

THE USER EXPERIENCE EXPLORED

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THE PERFECT BANKNOTE

From the Public's view:

- Easy to use
- Easy to handle
- Easy to trust



TRUST IN A BANKNOTE

Trust means having confidence that the banknote is not a counterfeit. Confidence is provided by security features.

What makes an excellent security feature? Two things:

1. An easily perceived *critical signal* that the note is “good”, not fake.
 - A window, movement, a 3D illusion.
2. The critical signal must be very hard to counterfeit.

Trust on a banknote is a psychological event; it happens in the brain of the public user and is driven by their perception of the *critical signal*.

A PERCEPTION SCIENCE APPROACH

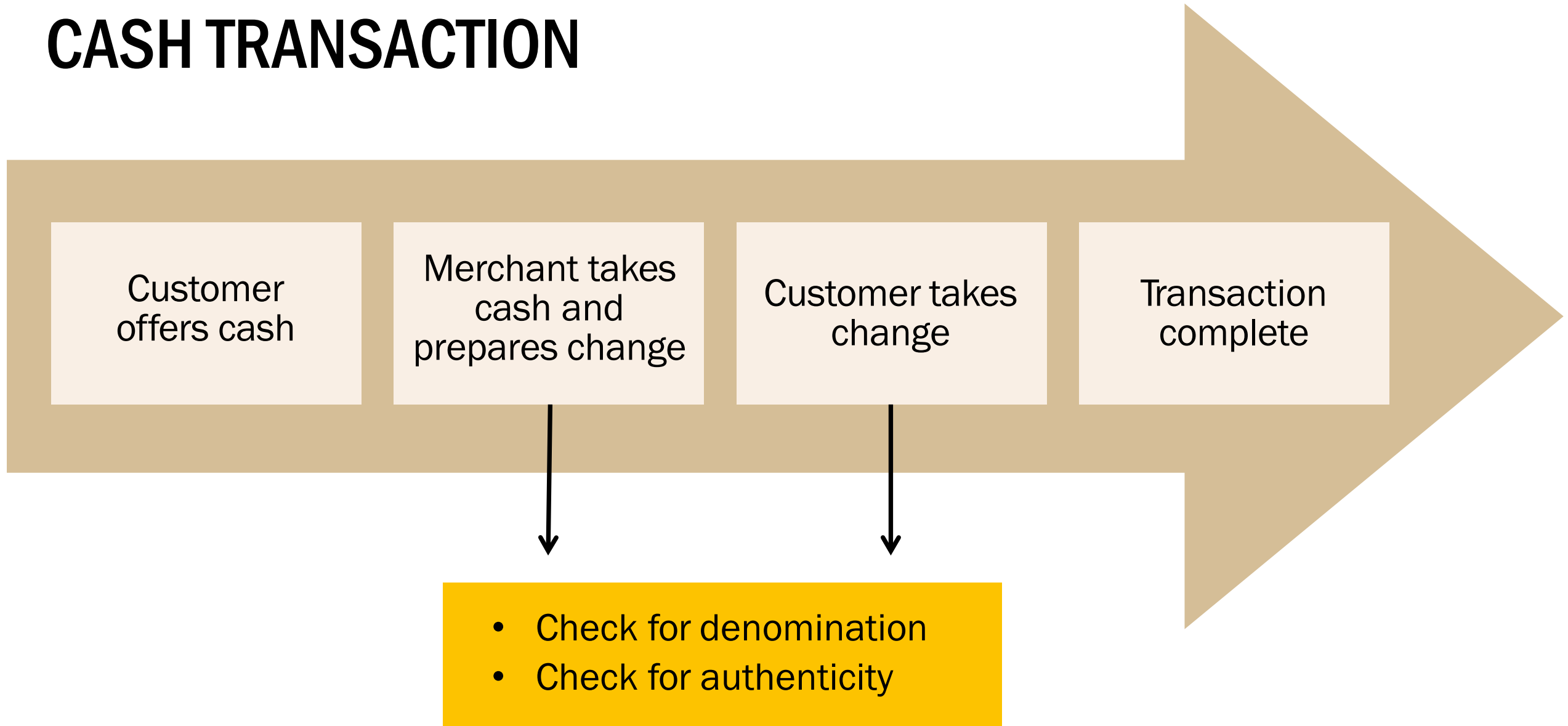
- A close look at a cash transaction.
- Perception Science: What can it tell us?
- A perception study of Crane's MOTION SURFACE®

