Basics of Fitts' Law

Schwind, V., Mayer, S., Comeau-Vermeersch, A., Schweigert, R., & Henze, N. (2018). Up to the Finger Tip: The Effect of Avatars on Mid-Air Pointing Accuracy in Virtual Reality. CHIPLAY.

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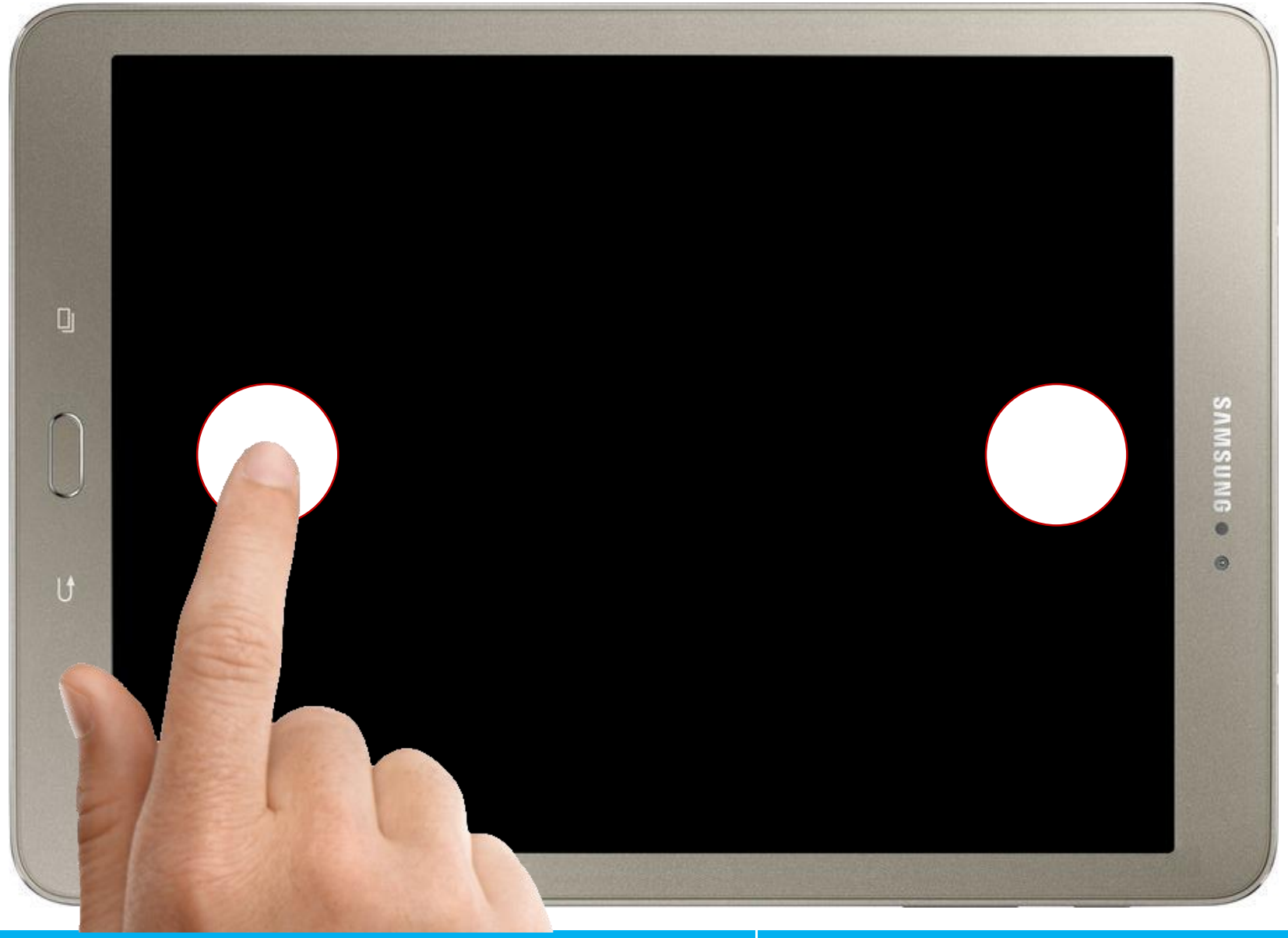
Learning Goals

