

# COGNITIVE PROFILES (CogPro)

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Before we start, we want to thank NIST and the FBI for funding this project. Without them, this project would not be possible – **THANK YOU!**

# COGNITIVE PROFILES

- What are they.
- What are they good for.
- How do you develop & validate them.
- What we have done so far on this project.
- What still needs to be done.
- The future.
- (questions)

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# What are cognitive profiles?

- Unique and specific set of cognitive abilities and skills that experts need in order to perform their work (well).
  1. Individual's ability
  2. Abilities needed to do the job
  3. The fit between them!

# What are cognitive profiles?

Journal of Applied Psychology  
1993, Vol. 78, No. 5, 763–773

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0021-9010/93/\$3.00

## Visual–Spatial Abilities of Pilots

Itiel E. Dror, Stephen M. Kosslyn, and Wayne L. Waag

U.S. Air Force pilots and control subjects participated in five experiments, each of which assessed a different type of visual–spatial ability. Although pilots judged **metric spatial relations** better than did nonpilots, they did not **judge categorical spatial relations** better than did nonpilots. Pilots mentally rotated objects better than did nonpilots, but pilots did not extrapolate motion, scan images, or extract visual features from objects obscured by visual noise better than did nonpilots. The results imply that efficient use of specific processing subsystems is especially important for, and characteristic of, pilots. The possible neuropsychological bases for the enhanced abilities and their susceptibility to change are discussed.

Different professions require different abilities. This is obvious when one considers what distinguishes accountants from interior decorators, but the observation applies to all specialized professions. The special abilities may develop on the job through training and practice or may be brought into the job

form complex—and yet, flexible—information processing. Knowledge of the neuroanatomy of the brain and of how brain damage selectively affects cognitive functioning is crucial for understanding these different subsystems. In a similar way, computational models provide important hints about the nature of

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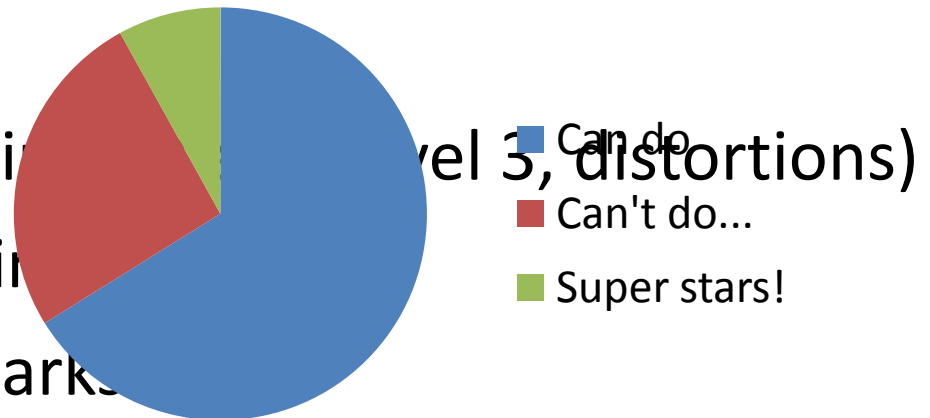
# What are cognitive profiles good for?

- Recruitment
  - Minimal ability (doing yourself and them a big favour!)
  - Distinguish and rank candidates
  - ‘Super stars’

- Specialization
  - Within latent fingerprints
  - Across forensic domains

- Training targets/benchmarks

- Job performance



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# How do you develop & validate cognitive profiles?

- Scientifically!!
- Combined methodology:
  - Survey (in forensic and other domains)
  - Interviews
  - Job/task analysis
  - Experimental field data collection, and...
  - Cross-validation!

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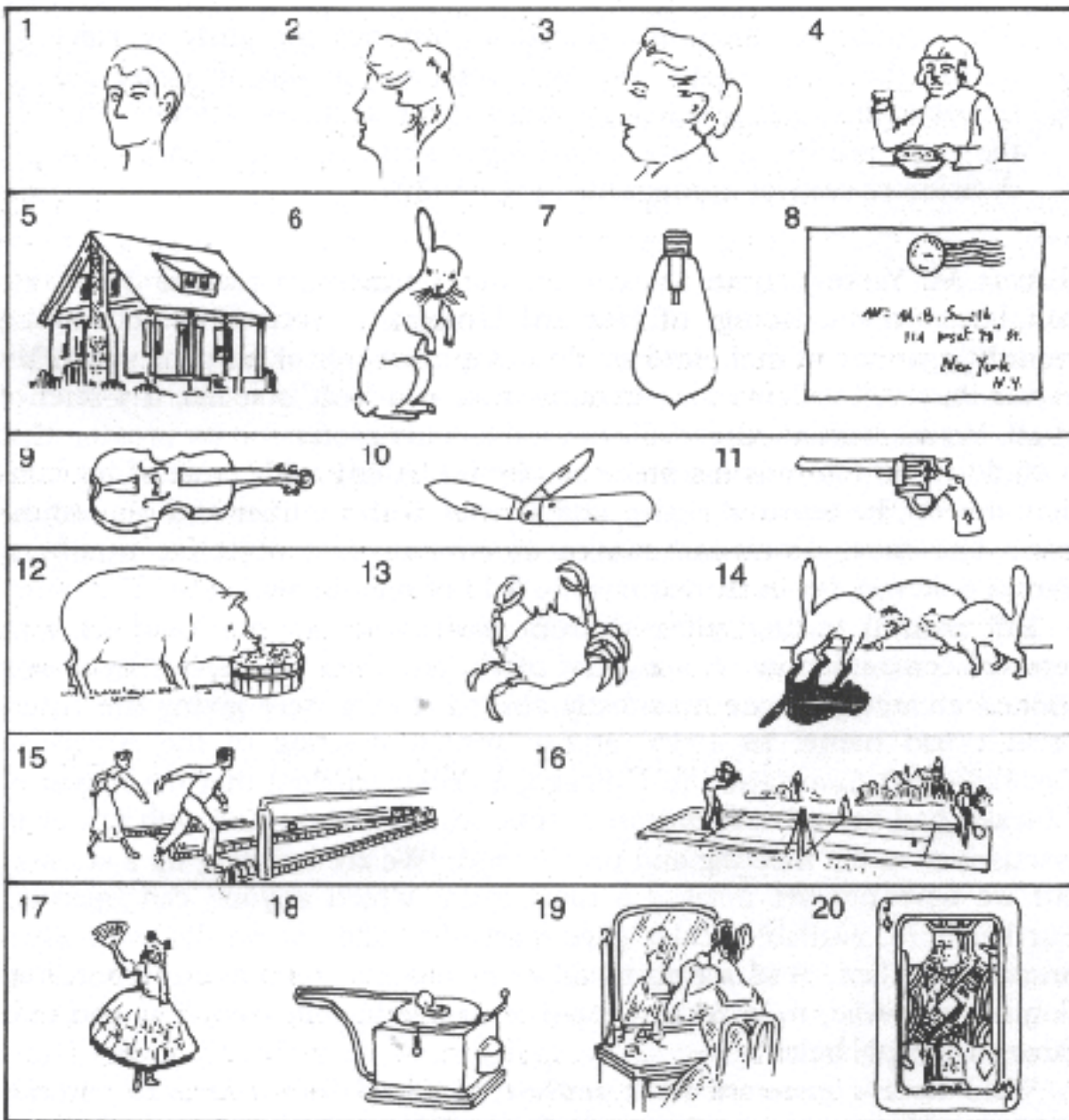
# What we have done so far on this project?