A CLOSE LOOK AT A CASH TRANSACTION

The whole transaction
lasts about 13 sec



A CLOSE LOOK AT A CASH TRANSACTION

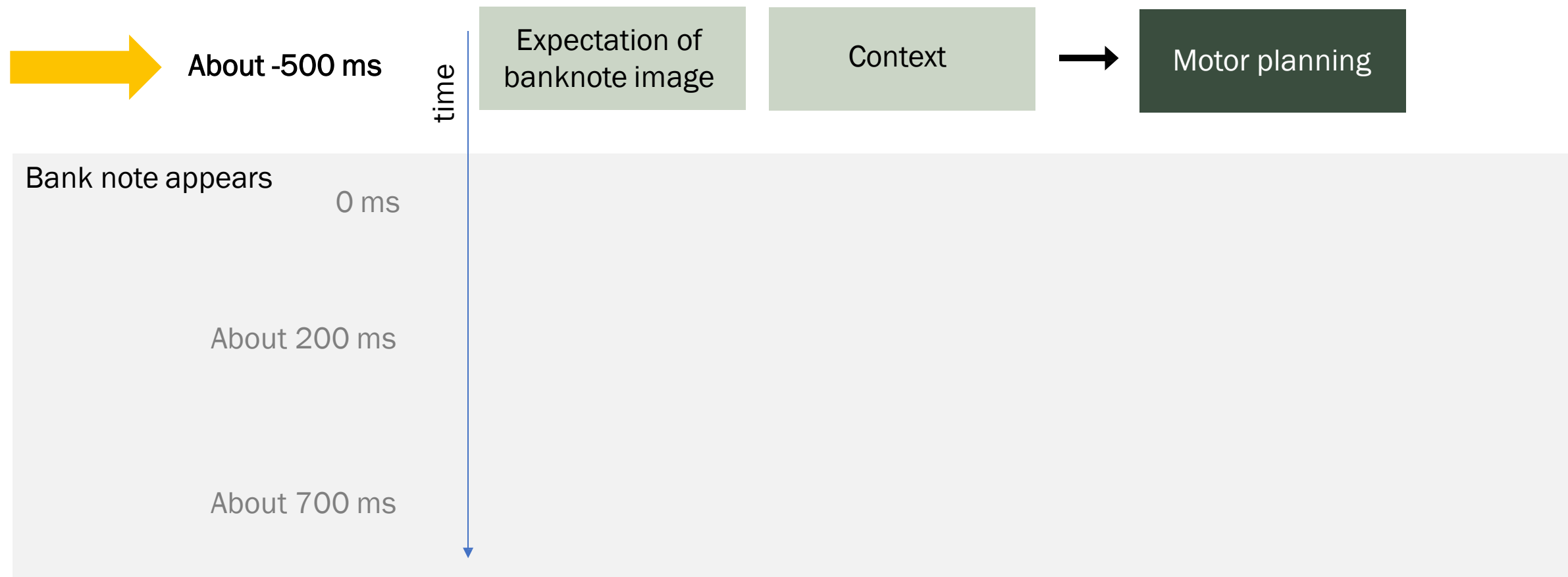


A THEORETICAL APPROACH TO AUTHENTICATION

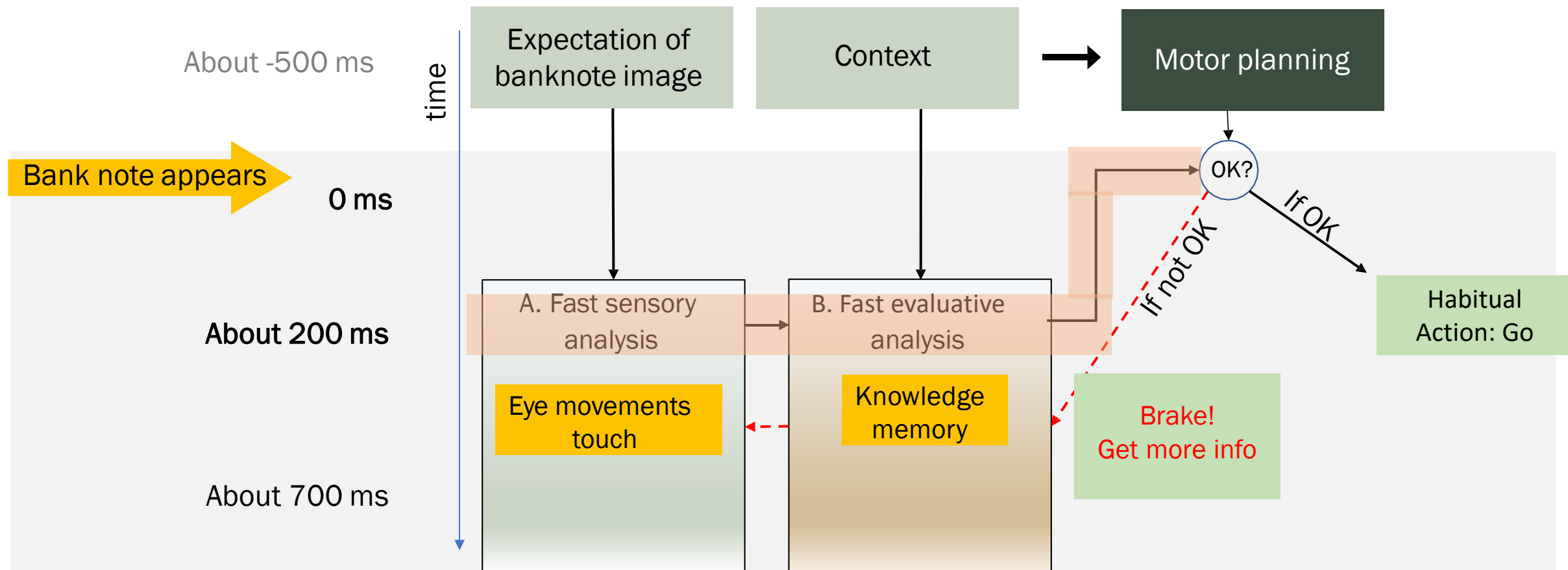
A three stage model:

1. Expectation
2. Fast check for critical signals
3. Slow inspection (if needed).

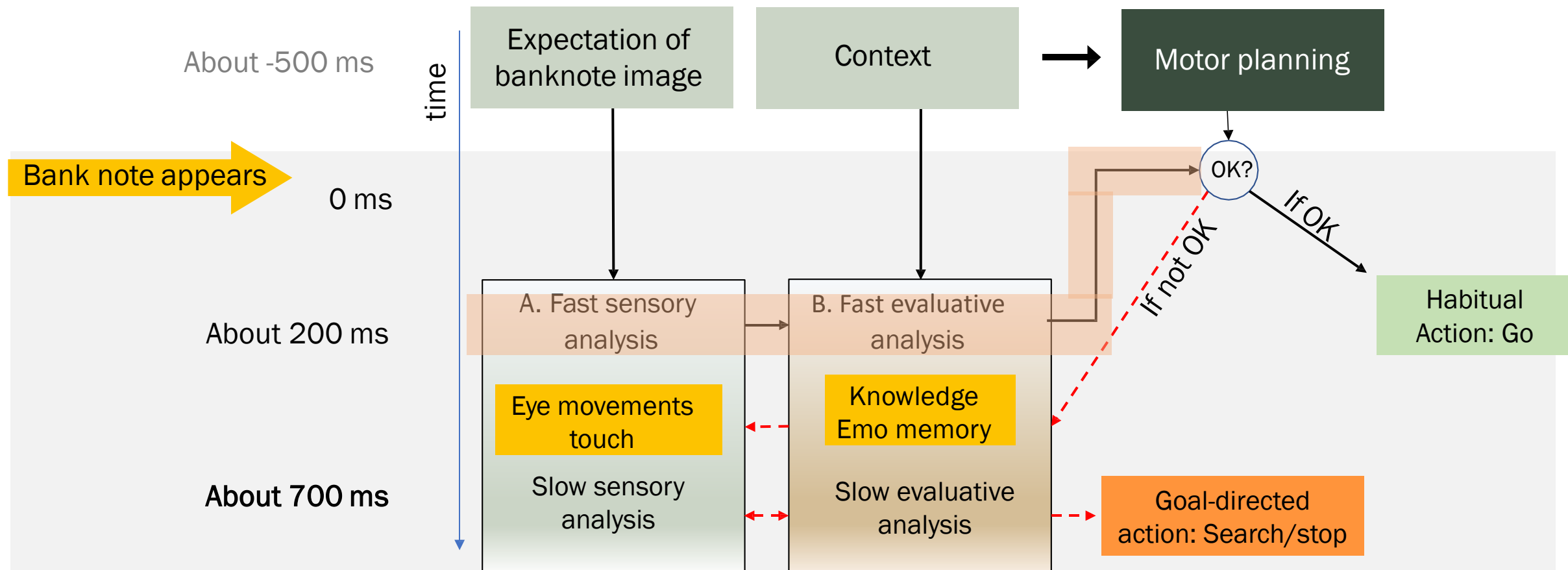
STEP 1: SETTING EXPECTATIONS



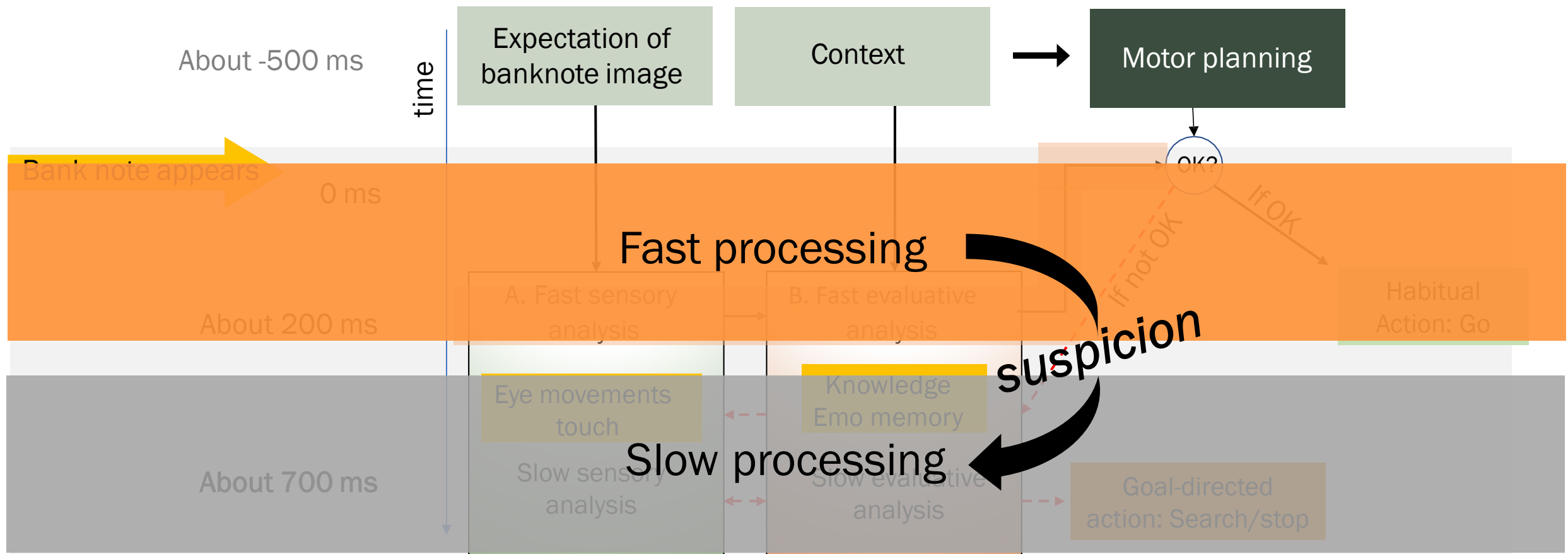
STEP 2: RAPID ANALYSES



STEP 3: SLOW RECONSIDERATION



A TWO STAGE MODEL



SIMBA: Suspicion Initiated Model of Banknote Authentication

Suspensions are raised: Fast processing

Scrutiny follows: Slow processing

Different security features are need at each stage.

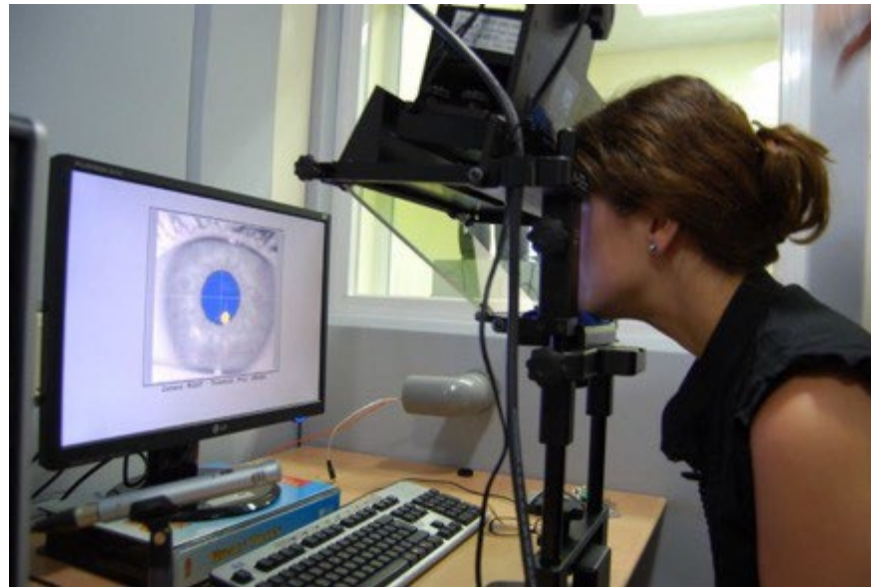
EVIDENCE FOR SIMBA

How can we know that there is a fast initial brain process?

1. Eye movement studies
2. Brain recordings
3. People's behaviour under controlled conditions

USING TECHNOLOGY TO VERIFY BRIEF GLANCES

Measuring eye movements.



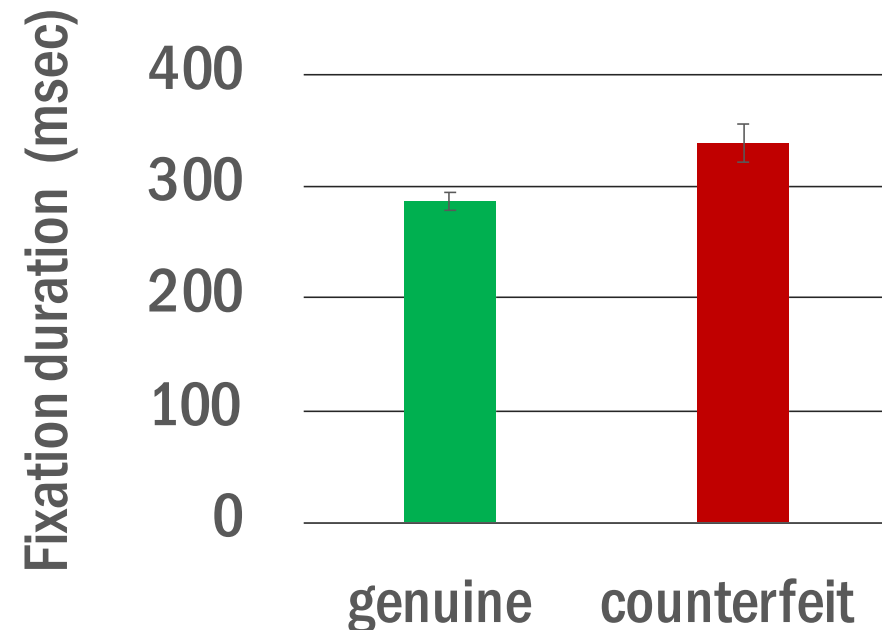
A person viewing specimen note for the first time (3 s). Each blotch is a fixation.



