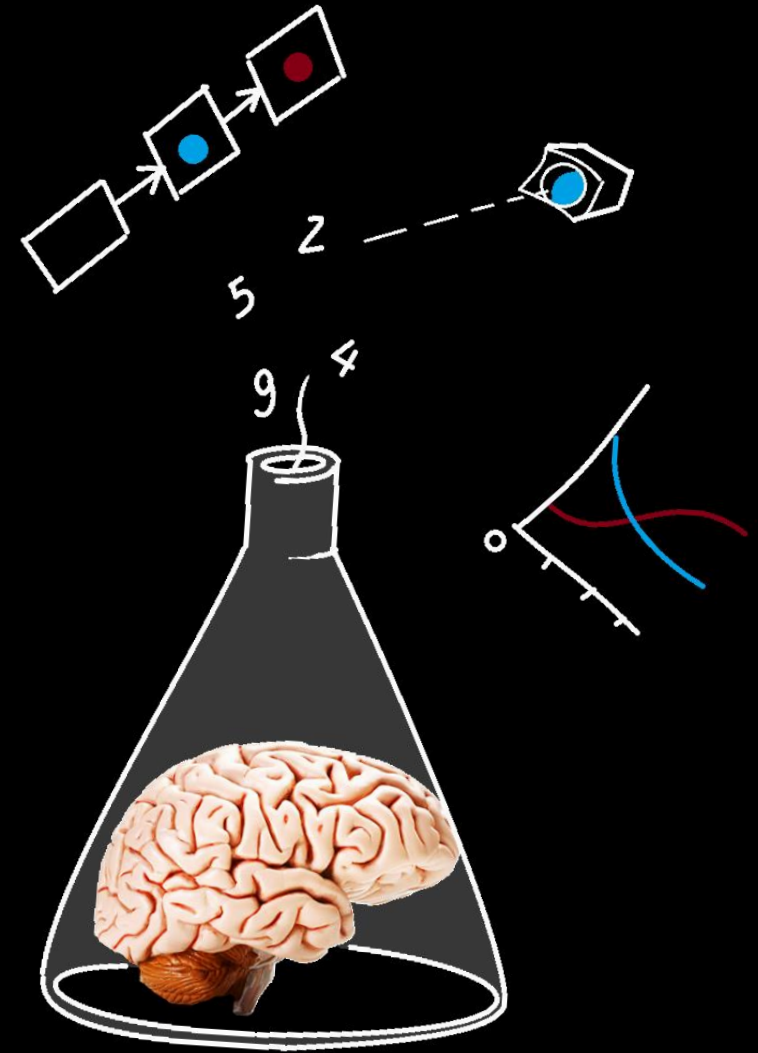


21-09

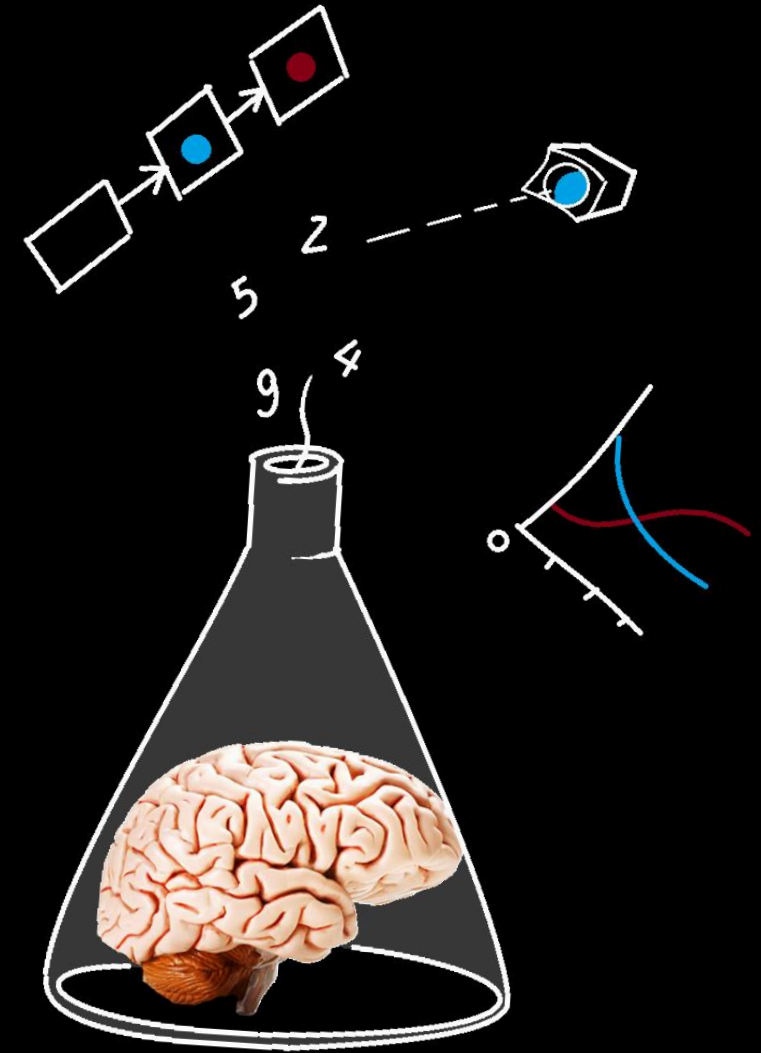
Response time, accuracy & signal detection theory