- Survey

# Survey

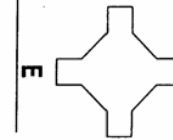
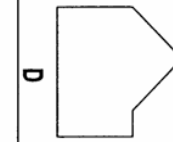
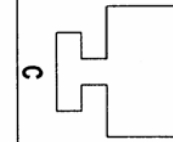
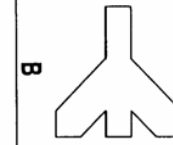
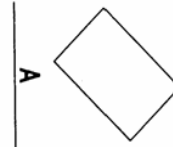
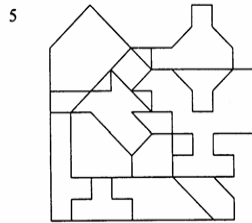
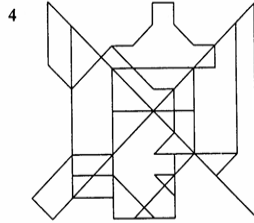
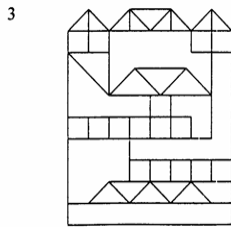
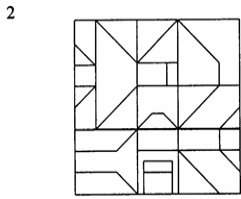
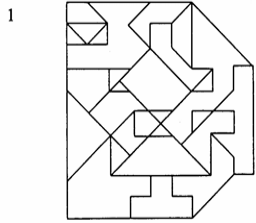
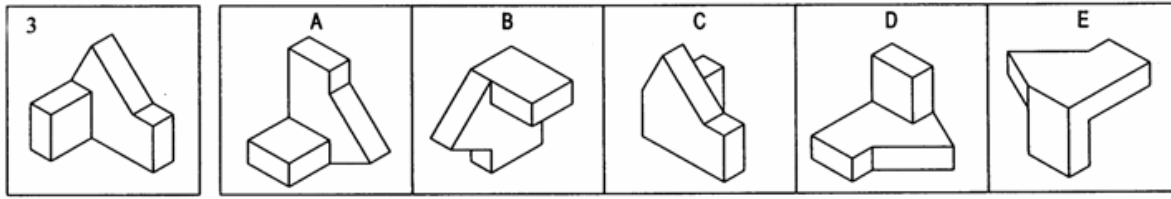
- A long history.





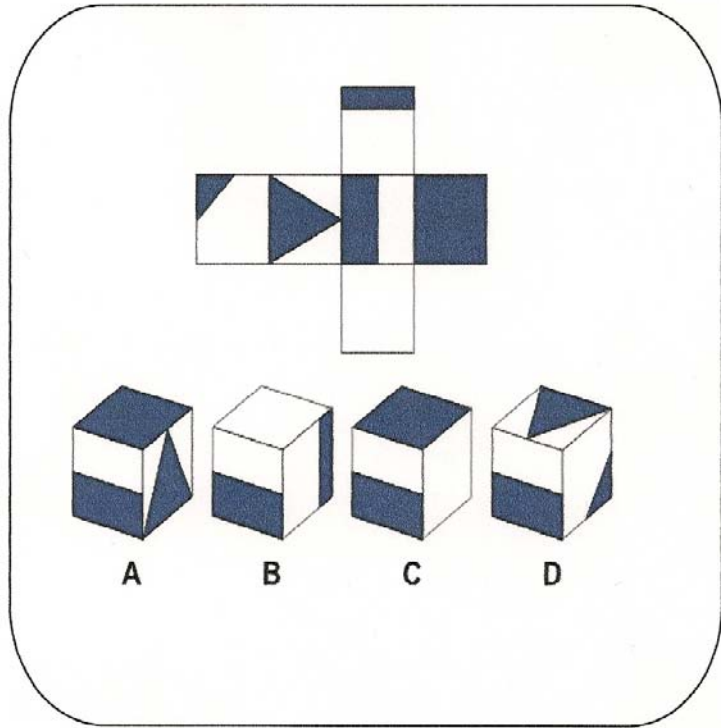
# Survey

- A long history.
- Most professions have specific cognitive testing
  - Astronauts
  - Pilots
  - X-ray security screeners at airports
  - Air traffic controllers



# Survey

- A long history.
- Most professions have specific cognitive testing.
- But not much in fingerprinting....
  - General, scientific & validated tests, but not specific or suitable to fingerprinting