USING EYE MOVEMENTS

Looking at a familiar note while handling it. Each fixation is brief and directed at a point of interest.

Raymond J. E. & Jones, S. P. (2019). Strategic eye movements are used to support object authentication. **Scientific Reports**. 9:2424 (<https://rdcu.be/bnGuR>).



MEASURING BEHAVIOUR

Humans can:

- Recognise a face with < 100 ms of viewing
- Recognise a word with < 100 ms of viewing.
- Movement with < 100 ms of viewing.

What about banknotes and security features?



HOW GOOD IS MOTION SURFACE®?

- Can MOTION SURFACE support fast stage authentication?
- Would the absence of its critical signal trigger suspicion?

TWO CRITICAL SIGNALS:

1. Depth or 3D

2. Movement



3D IN MOTION SURFACE®

Deep:

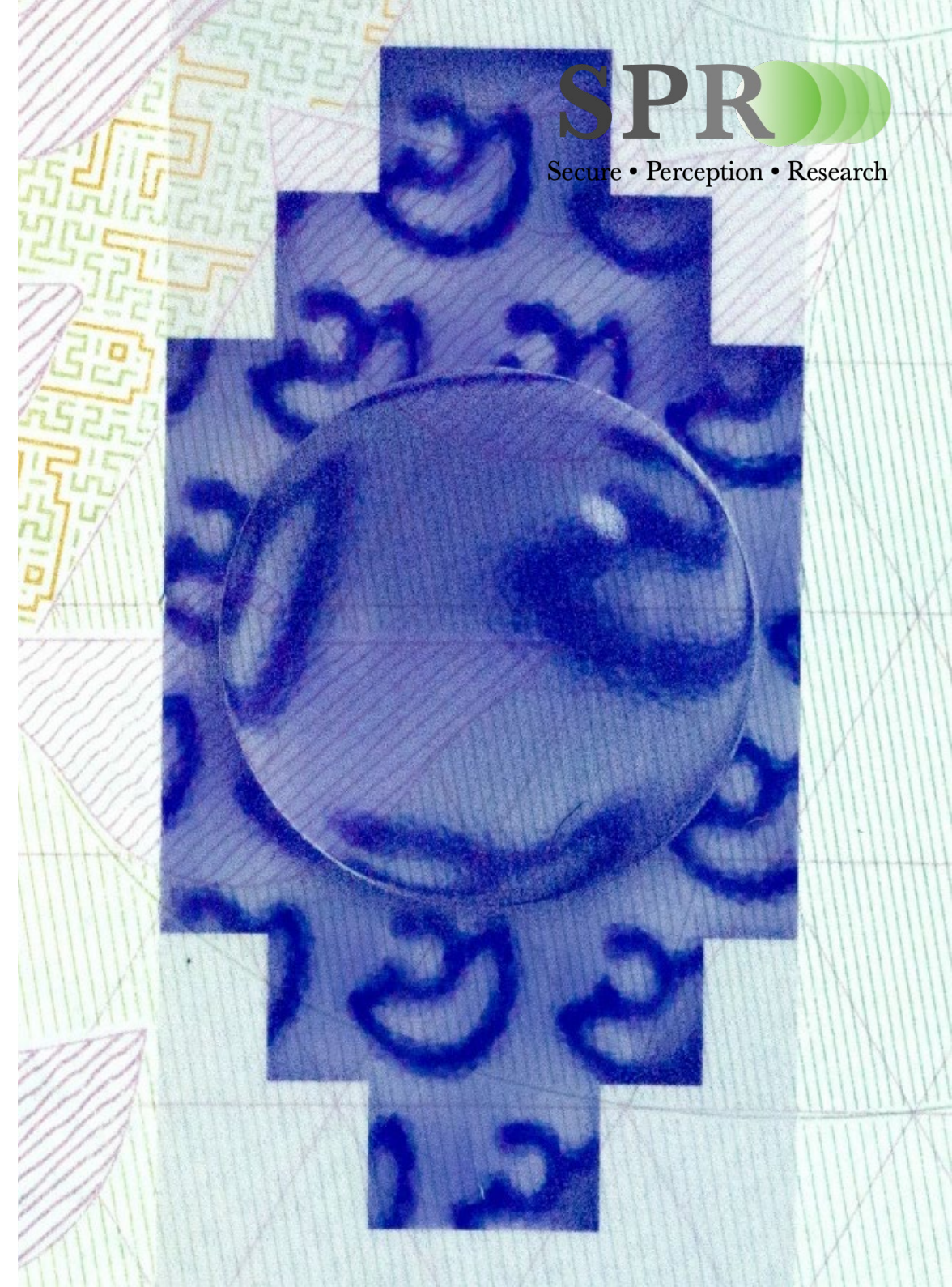
The powerful sense that there is second deeper surface below the plane of the banknote.

Topo:

The illusion of a 3D droplet on top of the banknote.

These are both easily perceived critical signals that are very difficult to copy. But can they be seen in a split second?