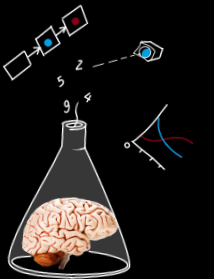
21-09

Practical points

- Start implementing your experiment
- Helpdesk opened on Canvas > Discussions
- Recorded lecture *Memory & Decision-making* online tomorrow
- Monday 25th: eye-tracking & pupillometry

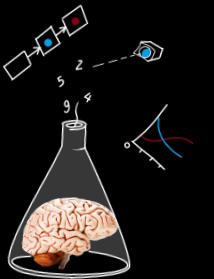
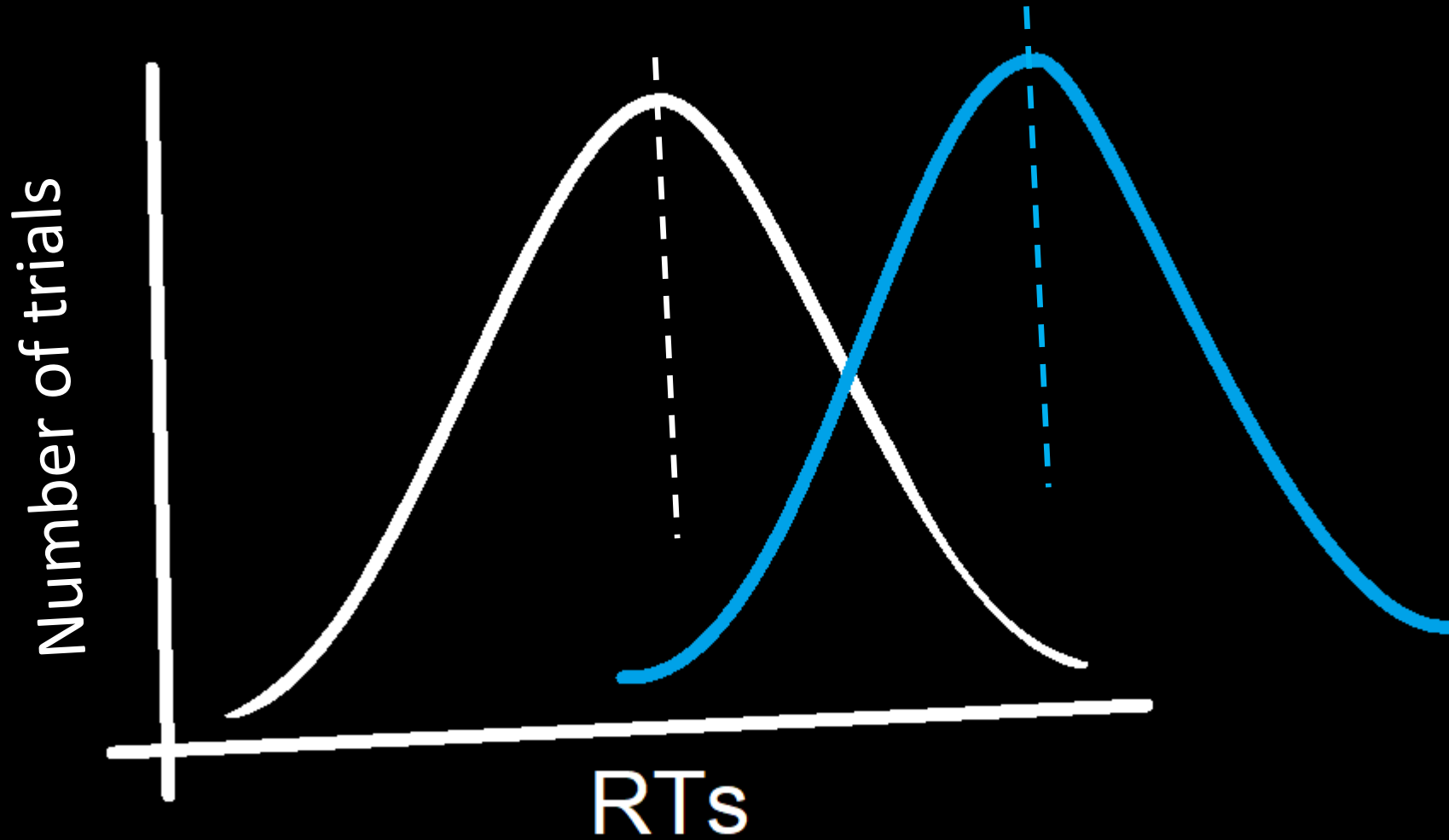