A

B

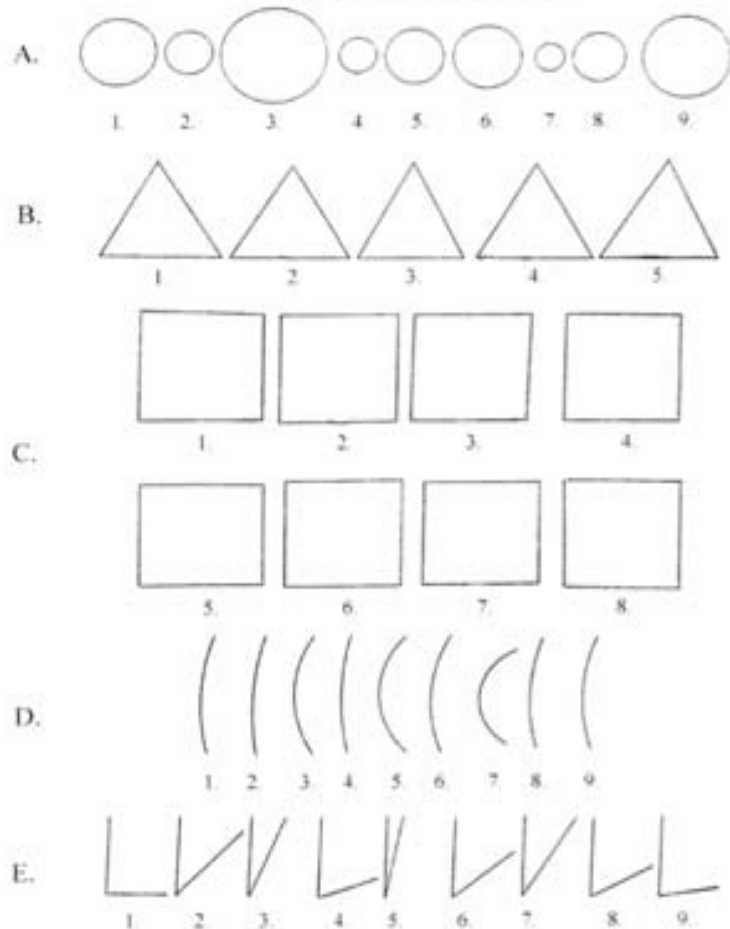
C

D

# Survey

- A long history.
- Most professions have specific cognitive testing.
- But not much in fingerprinting....
  - General, scientific & validated tests, but not specific or suitable to fingerprinting
  - Specific for fingerprinting, but not scientific or validated tests...
  - Or, an old and inappropriate test, e.g. Form Blindness

## FORM BLINDNESS TEST



- The test was developed in 1939...
- Built to test defects, not to quantify special abilities.
- It lacks proper validation even within the area it was designed for i.e., document examination.

# What we have done so far on this project?

- Survey
- Interviews



# Interviews

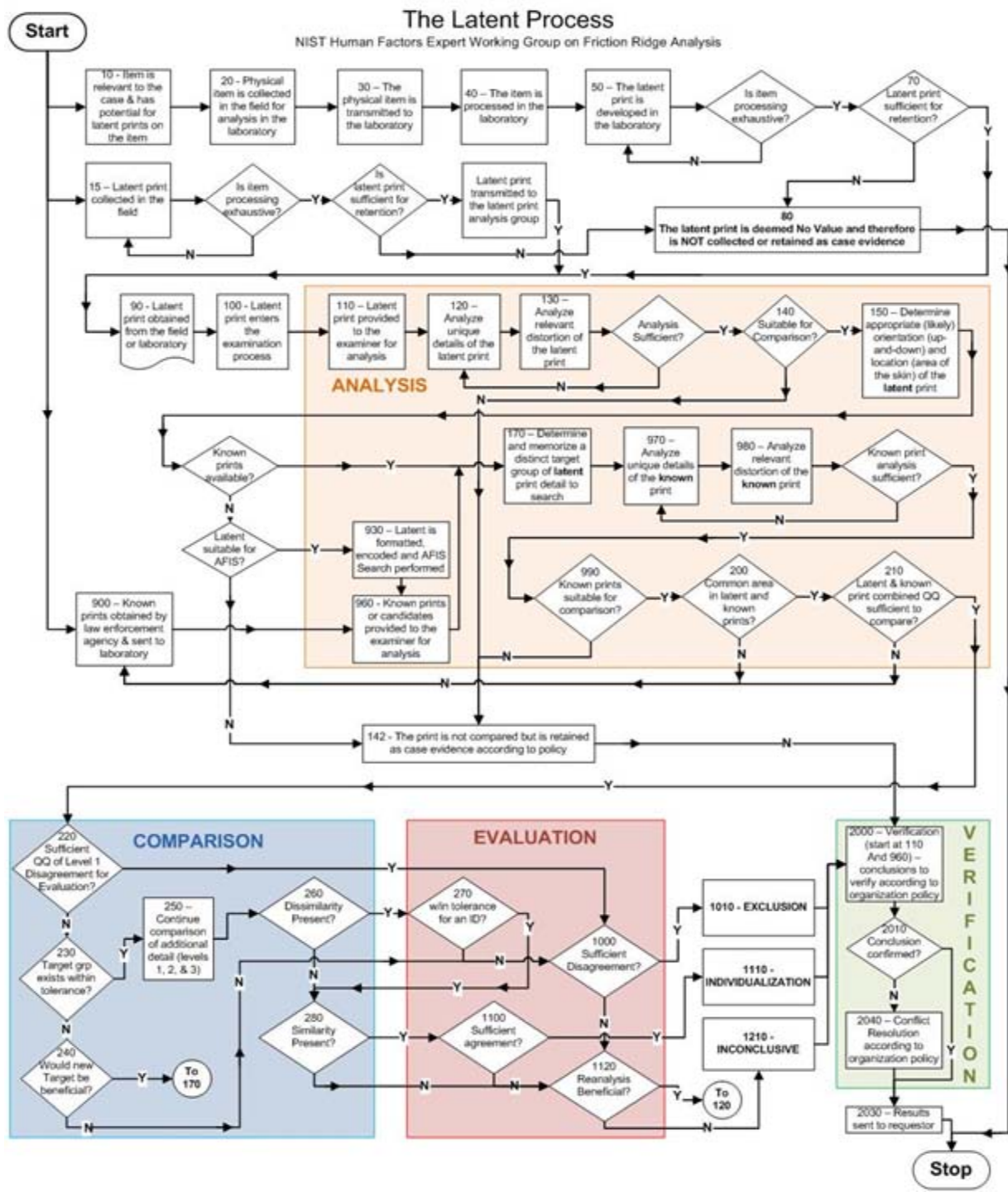
- Conducted 40 interviews
  - LPE
  - Managers
  - Trainers

