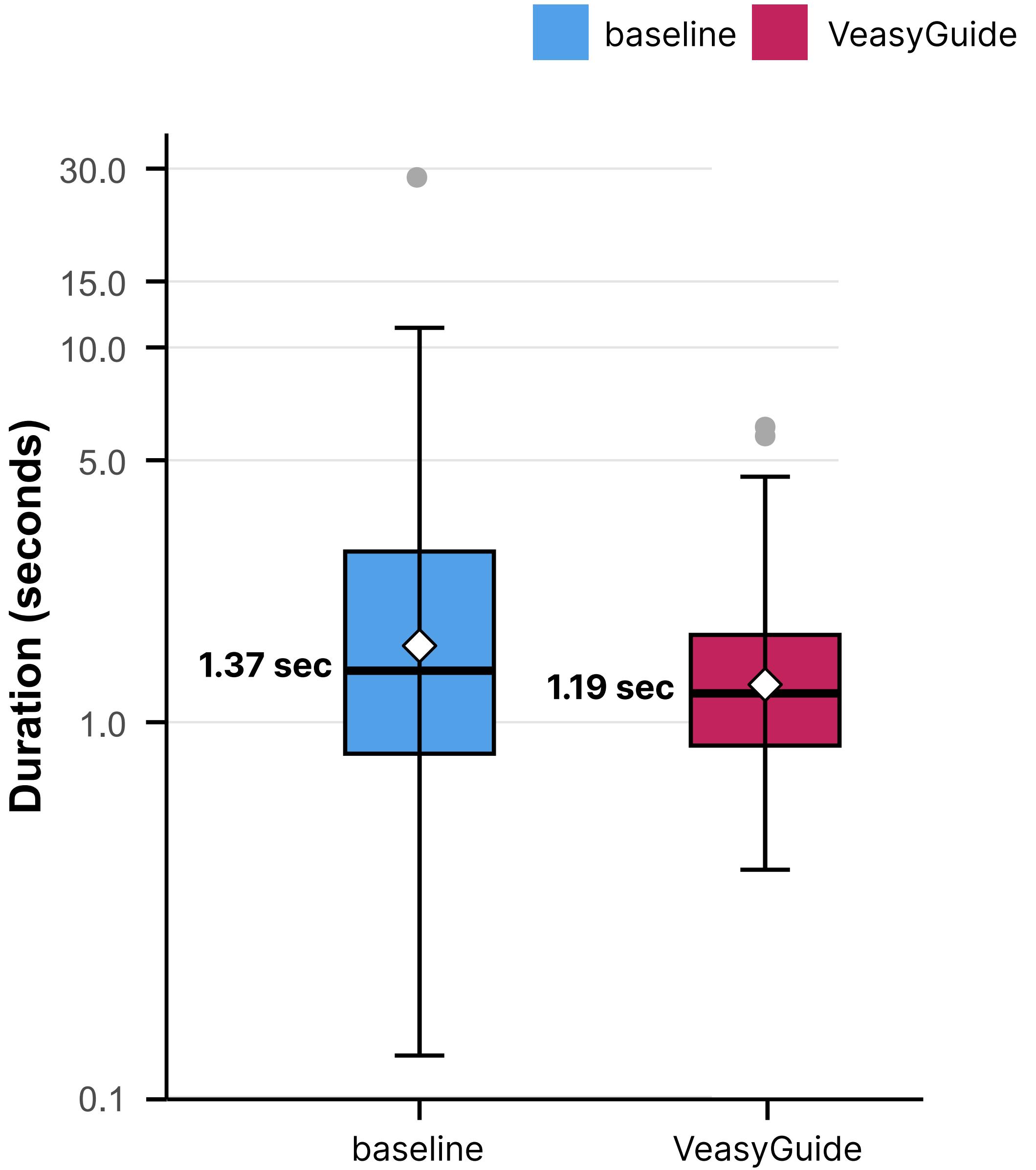
**Low vision participants
significantly notice more
activities**