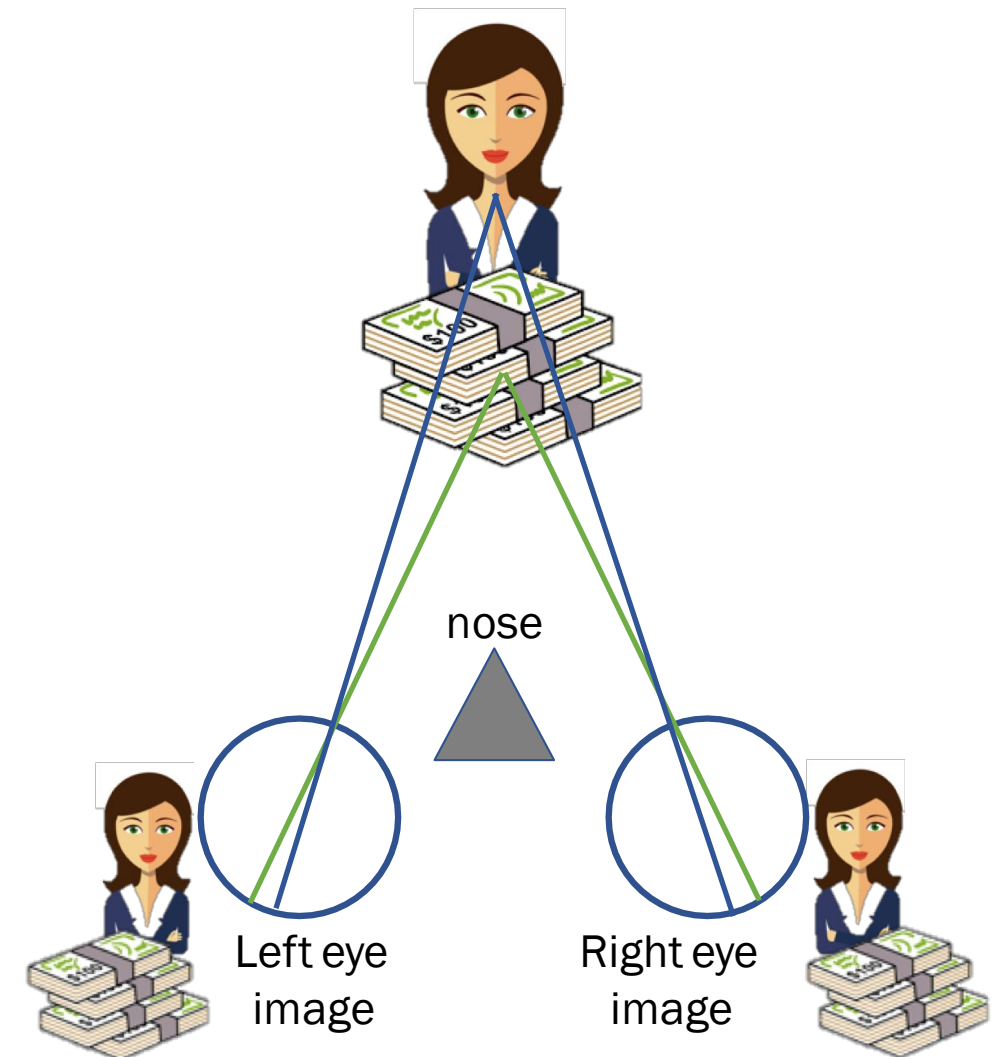
Can they be seen under low light?



SEEING IN 3D

How does it work?

- Each eye receives a different image.
- The brain calculates the difference in the image, point by point.
- This difference generates the sensation of *stereopsis* (strong 3D experience).
- An ordinary 2D surface does not enable the brain to produce *stereopsis*.



SEEING IN 3D

Put the glasses on

- The image is printed twice.
- The left eye sees one version and the right eye sees a different one.
- The face image is the same for both eyes so it seems closer.



SEEING IN 3D

Put the glasses on

Even when the image is displayed for only $\frac{1}{2}$ second, the impression of depth is still easily perceived.

3D **provides**

fast, easy **communication**

signal



PERCEPTION STUDY OF 3D IN MOTION SURFACE

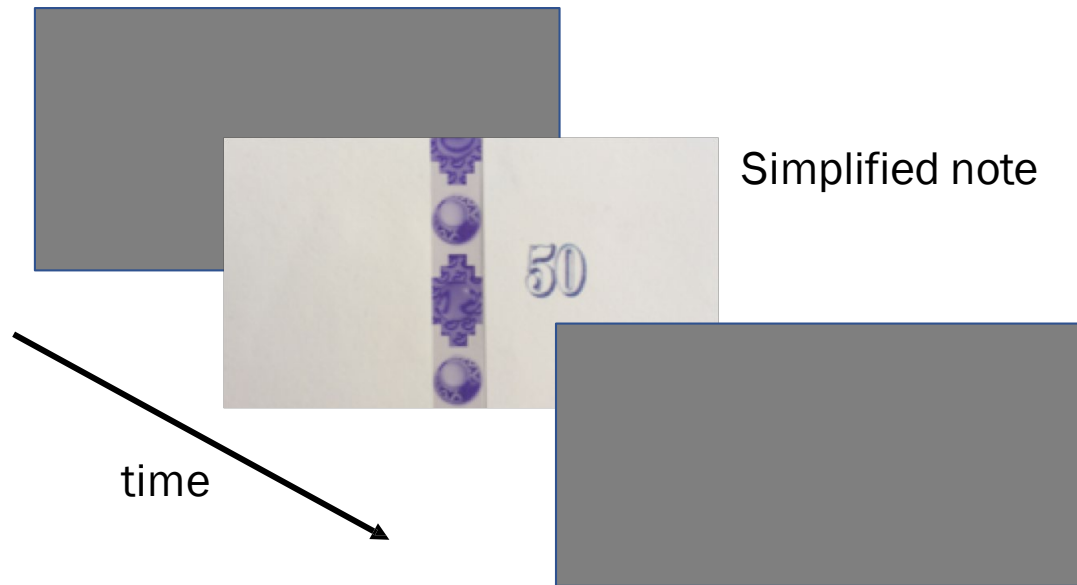
Objectives:

1. Can 3D support authentication with very brief looking?
2. Can 3D support authentication under low light?

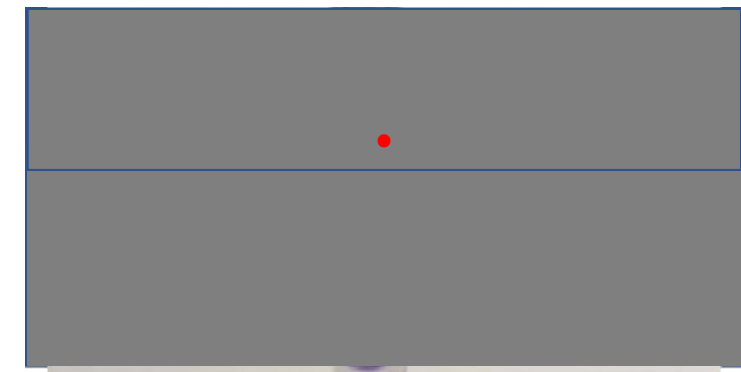
To focus on the 3D aspect of the security feature, perception studies used stationary notes that did not provide any visual motion signal.

PERCEPTION TEST

1. Each person was tested one at a time.
2. They are shown a simplified banknote for a very brief interval.
3. They judge the denomination and whether the note is real or fake.
Half the notes were fake 'Motion Surface' strips.



