

EVALUATING PUBLIC SECURITY FEATURES

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UNDERCURRENCY®

 **PerceptNote®**
Image Analytics

SPR 
Secure • Perception • Research

OUTLINE

1. Public perception

2. **PerceptNote®**: A new measurement tool

3. A study to evaluate security features



BANKNOTE PERCEPTION



AUTHENTICATION, TRUST.

Can you measure such things?

Yes!

PERCEPTION STUDIES

- Public authentication accuracy and speed
- Eye movements
- Brain responses

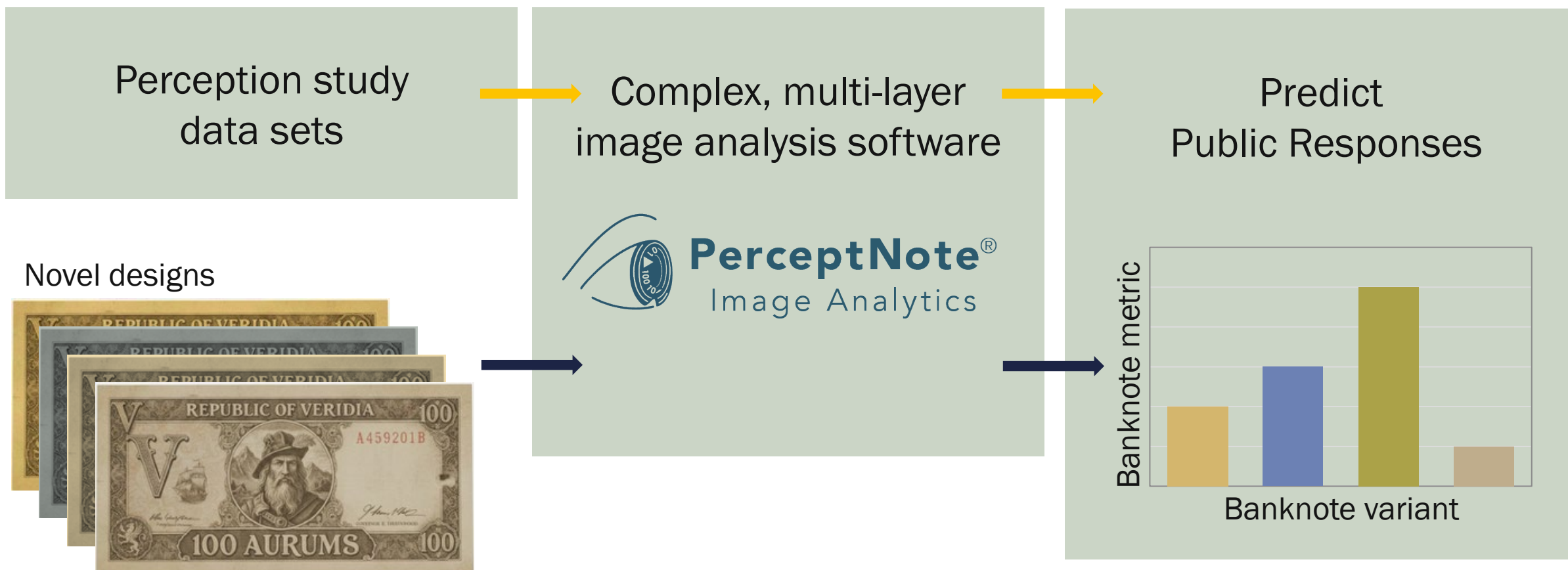
20 YEARS OF BANKNOTE PUBLIC PERCEPTION RESEARCH

- Authentication is fast (1-2 secs).
- Looking directly at security features leads to authentication accuracy.
 - Security features must ‘grab’ attention quickly and automatically.
- To be effective, features need to be easy to use and interpret.
- Perception studies are slow, expensive, & challenging.