# What we have done so far on this project?

- Survey
- Interviews
- Task analysis

# The Latent Process

NIST Human Factors Expert Working Group on Friction Ridge Analysis



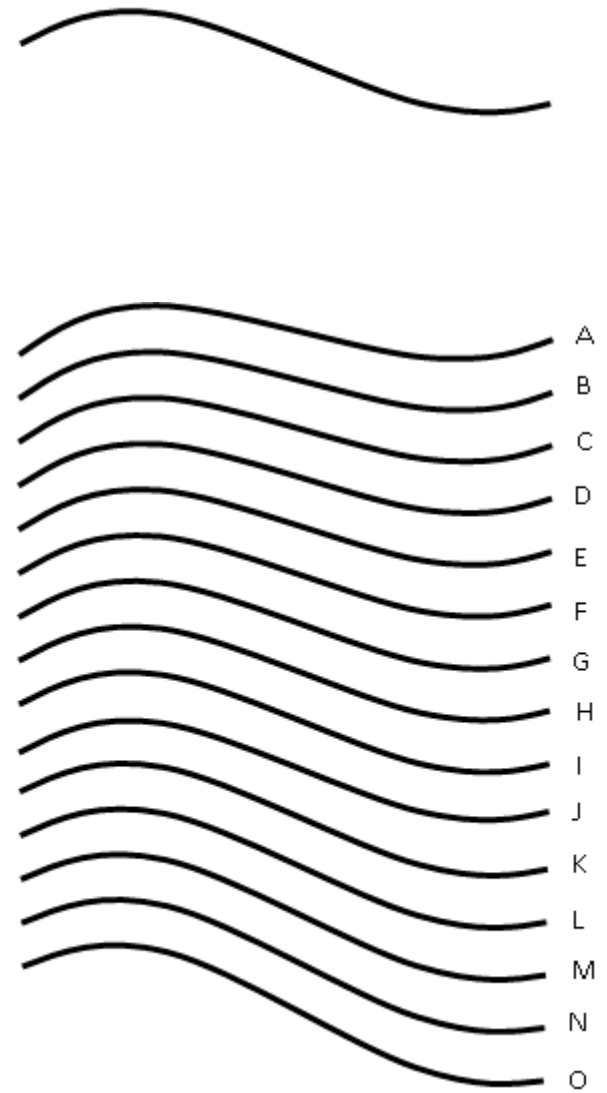
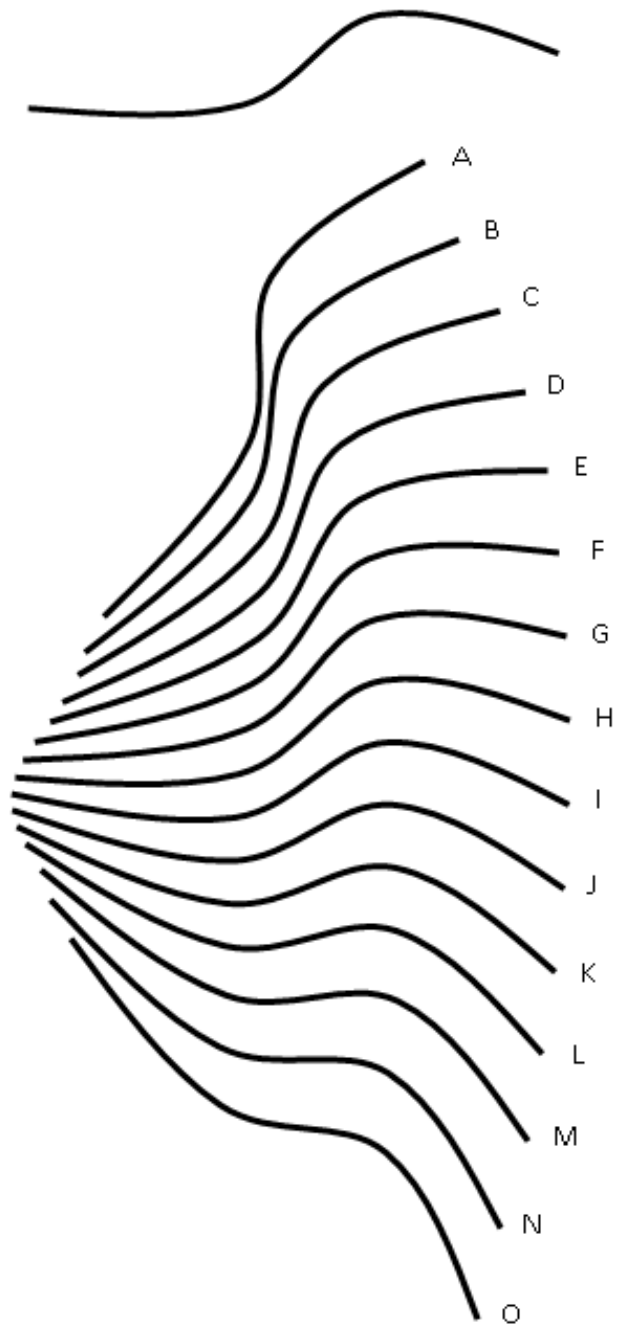
# What we have done so far on this project?

- Survey
- Interviews
- Task analysis
- Experimental field data collection measuring and quantifying the actual existence of specific profile elements -- (ongoing).