- Now the purpose of Fitts' Law
- Can determine the index of difficulty for pointing tasks
- Be able to determine the device-specific constants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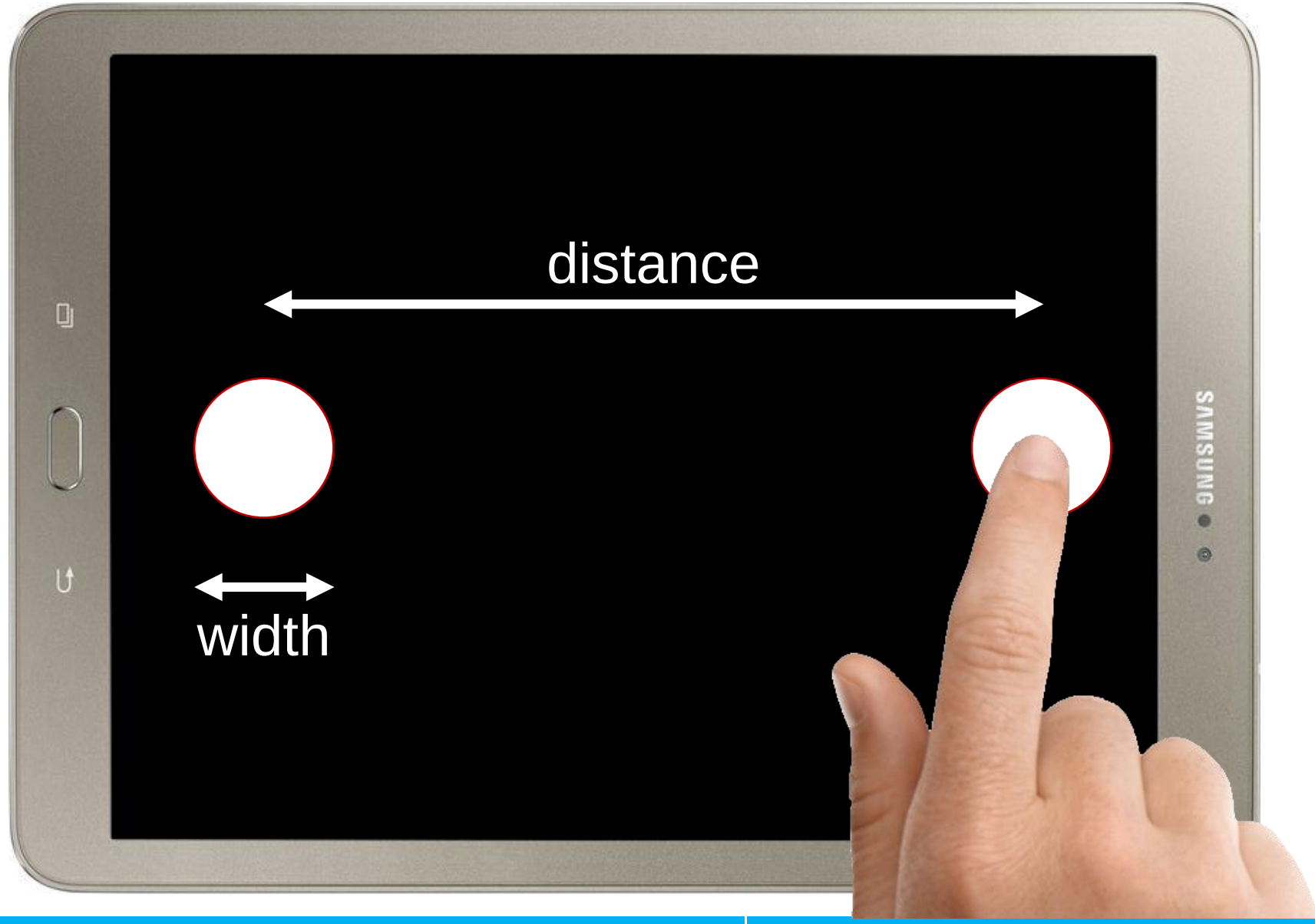
distance
width
SAMSUNG