The participant's view



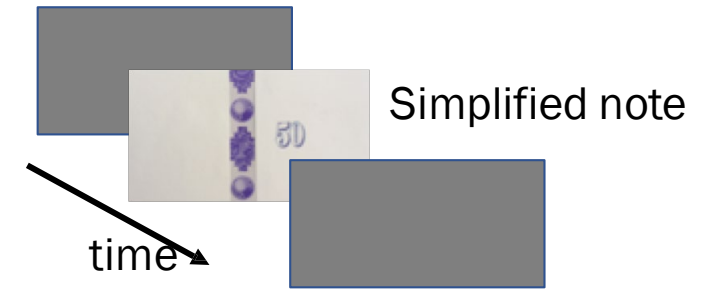
ADDITIONAL MEASURES

How do people handle the specimen banknote? No instructions given. (60 people from the general public)

ACTION	% OF PARTICIPANTS
Pivots the note	65%
Left right tilt	35%
Front back tilt	76%
Touches security feature	47%

People immediately know what to do to see the visual effects

HOW GOOD IS AUTHENTICATION?

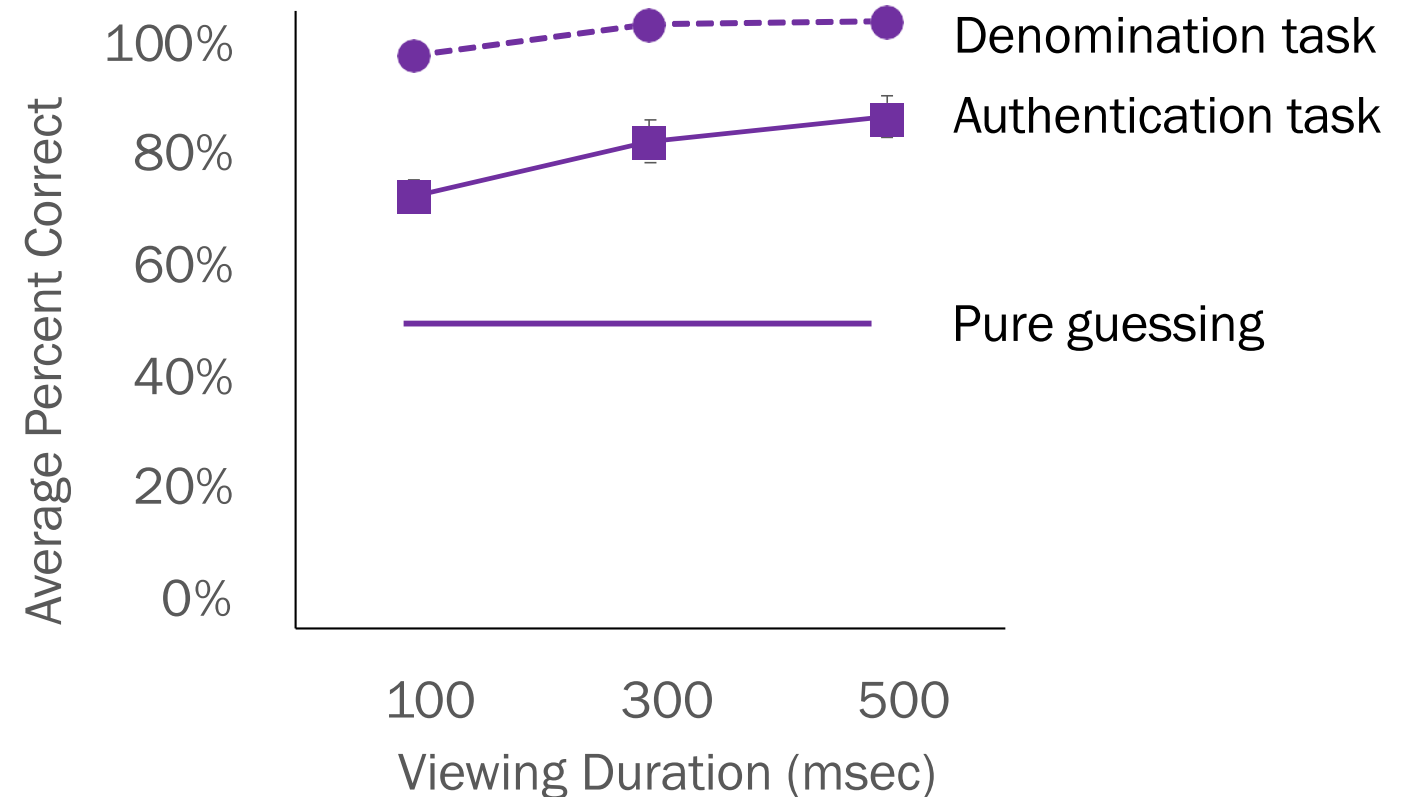


Study 1:

30 adults; 21 – 65 years, average = 35 years

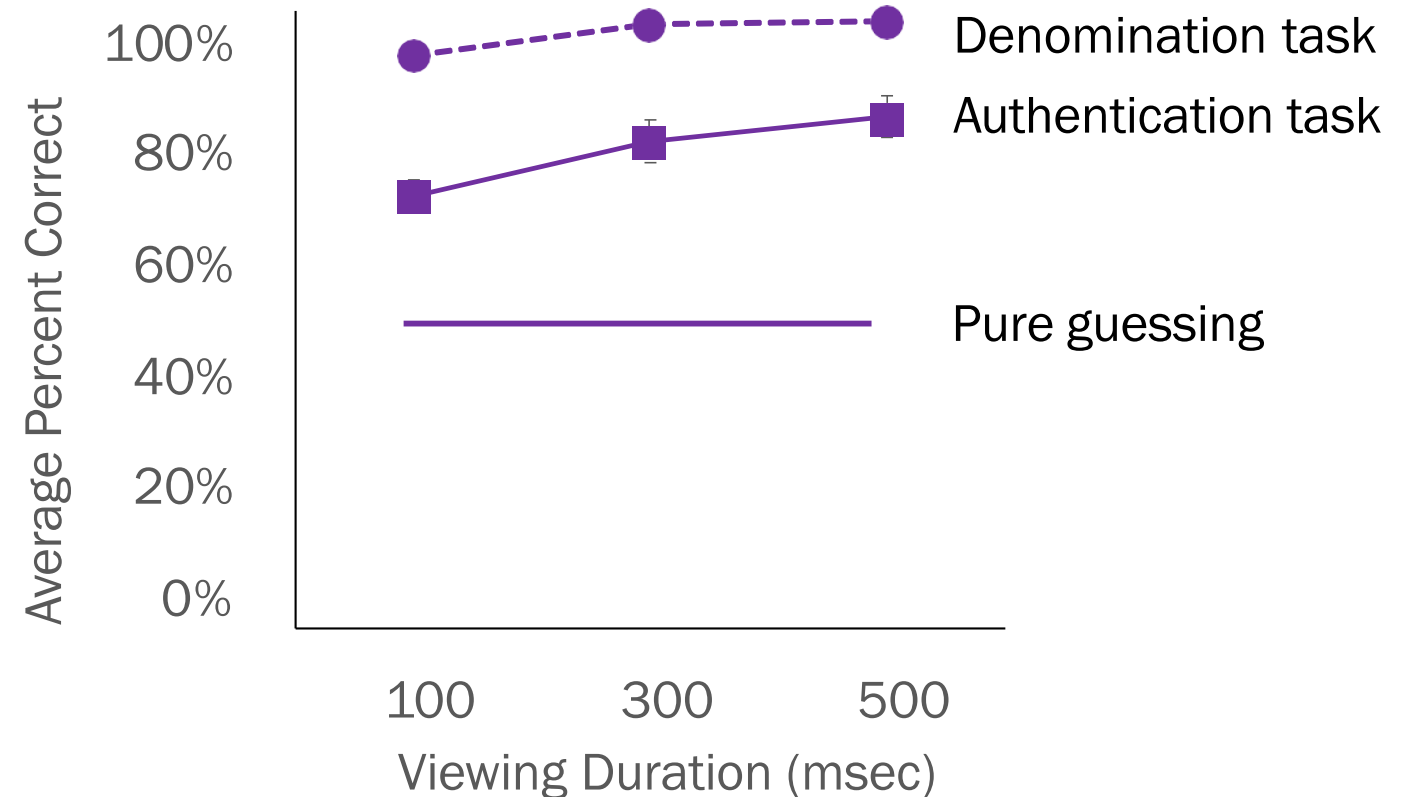
Three very brief viewing times are tested.