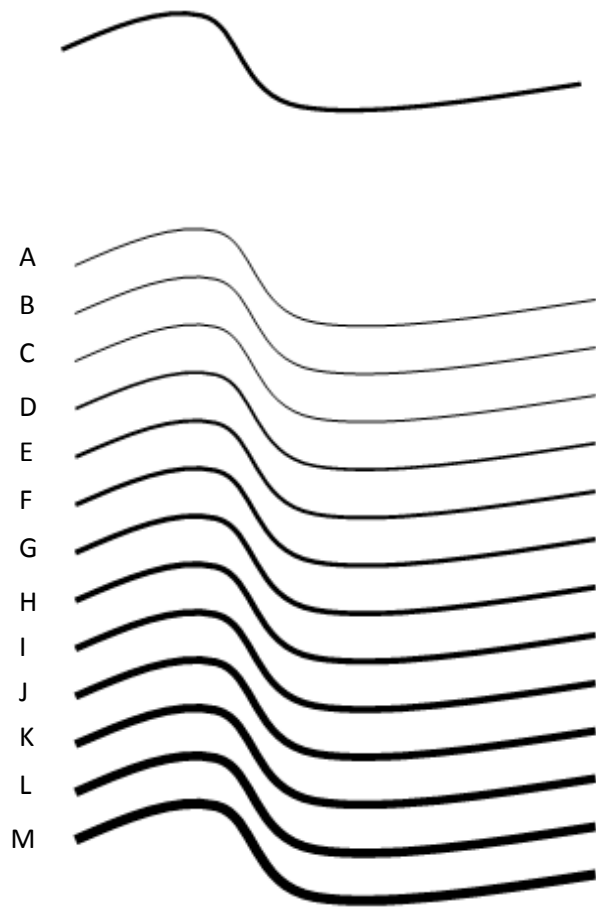
# Test for cognitive profile

- PPCAA- ability to perceive curvatures
- PPWAA- ability to perceive width
- JARSC- ability to judge rotations and conduct visual search
- JAFAA- ability to judge and compare features
- JAPQF- ability to detect if a small pattern is present within a larger pattern
- JAPRF- ability to use visual mental rotation
- JATQA- ability to follow ridge lines
- JADAA- ability to deal with distortions
- JADQA- ability to make judgements with poor quality images
- JAFAN- ability to separate superimposed images
- JAFBN- ability to filter out background noise

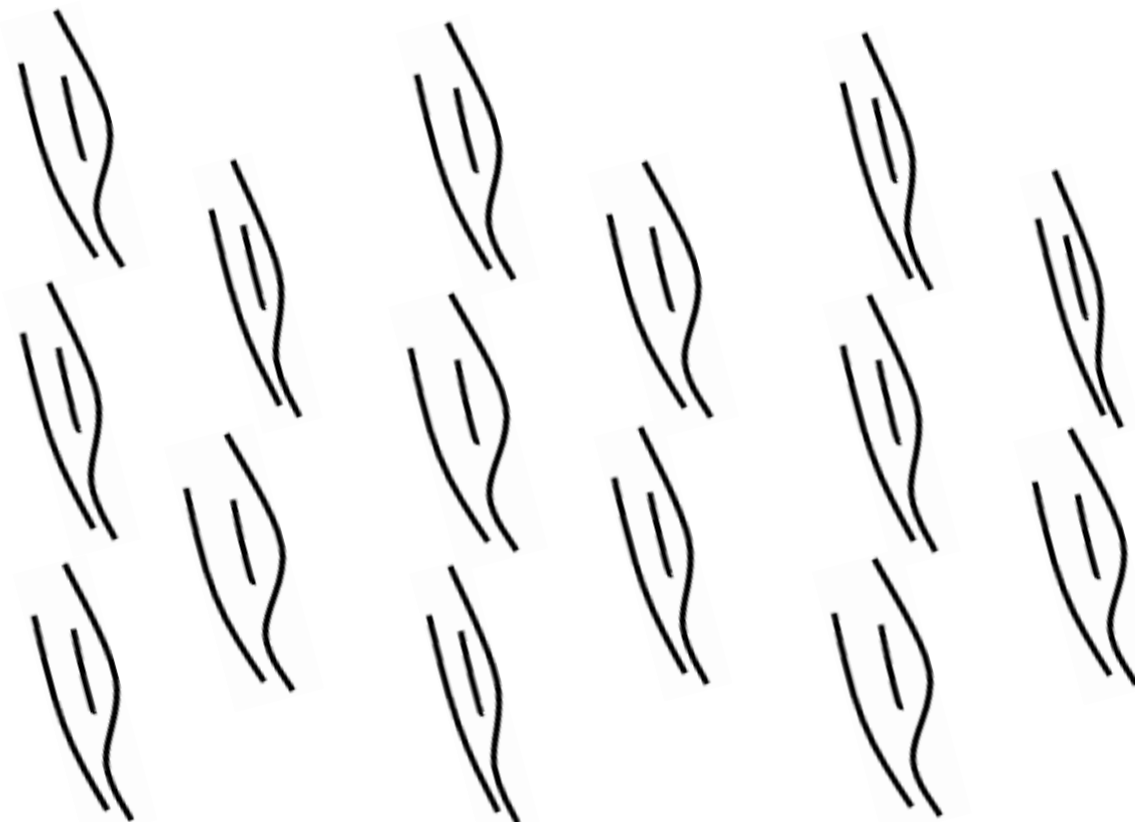
# PPCAA- ability to perceive curvatures



# PPWAA- ability to perceive width

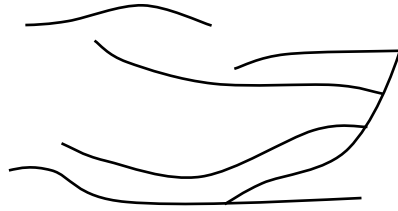
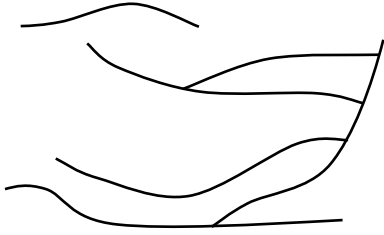


# JARSC- ability to judge rotations and conduct visual search

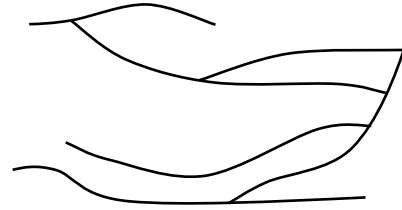




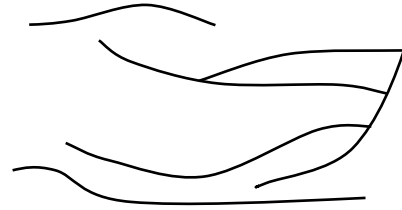
# JAFSA- ability to judge and compare features