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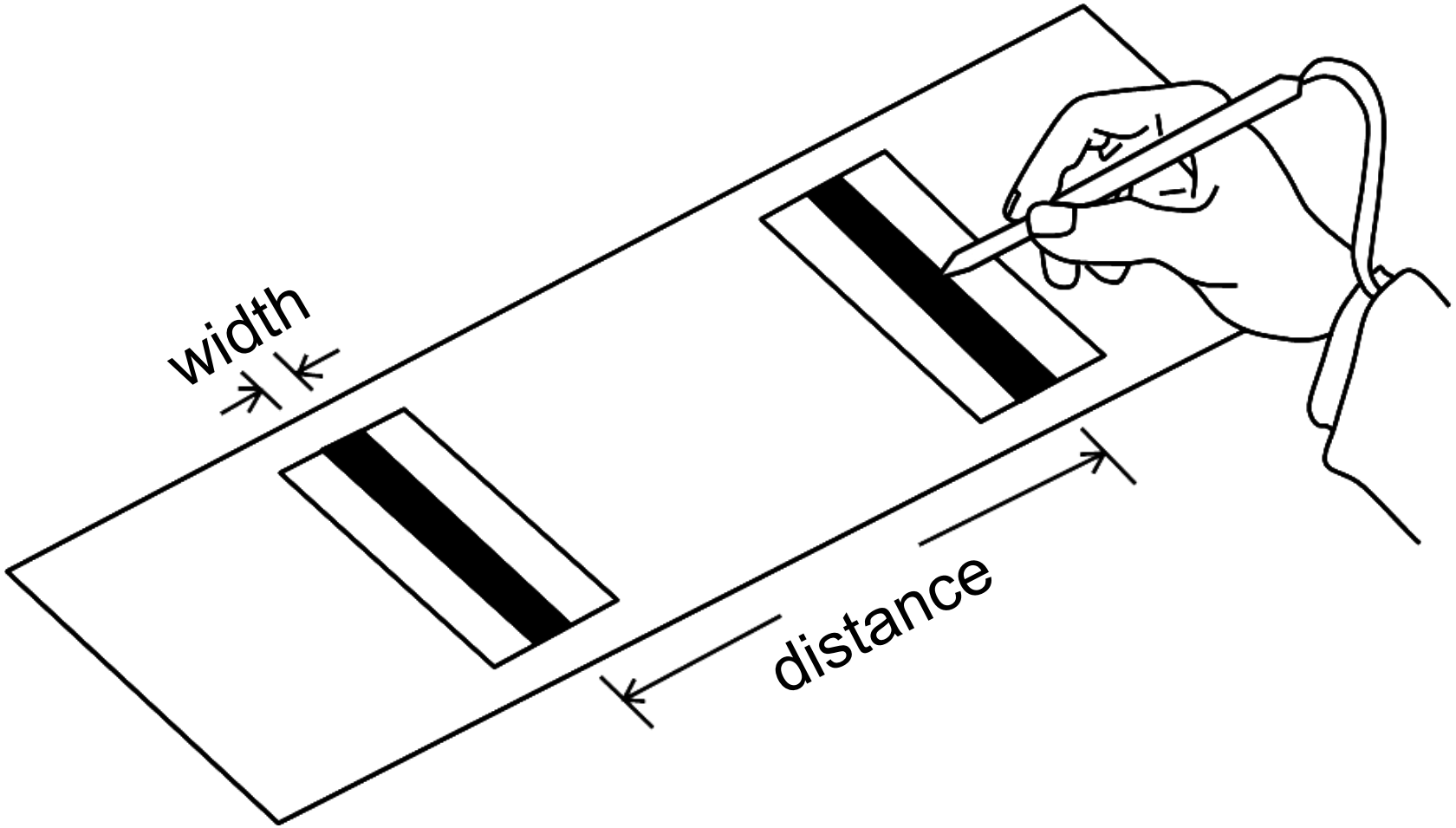
From: Fitts, P. M. (1954). The information capacity of the human motor system in controlling the amplitude of movement. Journal of experimental psychology, 47(6), 381.



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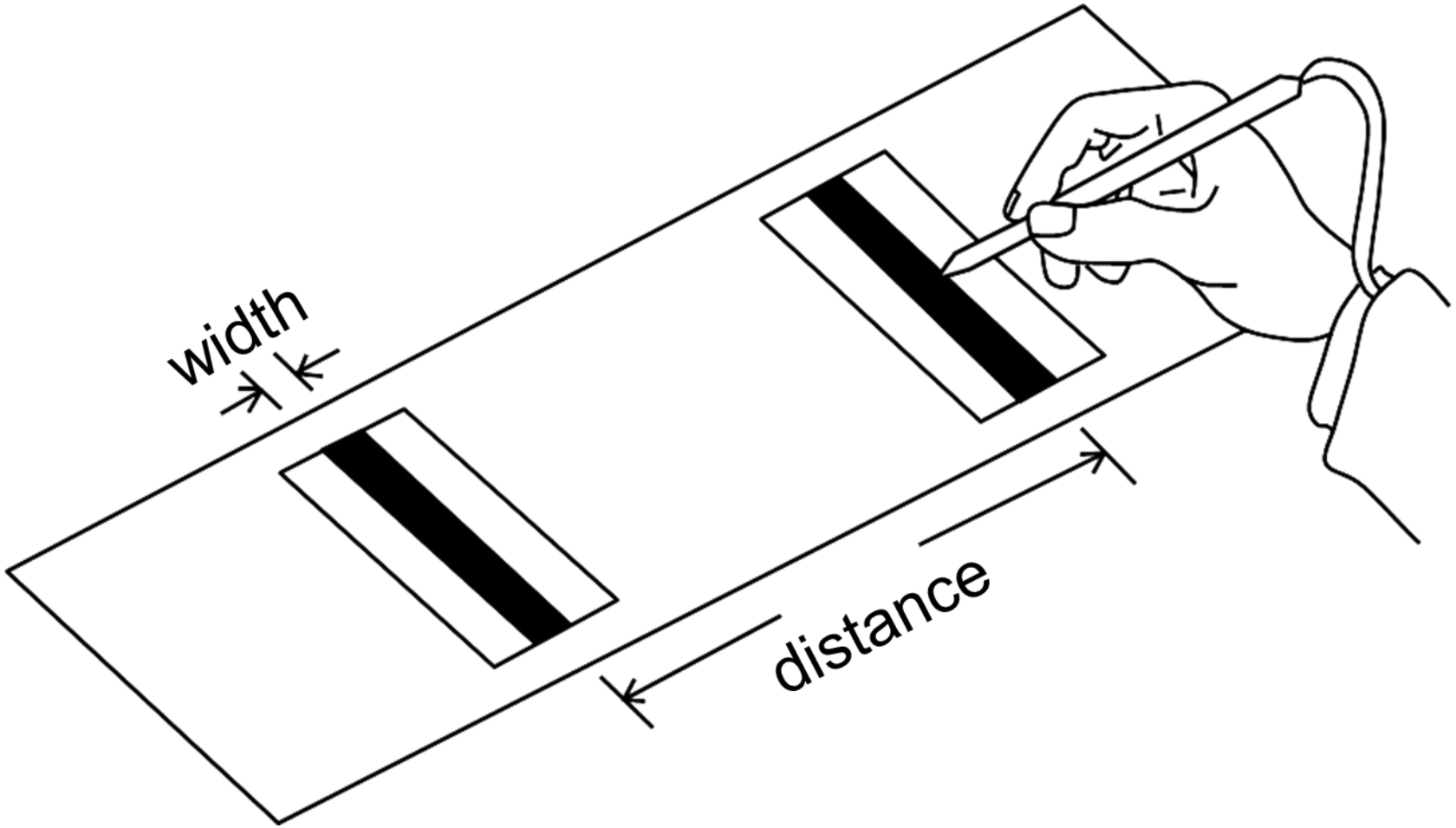