PREDICTIVE BANKNOTE PERCEPTION

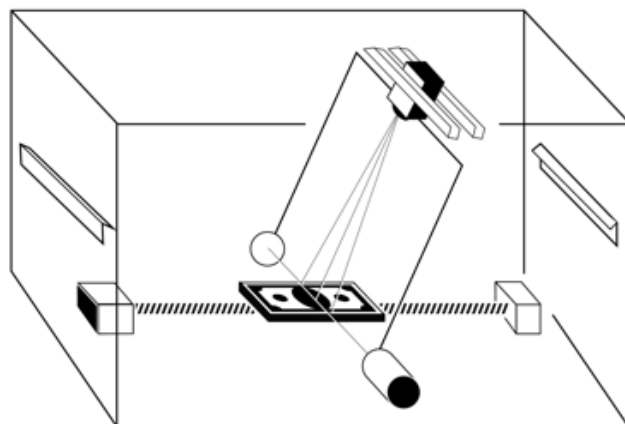
A practical approach to perception assessment



PerceptNote®

PerceptNote®: A hardware/software technology for evaluating perceptual functionality

Multi-angle Dynamic Image Scanner (MADIS)



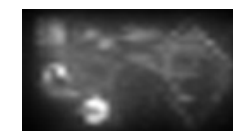
MADIS - Patent pending US 19/222,025

Multiple types of image analyses



 **PerceptNote®**
Image Analytics

Report



Visualizations



Charts



Interpretations

PerceptNote®

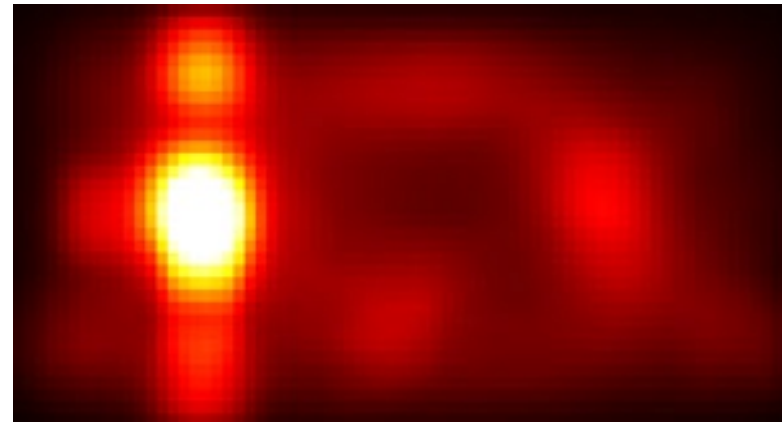
BANKNOTES:

- How is attention distributed across the banknote?
- Will the public authenticate accurately?
- How will wear affect perception?

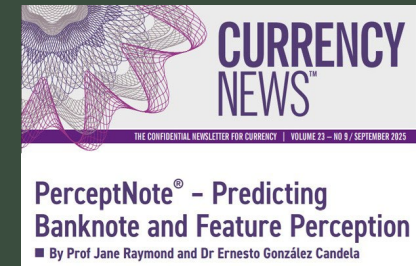


SECURITY FEATURES:

- How noticeable?
- How easy to recognize?
- How will wear affect their perceptual functionality?



Attention Map:
GBP£20
White shows
high likelihood of
attention capture



WANT TO KNOW MORE?

Read about the study in
Currency News from
September 2025

A NEW STUDY: SECURITY FEATURES

FOCUS: MICRO-LENS TECHNOLOGY.

Similar cues to authenticity:

- Motif pattern
- Colour
- Movement

Can PerceptNote® measure differences among these features?