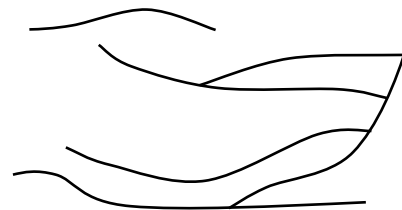
A



B



C

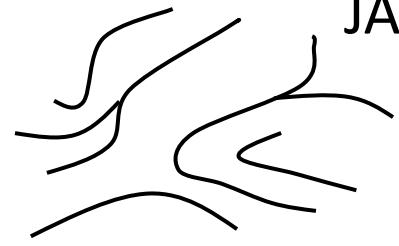


D

**None of the above**

E

JADQA- ability to make judgements with poor quality images



A



B



C

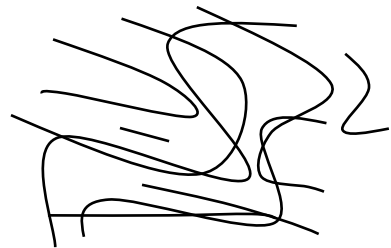
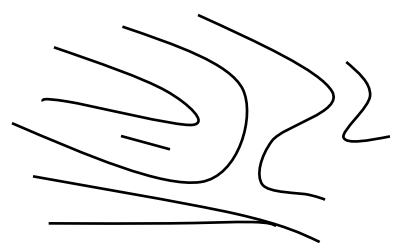


D

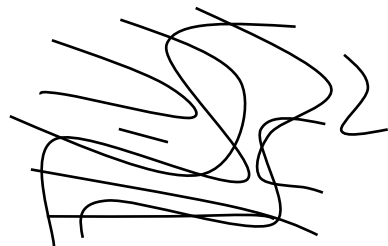
None of the above

E

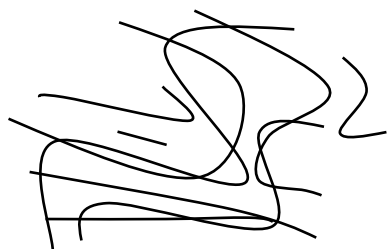
JAFAN- ability to separate superimposed images



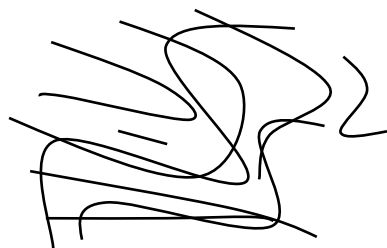
**A**



**B**



**C**

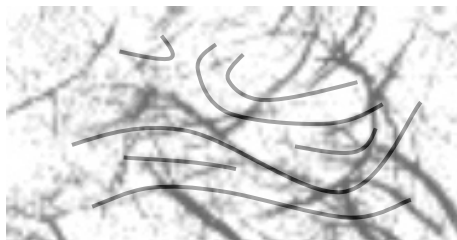
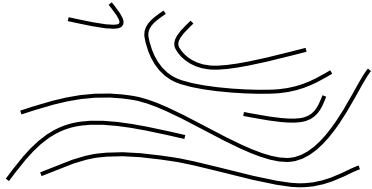