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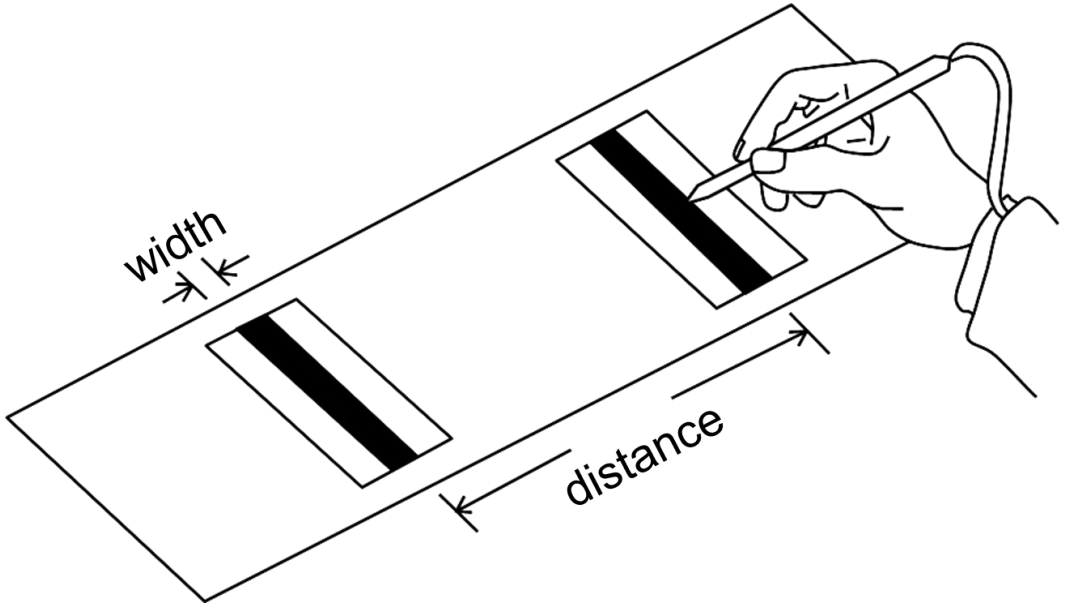

Four distances:

- 2, 4, 8, 16 inch

Four widths:

- 0.25, 0.5, 1.0, 2.0 inch

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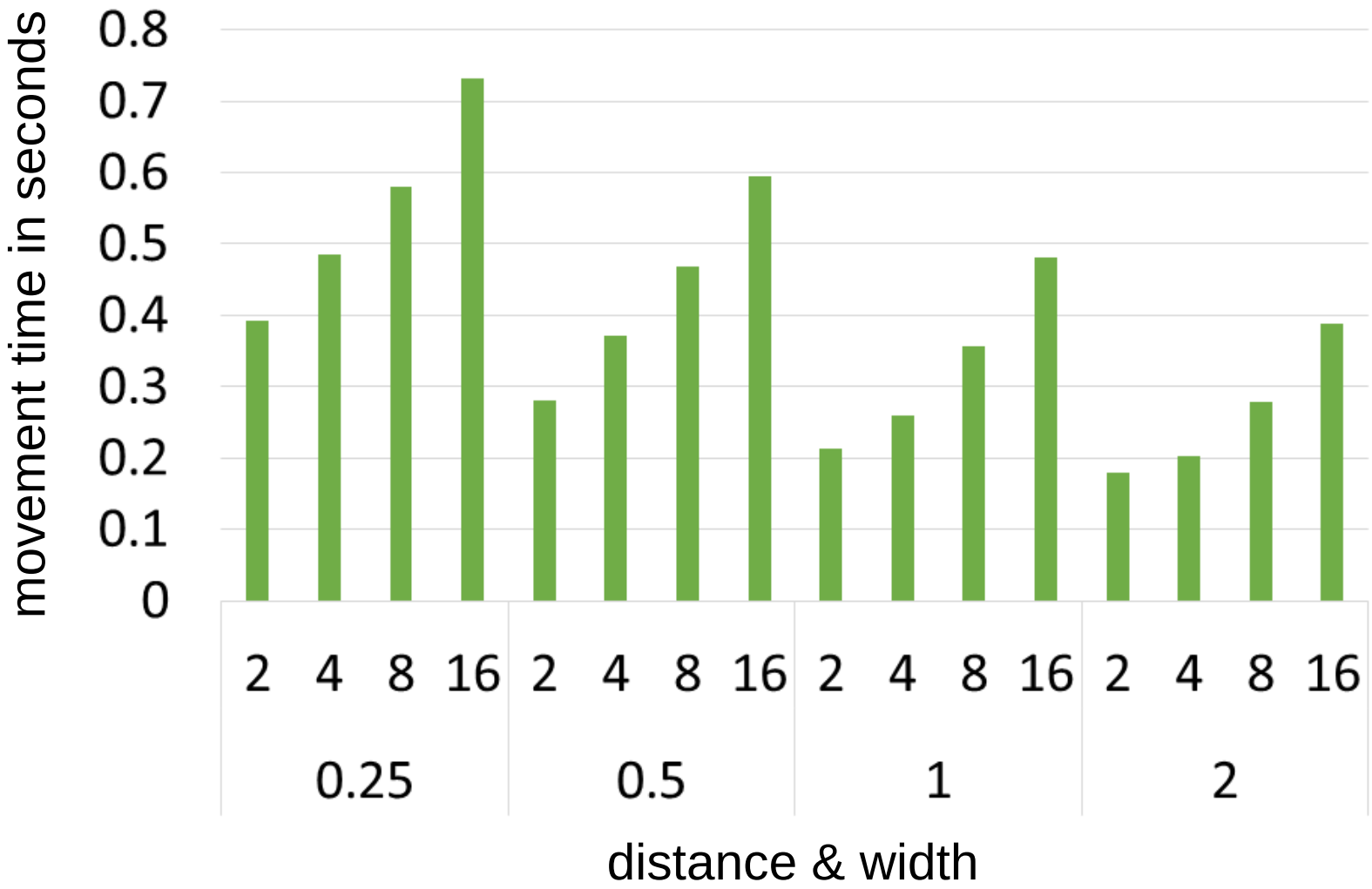