How correct are people on each task?



HOW GOOD IS AUTHENTICATION?

- Even with the shortest viewing time, 3D signals are available to the brain.
- Processing these signal to judge authenticity does not cause problems for judging denomination.
- 3D is an excellent fast, critical signal for a security feature.



HOW GOOD IS AUTHENTICATION UNDER LOW LIGHT?

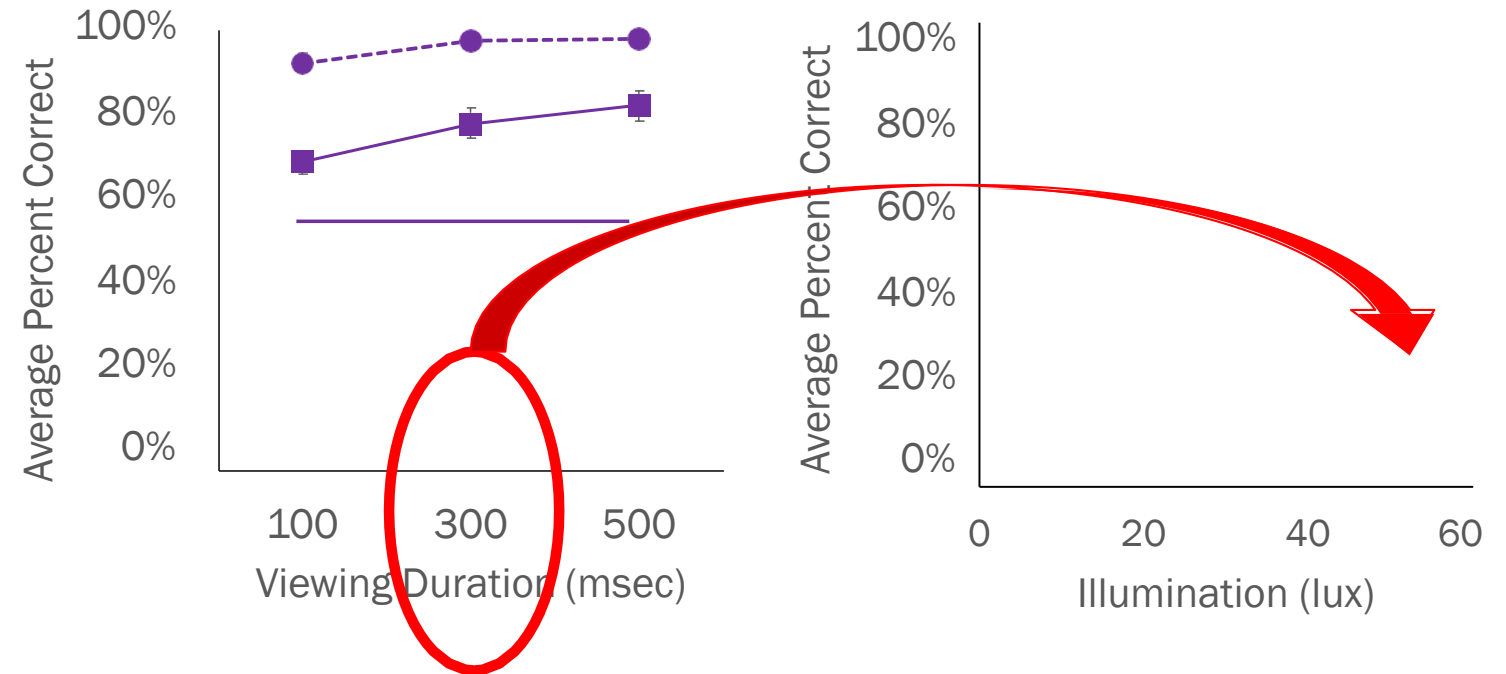
Study 2:

30 adults; 21 – 65 years, average = 35 years.

Bright (office), dim (bar) or dark (deep twilight) viewing.

Looking time = 300 msec

How correct are people on each task?