**D**

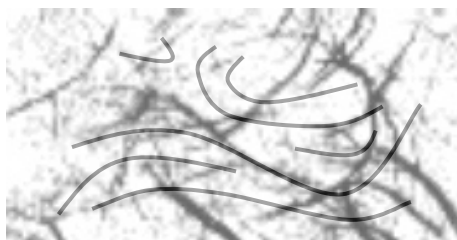
**None of the above**

**E**

# JAFBN- ability to filter out background noise



**A**



**B**



**C**

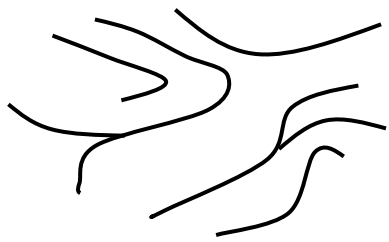


**D**

**None of the above**

**E**

JADAA- ability to deal with distortions



A



B



C



D

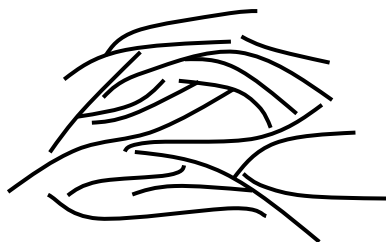
None of the above

E

JAPQF- ability to detect if a small pattern is present within a larger pattern



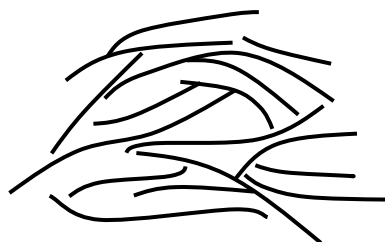
A



B



C



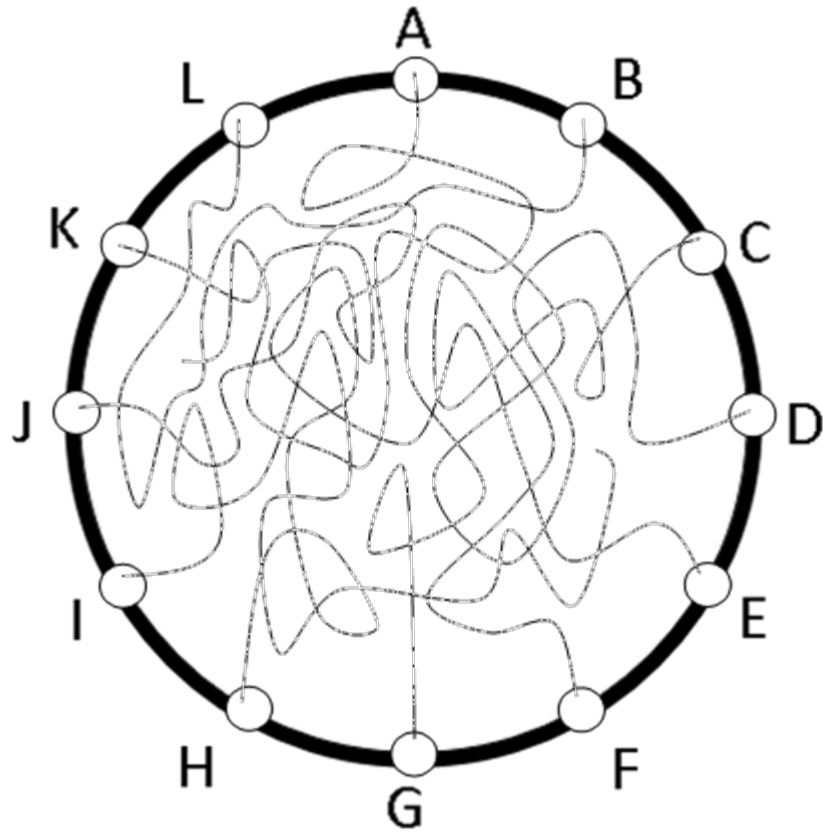
D



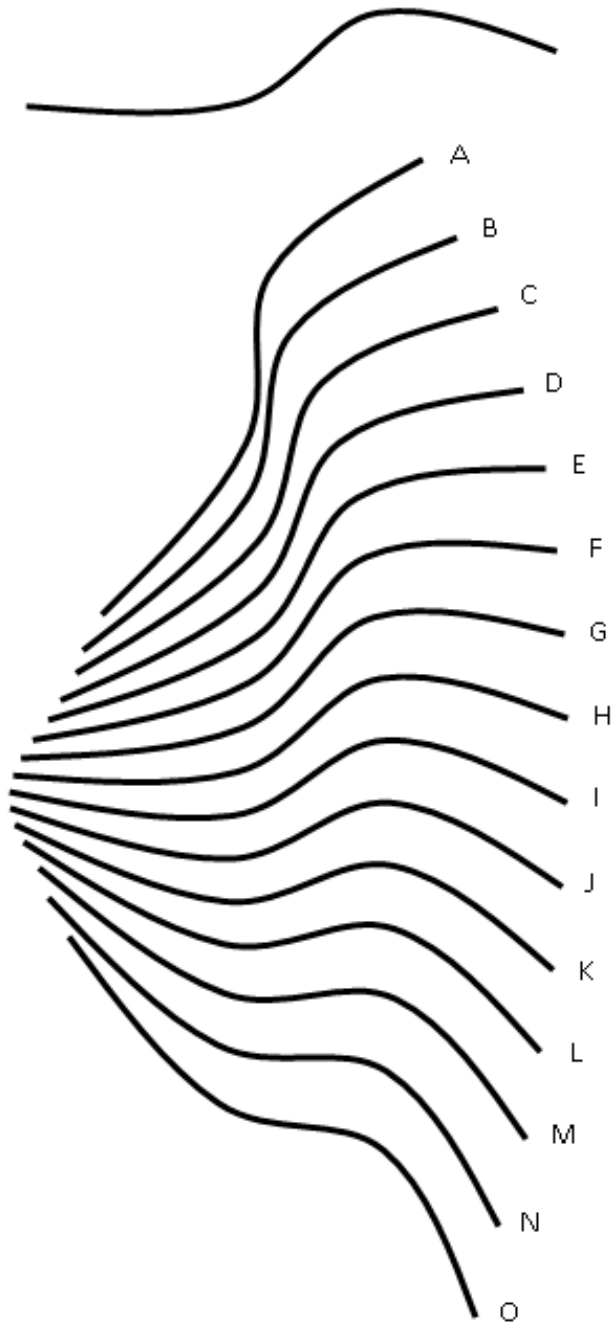
E

None of the above

# JATQA- ability to follow ridge lines

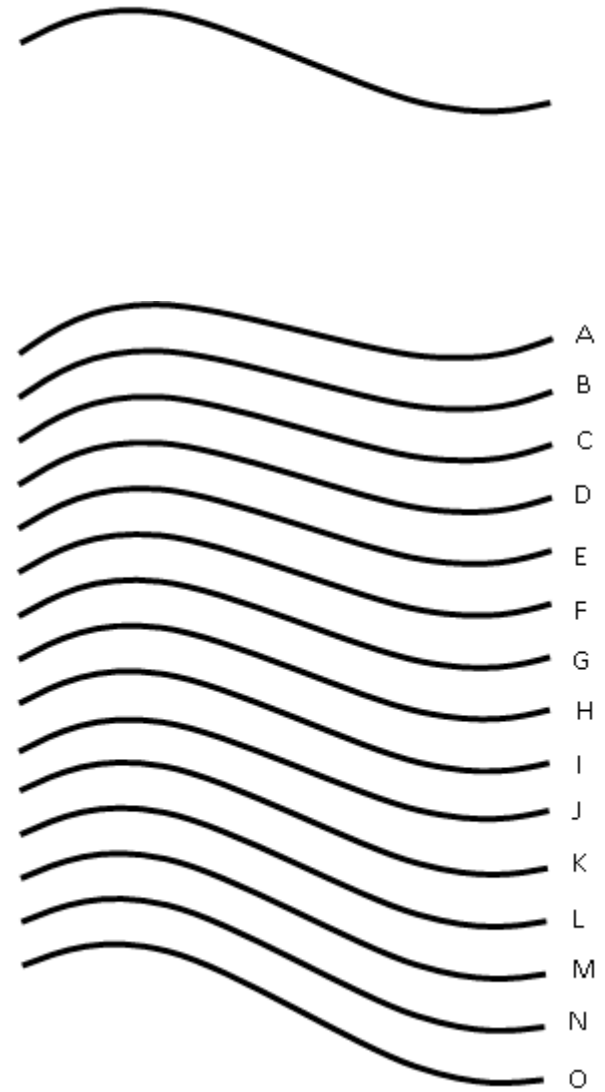


# PPCAA- ability to perceive curvatures

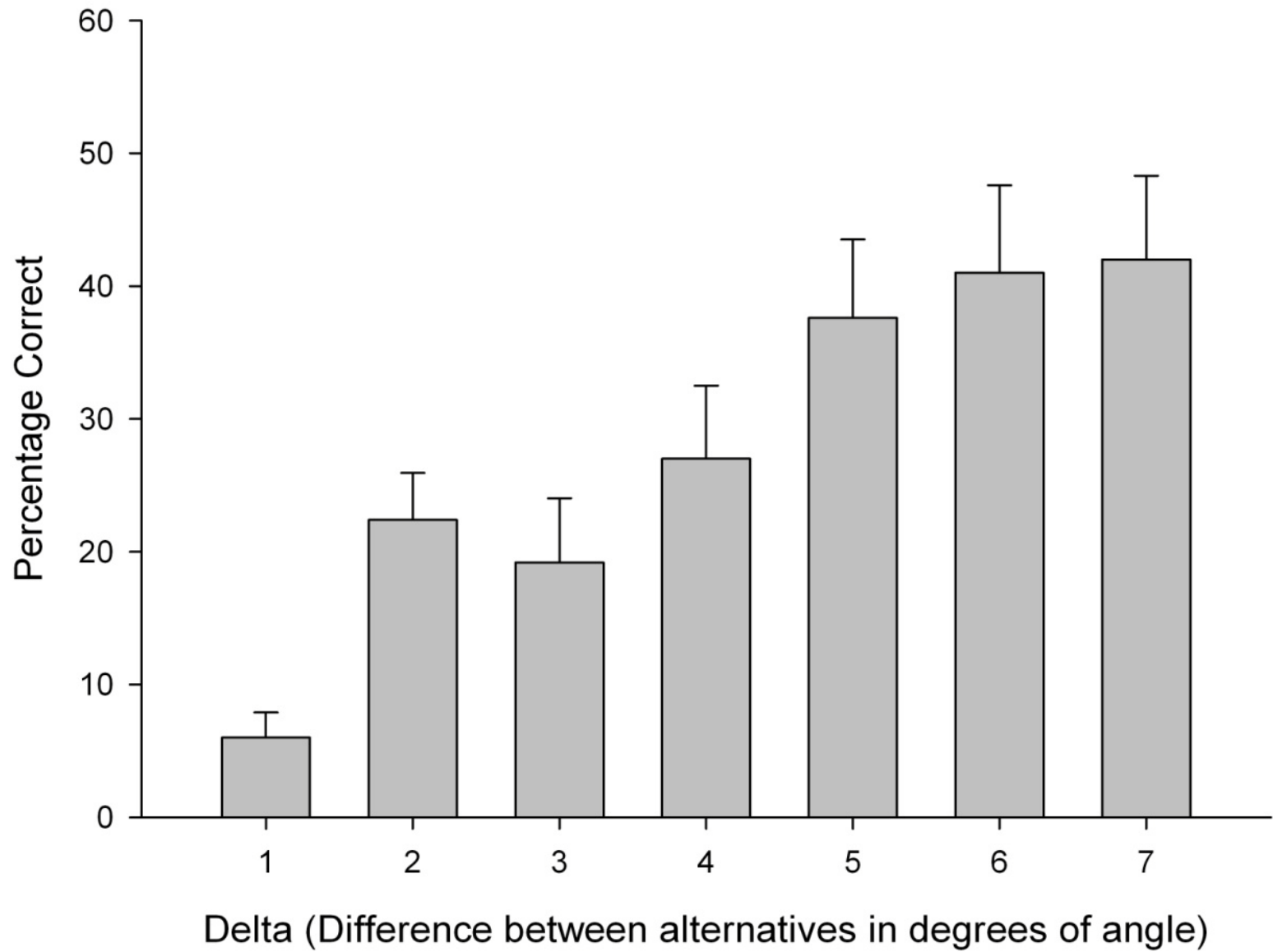


*Remember?*

*Some Data!*







Scoring: **10** points for a correct, **5** points when off by 1 line, 0 points when off by two, **-5** points when off by three, and... **-10** points when off by more than three (4+).

Participant	Profession	Age	Gender	Delta1	Delta2	Delta3	Delta4	Delta5	Delta6	Delta7	Total
118	f	35	M	22	35	50	50	45	50	45	297
110	n	20	M	18	26	35	40	31	50	45	245
116	p	53	M	8	31	30	45	35	40	45	234
114	n	22	F	11	35	25	40	45	45	31	232
107	n	29	F	1	18	40	35	41	35	50	220
103	p	33	M	-1	25	31	26	36	50	50	217
122	n	44	F	11	22	30	40	45	40	26	214