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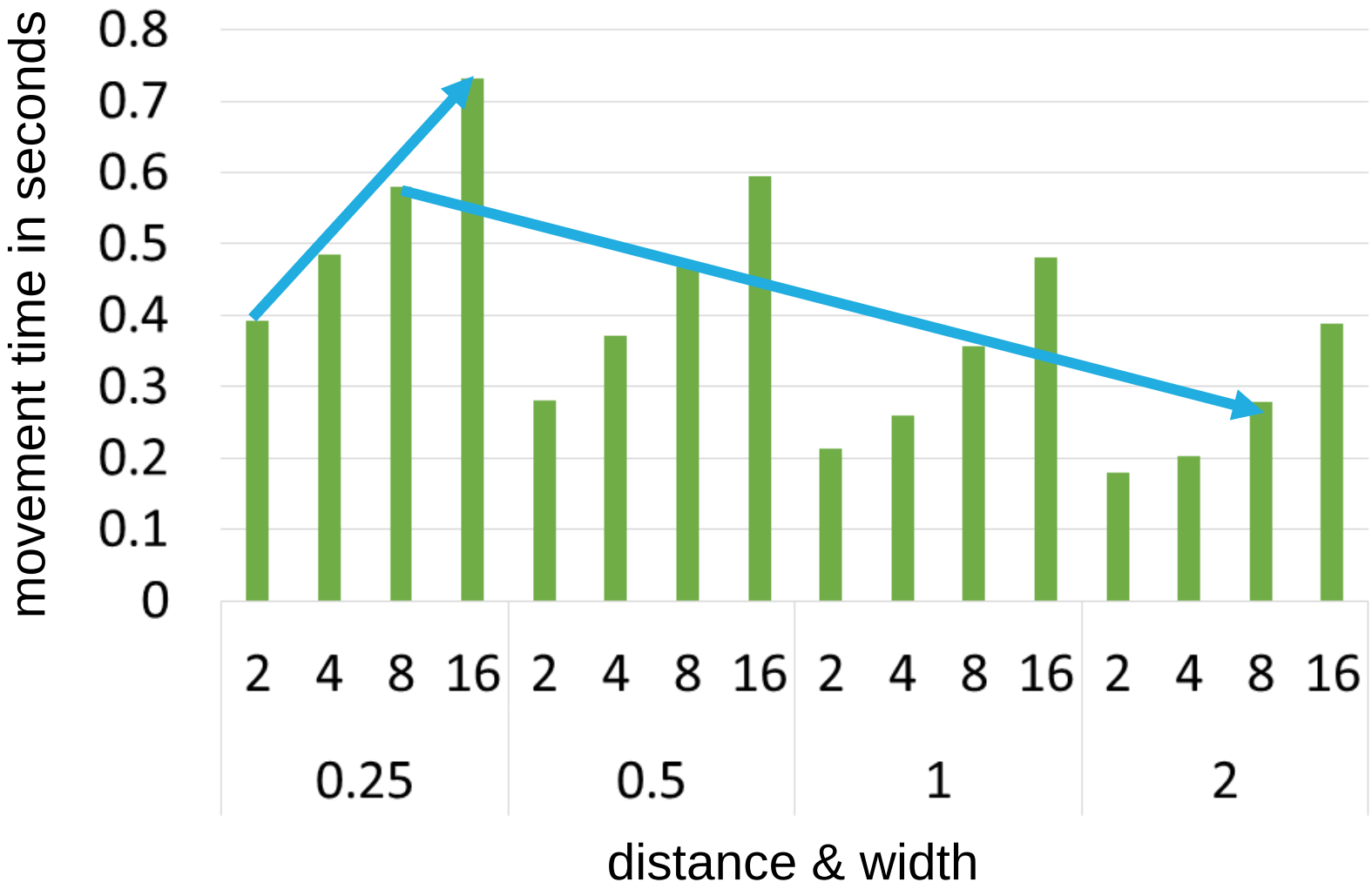
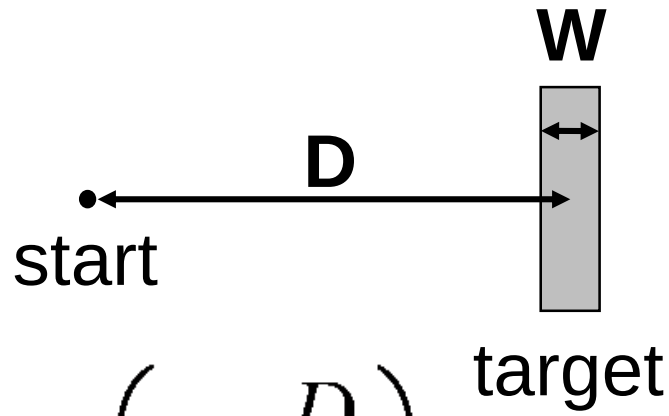