2014

RAPID® “Jellyfish”



2023

RAPID® Vision “Octopus”



RAPID® Vision “KZT”



2024

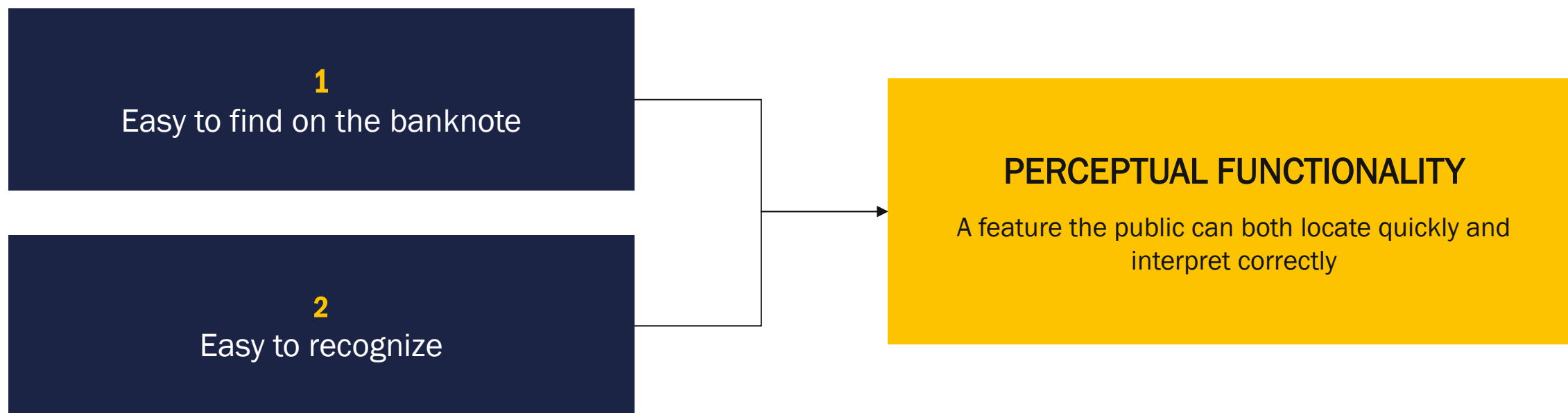
Anima™ “Brazil”



Anima™ “Butterfly”



WHAT MAKES A GOOD SECURITY FEATURE?



USER NEED

Easy to find.



Easy



Difficult

BRAIN SYSTEM?

Attention

Visual attention limits perception to a small zone. Only 2 or 3 zones are seen during a cash transaction.

SECURITY FEATURE?

1. High greyscale contrast
2. High colour contrast
3. Dynamic strength

USER NEED

Easy to recognise.



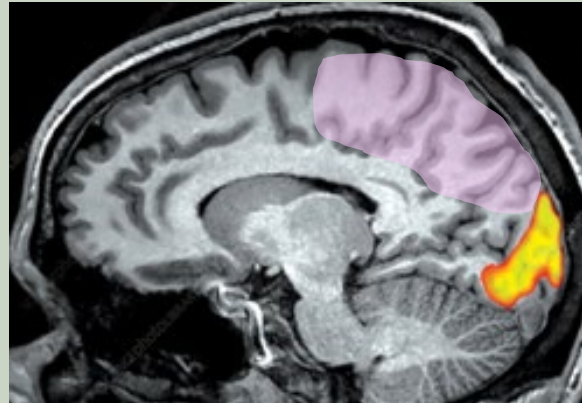
Easy



Difficult

BRAIN SYSTEM?

Visual pattern analysers



Object recognition

- Shape
- Colour
- Movement

SECURITY FEATURE?

1. High greyscale contrast
2. High colour contrast
3. Dynamic strength

QUANTIFYING PERCEPTUAL FUNCTIONALITY

Assessing security features should involve measuring key perceptual characteristics