(* statistically significant)

baseline VeasyGuide

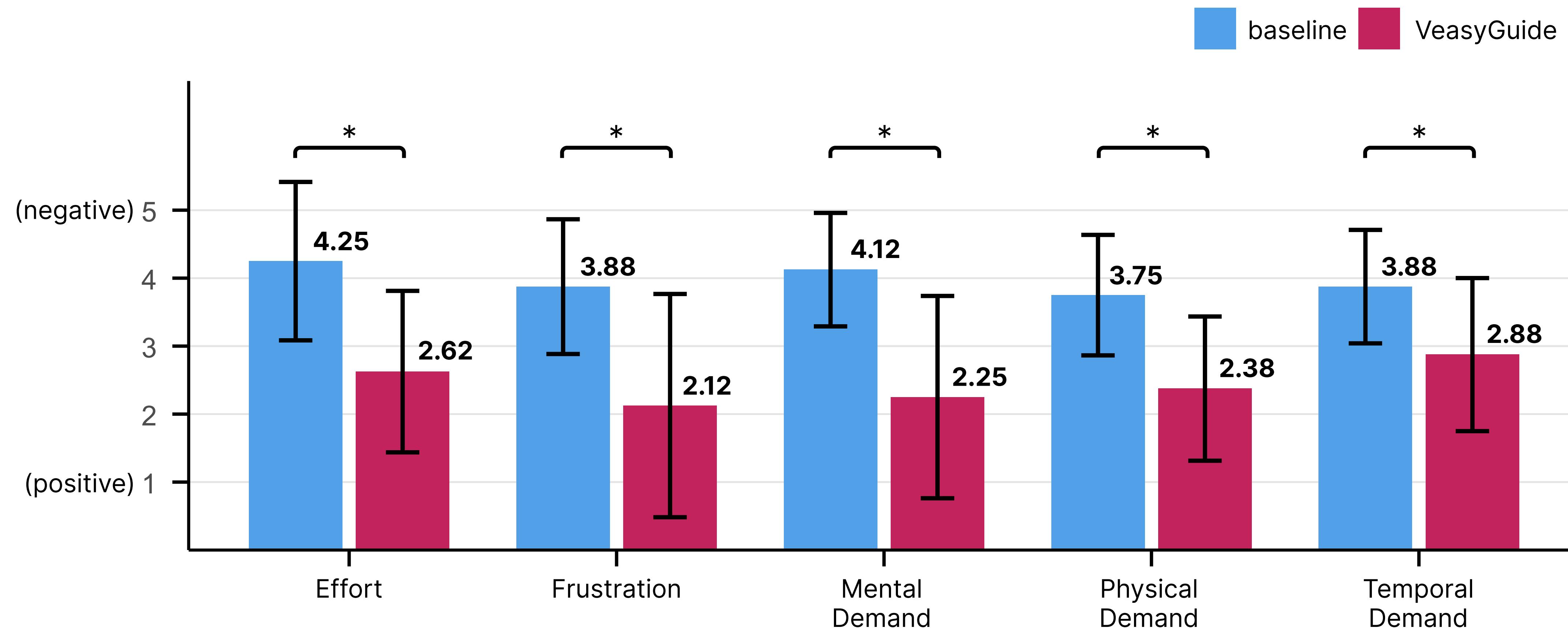


Low vision participants
notice activities **faster**



Significantly reduced cognitive load

(* statistically significant)



Easier to follow along the instructor

"It felt as if the instructor had control, so I can **connect with** the instructor's intent."

(L2)

"It helped me stay with the instructor. [...] I saw that [the instructor] was drawing a boat, and I was **happy I did not miss it.**"

(L3)

Improved the overall **experience of learning**

"One of the biggest problems is that **I don't know what in the video requires my attention.** [VeasyGuide] offloads this difficulty to software. **I strain less.**"

(L1)

"I felt relaxed listening instead of constantly worrying about where the next thing would show up. **I could just sit back, listen, and learn, and remember why I enjoy learning.**"

(L5)

Some limitations remain

“I would have to **get used to it**, but getting used to it and figuring out my own workflow would let me, I think, worry less about the visual part and focus more on content.”

Learning curve

(L1)

“With the zoom, parts of the screen get cut off, so I might have missed things. I'm not sure if there was a way to move the zoom window, but I'd really like the **freedom to move it around.**”

More granular control

(L6)

Provides some benefits for sighted participants

“If I’m bored, the highlights help **draw my attention** back to the video; and to the right place.”

Retain & preserve attention (S1)

“I could just focus on receiving information. It allowed me to **focus on the learning part.**”

Focus on learning (S2)

VeasyGuide has the **potential to enhance the learning experience** for others

Discussion

**How to design tools to support
low-vision users in tasks that
require visual search?**

Discussion: Design Framework

Familiarity with target visuals

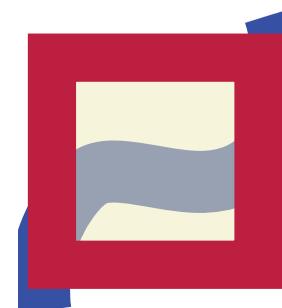
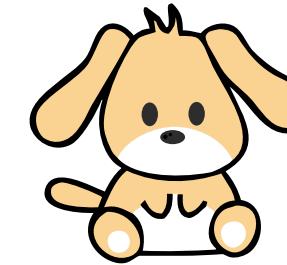
Predictability via spatial-temporal context

Personalization for changing needs

Extend beyond the co-design findings

Preserving user agency

VeasyGuide gives low-vision learners **the choice to look, see, and follow** the instructors. With the freedom to always find the right place to attend.