The movement time (MT) to select a target is a function of the target's width (W) and distance (D). It depends on the input device.



$$MT = a + b \log_2 \left(1 + \frac{D}{W} \right)$$

MT: movement time

a & b: input device-dependent constants

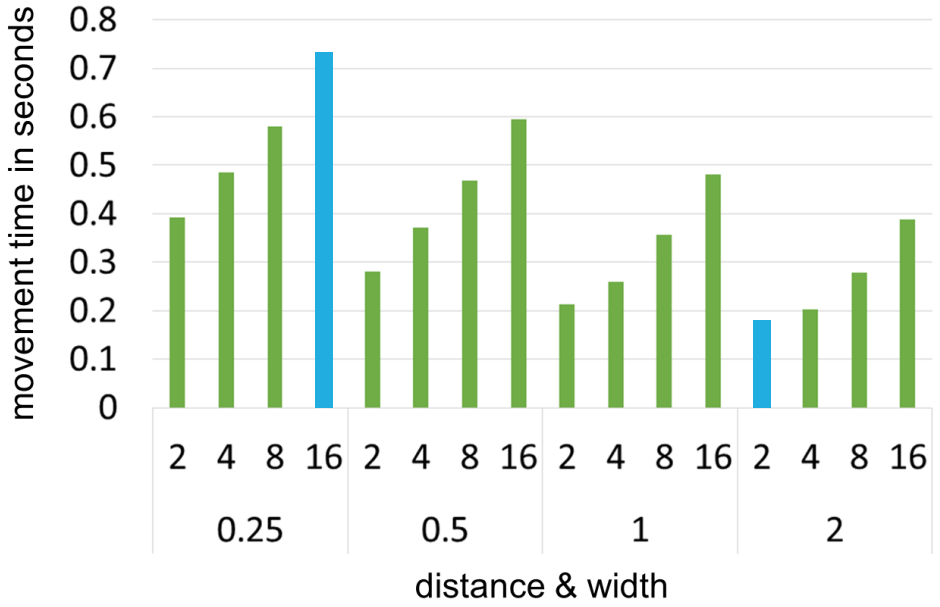
D: distance to the target

W: width of the target

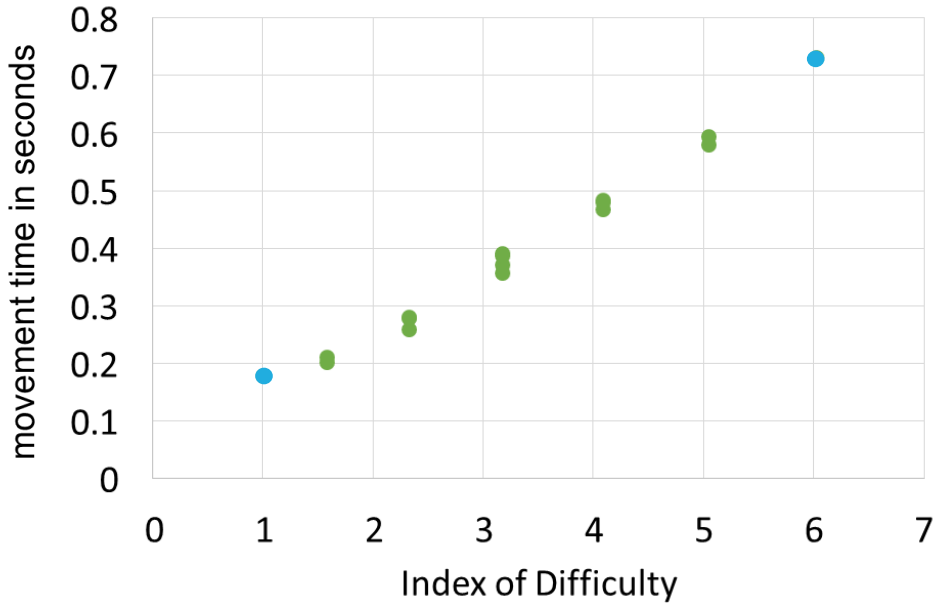
$$MT = a + b \underbrace{\log_2\left(1 + \frac{D}{W}\right)}$$

- Index of Difficulty, ID = $\log_2\left(1 + \frac{D}{W}\right)$
  - MT = a + b ·ID
  - ID how difficult a task is independent from the input device

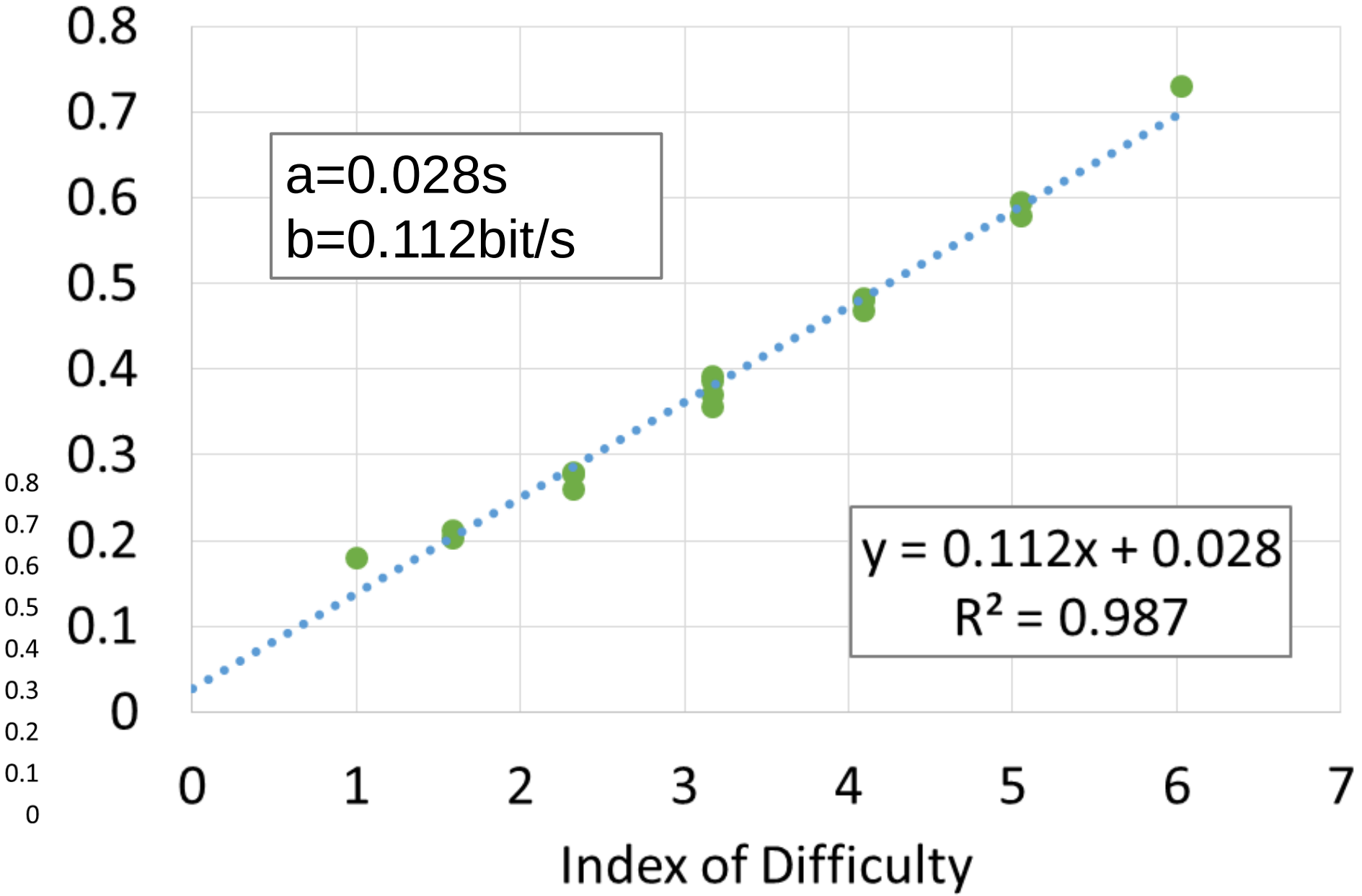
- Units:
  - a is measured in seconds
  - b is measured in seconds per bit
  - Index of Difficulty (ID) is described in bits