119	n	27	M	-5	40	26	35	40	35	40	211
105	p	26	M	2	9	21	17	31	45	40	165
113	f	22	F	-7	-15	22	26	45	40	36	147
121	p	44	F	-10	8	17	21	35	30	36	137
111	n	21	M	-11	7	25	26	36	25	25	133
109	n	37	F	-7	21	12	17	6	24	20	93
108	n	26	F	7	25	1	20	20	11	0	84
117	n	22	M	-9	14	-6	11	18	14	40	82
115	n	46	F	1	4	-1	19	19	-5	16	53
104	n	30	F	-5	10	1	-1	-11	11	17	22
112	f	28	F	-10	5	-7	-6	-17	10	13	-12
106	p	38	M	1	-5	9	-4	-13	2	-3	-13
101	p	47	M	-15	4	0	-15	5	21	-15	-15
100	n	24	F	6	4	-15	-11	10	0	-11	-17
123	n	17	F	-17	15	-21	-25	-3	11	19	-21
124	n	14	M	-9	-1	-5	6	0	-6	-15	-30
102	f	49	M	-3	9	4	-19	0	-15	-19	-43
120	f	36	M	-10	-15	-4	-15	-21	-15	14	-66

**Average Total Score 102.76**

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## What still needs to be done?

- Collect more data
  - We have already collected data from 136! 😊
  - Plan to collect much more!!!
- Cross validate
- Develop tests
- Get feedback from all stakeholders
- Refine and finalize tests

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## The future?!

- Wide use, but...:
- Costs
- Time
- Complexity

### → **Web-based testing**

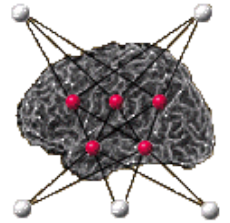
- Solves all the above, PLUS:
- Staircase testing
- Timed testing
- Feedback, data, updating.



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