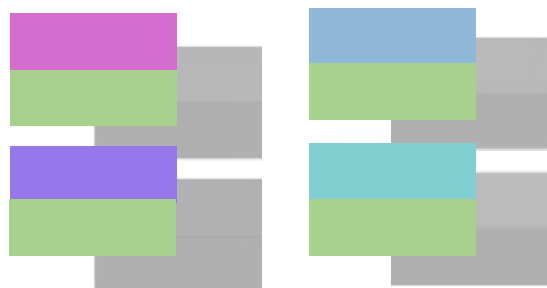
GREYSCALE CONTRAST



High

Low

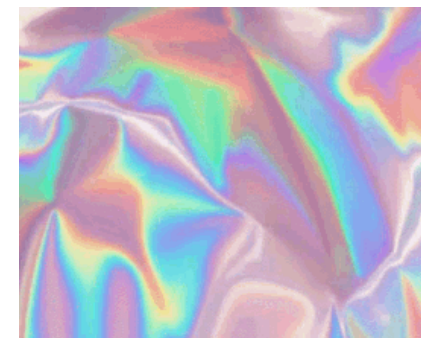
COLOUR CONTRAST



High

Low

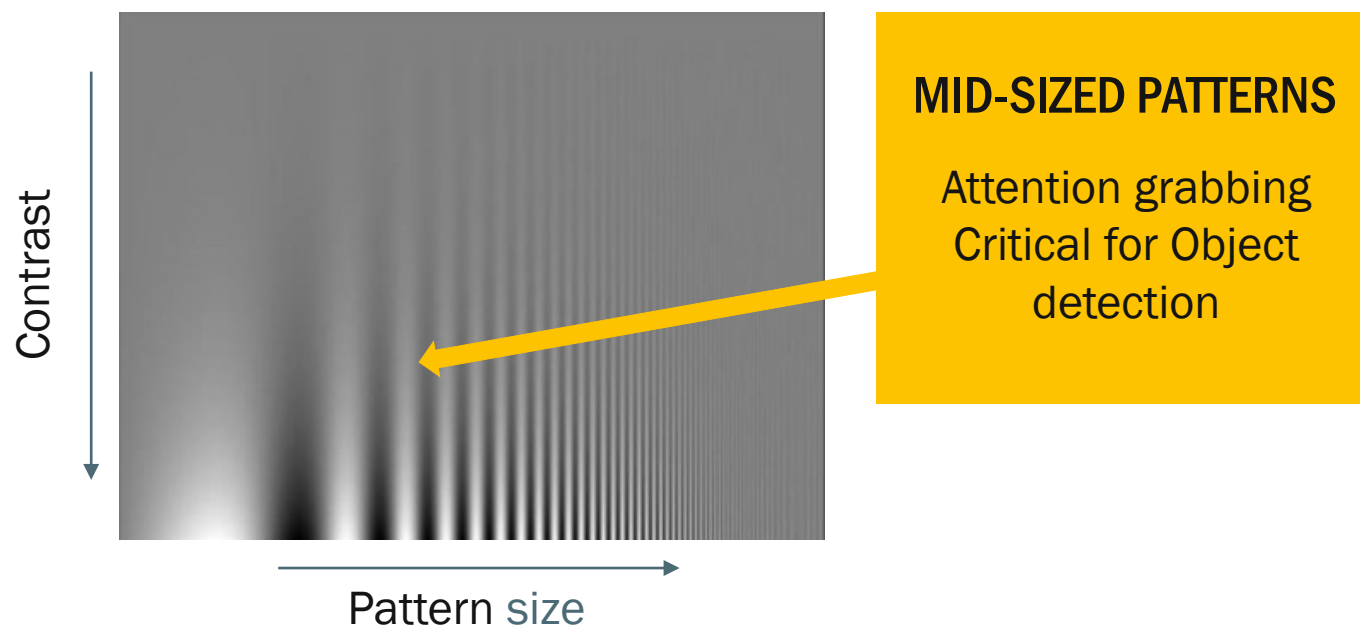
DYNAMIC STRENGTH



GREYSCALE CONTRAST AND MOTIF VISIBILITY

High greyscale contrast speeds brain processes.

But this effects varies with pattern size.



Humans are more sensitive to mid-sized motifs or shapes than to small details under low contrast.