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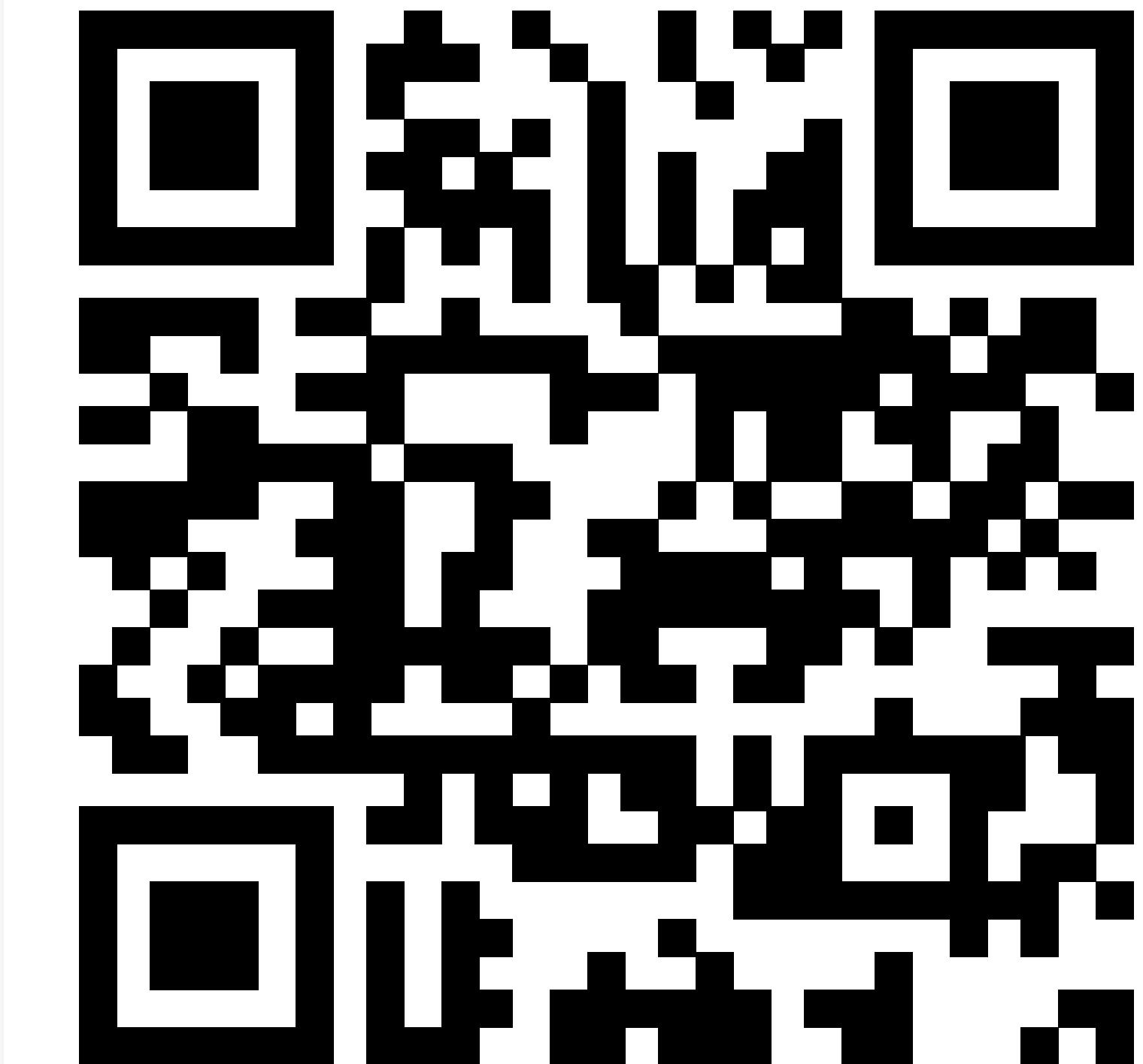


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Try it out online!



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