Response times



Response times

Certainty that an effect exists depends not just on the means, but on the spread.
→ The extent to which distributions overlap

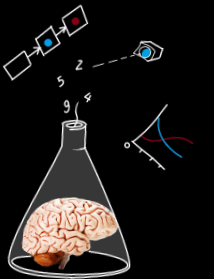


Response times

What we typically do in processing RTs:

- exclude incorrectly answered trials
- exclude very atypical trials (i.e., trials with RT beyond several SDs from the mean)

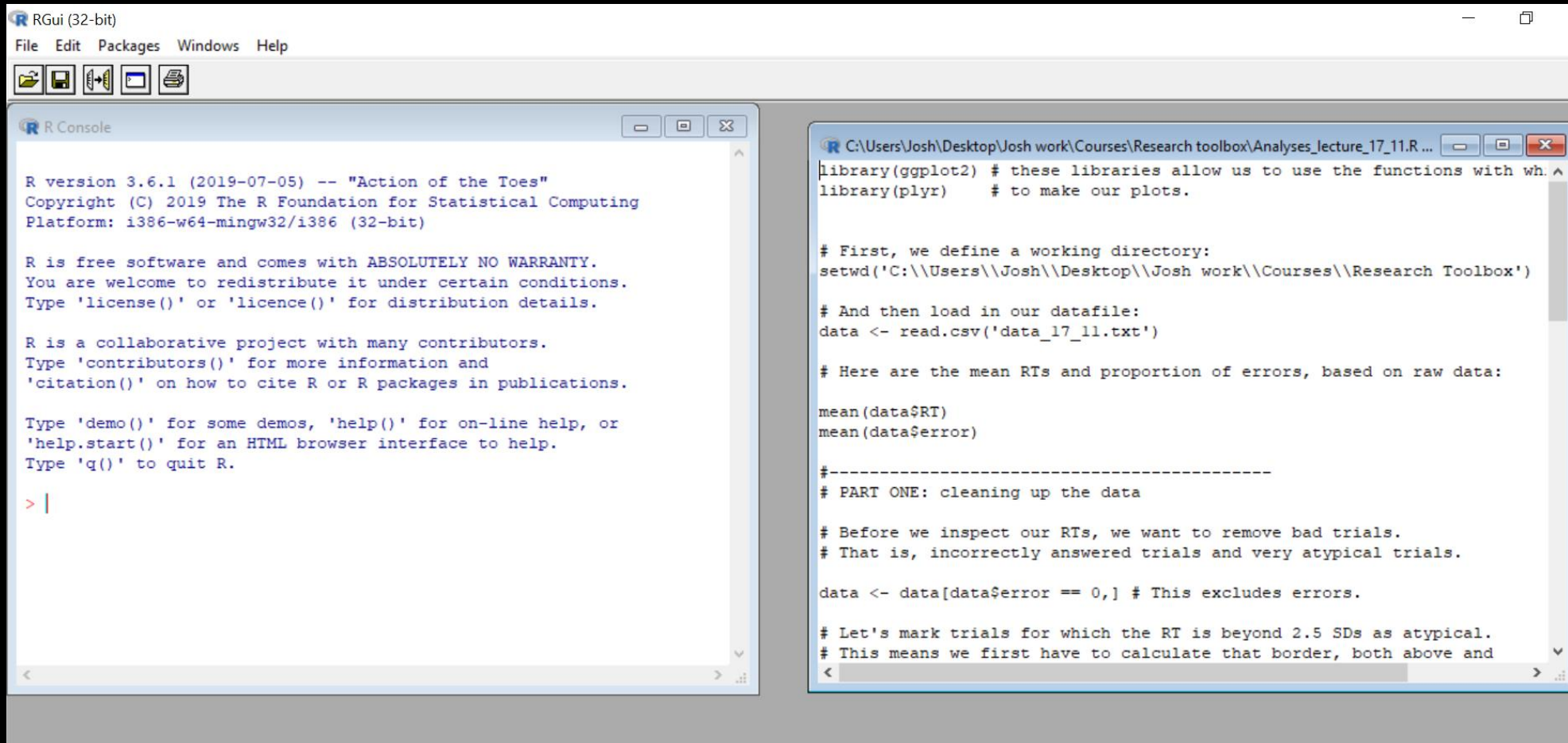
From today's module, download `data_21_09.txt`
and `Analyses_lecture_21_09.R`