$$ID = \log_2\left(1 + \frac{D}{W}\right)$$



- D=16, W=0.25
- ID=$\log_2(1+64)$=6.02


a=0.028s
b=0.112bit/s
y = 0.112x + 0.028
R² = 0.987
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
Index of Difficulty

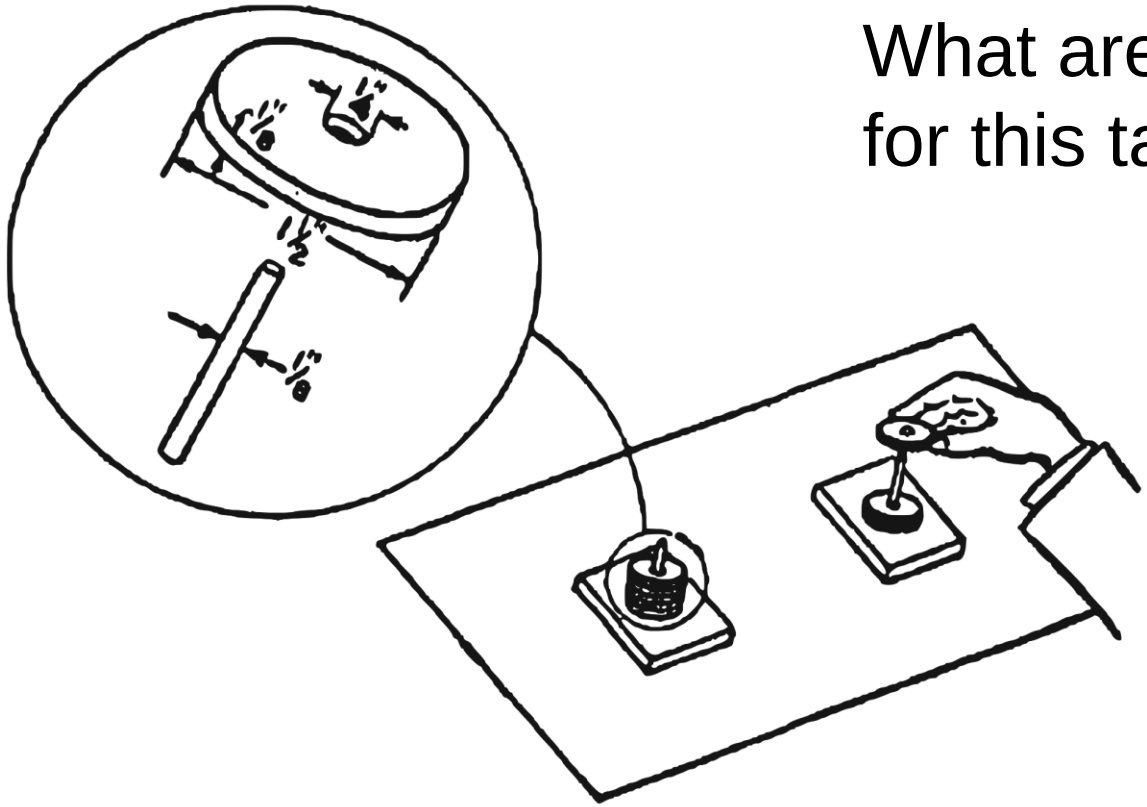
$$MT = a + b \log_2\left(1 + \frac{D}{W}\right)$$

- a=0.028s
- b=0.112s/bit

- How long does it take to select a target that is 21 inch away and 3 inch wide?
- MT = $0.028+0.112*\log_2(1+7)$
- = $0.028+0.112*\log_2(8)$
- = $0.028+0.112*3$
- = 0.364ms

From: Fitts, P. M. (1954). The information capacity of the human motor system in controlling the amplitude of movement. Journal of experimental psychology, 47(6), 381.

width	distance	MT
0.0625	4	0.697
0.0625	8	0.771
0.0625	16	0.896
0.0625	32	1.096
0.125	4	0.649
0.125	8	0.734
0.125	16	0.844
0.125	32	1.028
0.25	4	0.607
0.25	8	0.672
0.25	16	0.771
0.25	32	0.975
0.5	4	0.535
0.5	8	0.623
0.5	16	0.724
0.5	32	0.902



What are a and b for this task?

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