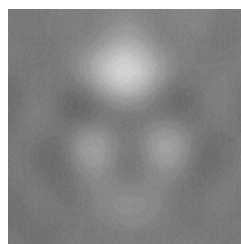
GREYSCALE CONTRAST

PerceptNote®'S CONTRAST ANALYSIS

Fourier decomposition is used to measure contrast at each spatial scale.



Greyscale
image



Mid-sized
scale



Small
scale



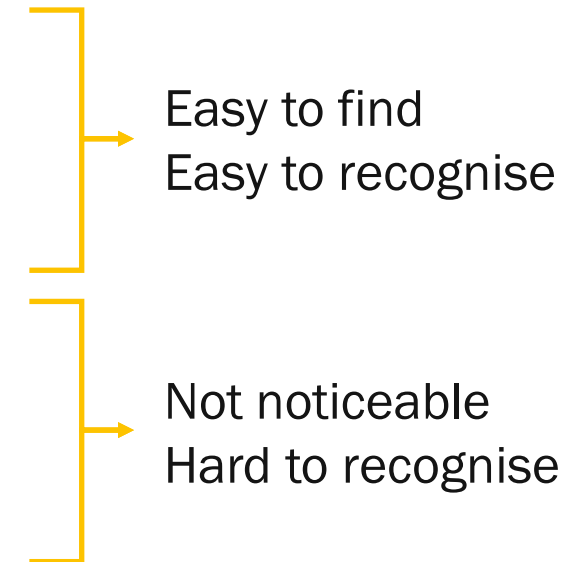
Critical metric : Mean mid-sized contrast.

GREYSCALE CONTRAST

Mean greyscale mid-sized contrast for each feature.

GREYSCALE CONTRAST

Mean greyscale mid-sized contrast for each feature.



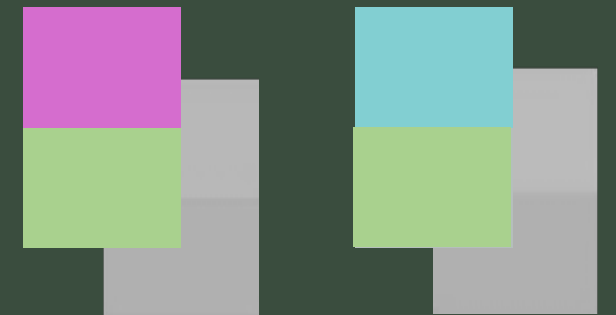
WHY IS COLOUR CONTRAST IMPORTANT?