LOW LIGHT AUTHENTICATION

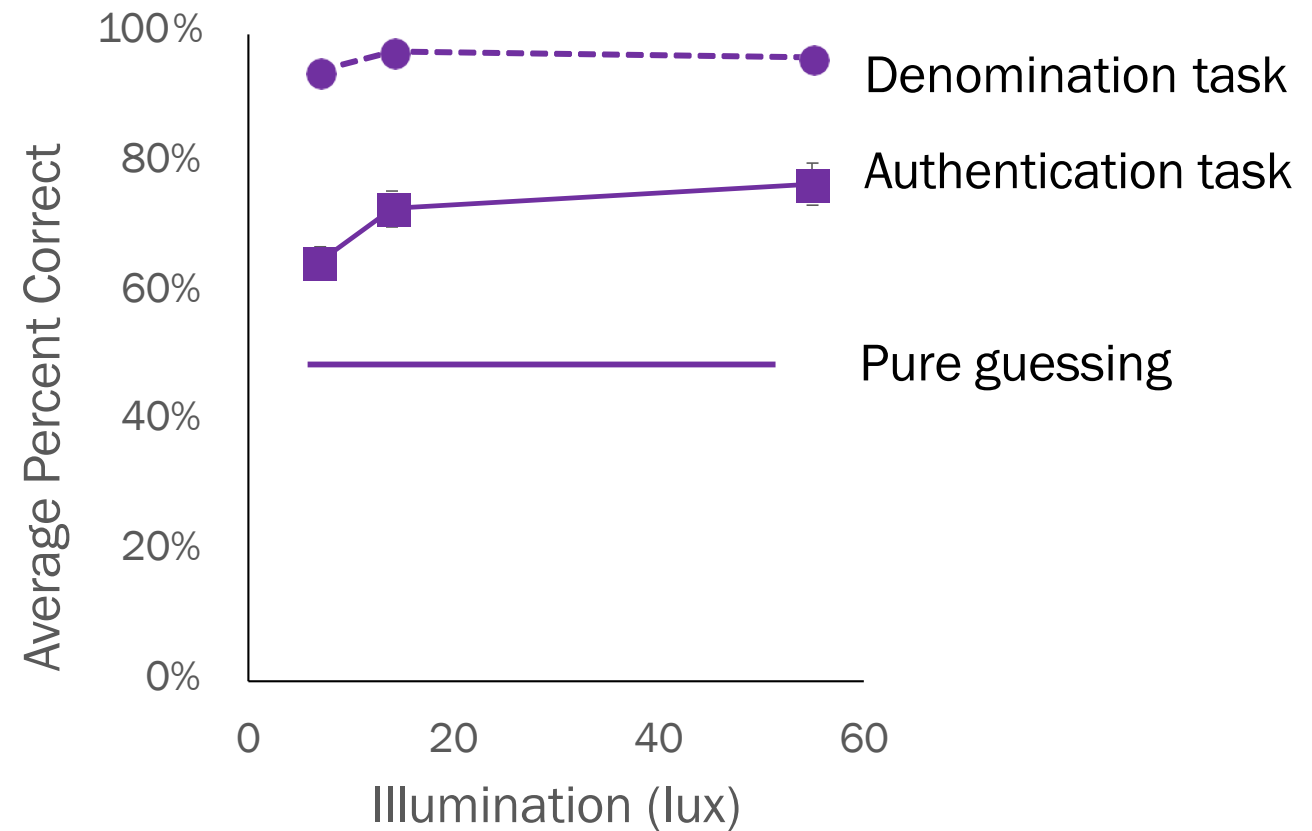
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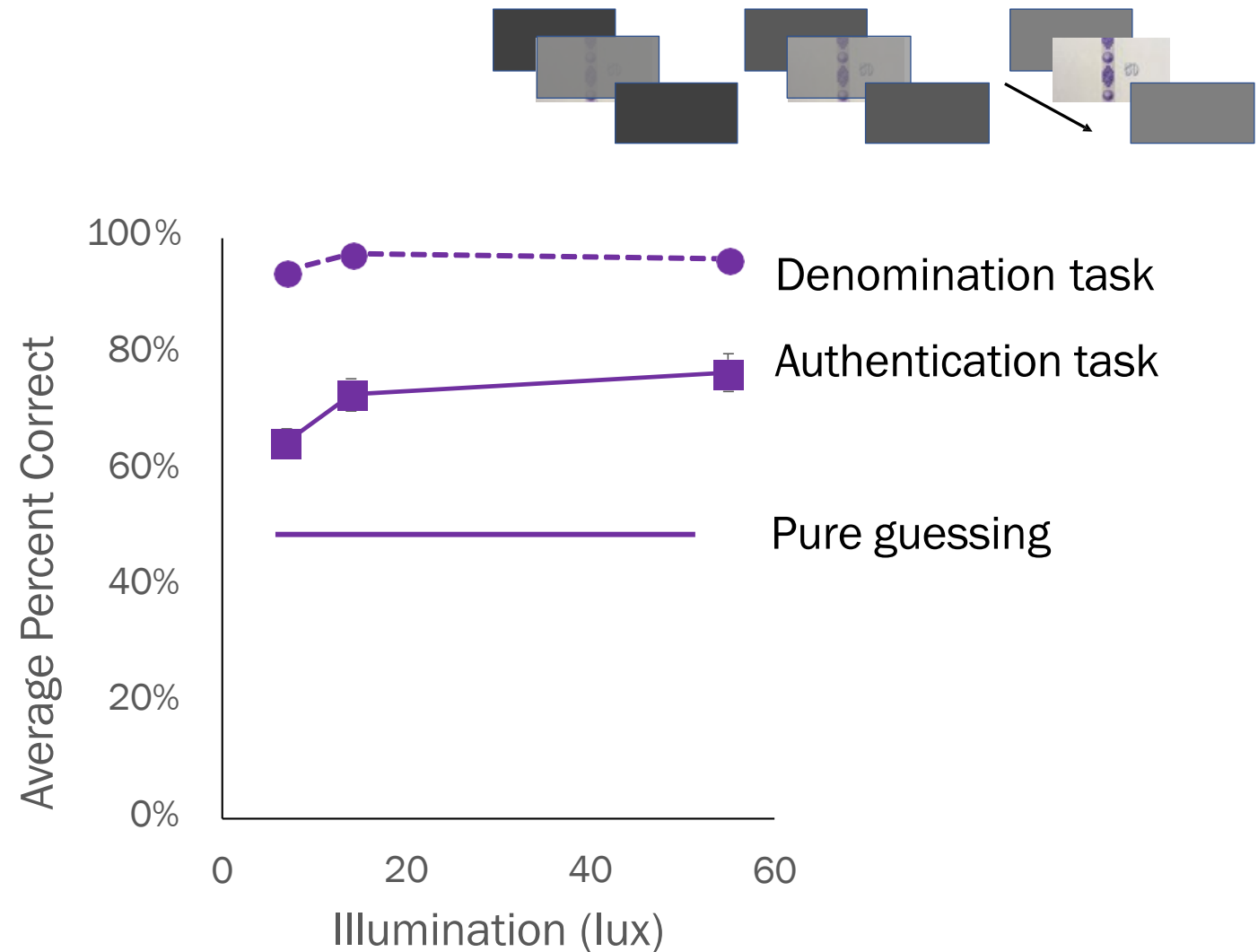
How correct are people
on each task?



LOW LIGHT AUTHENTICATION

Study 2:

- Performance is very good even with the dimmest light.
- There is no cost to accuracy of denominating the note.
- 3D provides an excellent low light level security feature.



SUMMARY

- Ordinary cash transactions take place quickly; notes are viewed for about $\frac{1}{2}$ second.
- Yet, a brief look at a banknote is sufficient to acquire a lot of information.
- Appropriate security features can quickly nudge the brain into “suspicion” or approval.
- They do this by providing a fast and easily perceived *critical signal* to the brain.
- Perception studies show that 3D makes an excellent *critical signal*, as it is robust under low light and with very brief viewing.



THANK YOU!

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