| Children watch Andy Pandy in 1950

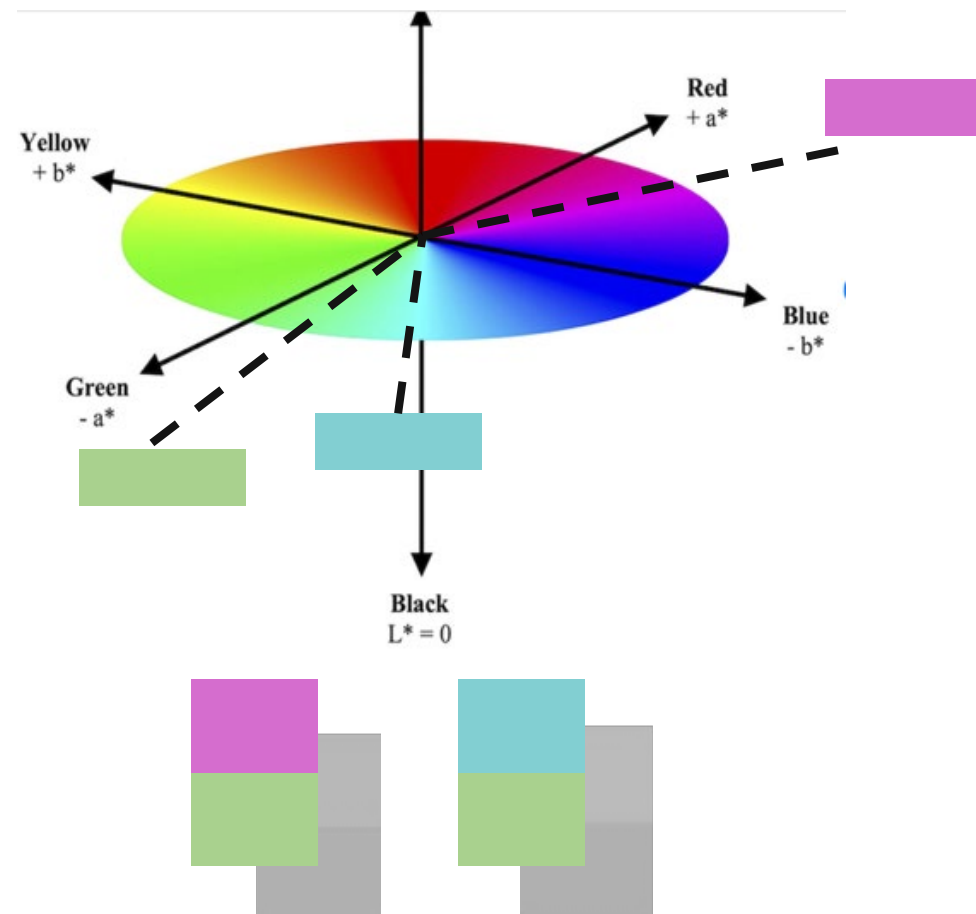
COLOUR CONTRAST SPEEDS OBJECT RECOGNITION

- Enhances object perception.
- Amplifies mental engagement



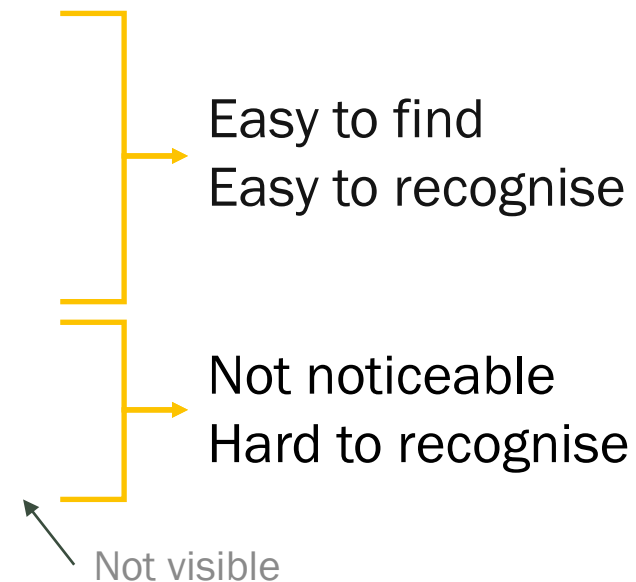
PerceptNote®'S COLOUR ANALYSIS:

- Every pixel is plotted in 'colour space'.
- Hue 'angles' index colour contrast. Large angles indicate high colour contrast



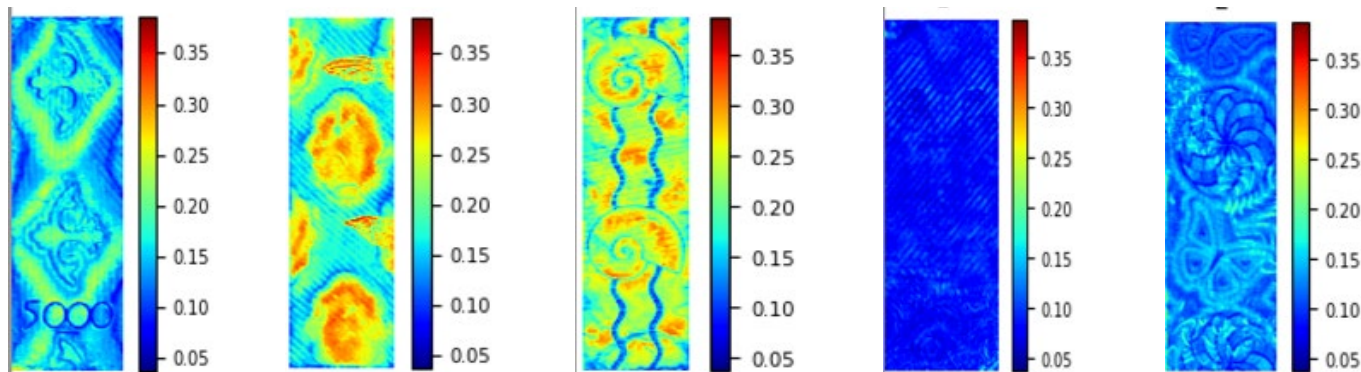
PerceptNote®'S COLOUR ANALYSIS:

Monochromatic features have significantly lower colour contrast, as expected.



PerceptNote® QUANTIFIES DYNAMIC STRENGTH

- Light variation in each pixel was analysed across 21 angles of tilt.
- Dynamic maps show magnitude of change at each location.
- **Dynamic Strength:** a summary metric of light changes induced by tilt.



Red and orange regions indicate strong dynamic effects.

KZT

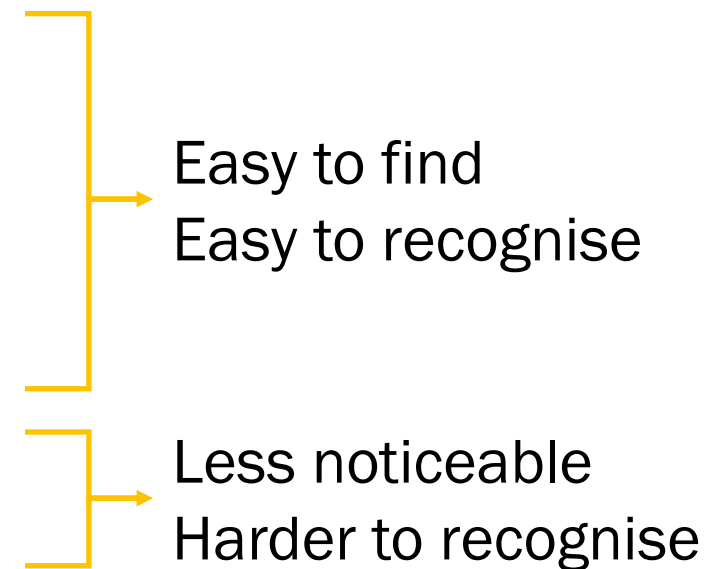
Octopus

Jellyfish

Brazil

Butterfly

PerceptNote® QUANTIFIES DYNAMIC CHANGE



COMPOSITE RELATIVE SCORE

THREE METRICS COMBINED:

Greyscale contrast

Colour contrast

Dynamic strength

Max score = 3.0

PerceptNote® metrics show clear differences in perceptual functionality of different features and reveal areas for improvement.

SUMMARY OF THE STUDY

- **PerceptNote®** compared 5 different micro-lens security features.
- **PerceptNote®** quantified each design's perceptual strength in terms of
 - **Motif pattern**, by measuring **greyscale contrast**,
 - **Colour**, by measuring **colour contrast**
 - **Movement**, by measuring **dynamic strength**.
- Results provide clear, objective measures of the perceptual functionality of each feature and allow direct comparisons.
- **PerceptNote®** provides a useful tool for the assessment of security features.

PAST

PerceptNote® grew out of decades of experience, is based on sound science, and has been properly validated using traditional perception study data.

PRESENT

PerceptNote® services are currently being used by several large central banks for assistance in new banknote design development and for studies of wear on perception. It is being used to assess a wide range of OVD technology.

FUTURE

PerceptNote® offers an important path forward for establishing international standards and specifications for security features and banknotes.

THANK YOU!

Please contact us anytime for information about assessment of your security features or banknotes

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