Response times

From today's module, download `data_21_09.txt`
and `Analyses_lecture_21_09.R`

Execute any command by
selecting it and pressing `ctrl+r`



The screenshot shows the RGui (32-bit) interface. The 'R Console' window on the left displays the R startup message and version information (3.6.1, 2019-07-05). The script editor window on the right, titled 'C:\Users\Josh\Desktop\Josh work\Courses\Research toolbox\Analyses_lecture_17_11.R ...', contains the following R code:

```
library(ggplot2) # these libraries allow us to use the functions with wh. ^
library(plyr)    # to make our plots.

# First, we define a working directory:
setwd('C:\\Users\\Josh\\Desktop\\Josh work\\Courses\\Research Toolbox')

# And then load in our datafile:
data <- read.csv('data_17_11.txt')

# Here are the mean RTs and proportion of errors, based on raw data:

mean(data$RT)
mean(data$error)

#-----
# PART ONE: cleaning up the data

# Before we inspect our RTs, we want to remove bad trials.
# That is, incorrectly answered trials and very atypical trials.

data <- data[data$error == 0,] # This excludes errors.

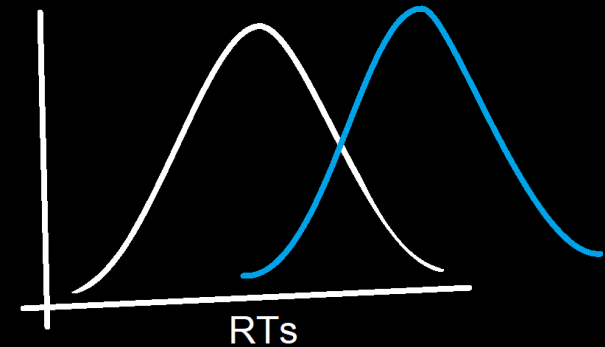
# Let's mark trials for which the RT is beyond 2.5 SDs as atypical.
# This means we first have to calculate that border, both above and
```



889	NA
632	NA
684	NA
581	NA
849	NA
537	NA
484	NA
2144	NA
708	NA
682	NA
603	NA
552	NA
759	NA

Response times

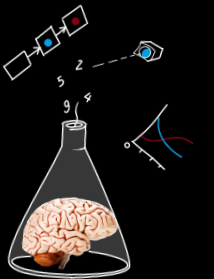
Is this all that there is to RTs?



Distributions could reveal more information

→ A difference between two response conditions may be more strongly expressed in the faster portion of RTs than in the slower portion.

(Gomez & Perea, 2020)



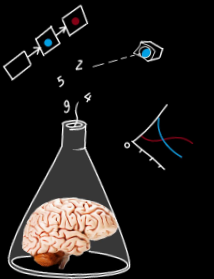
Response times

A case study: the Stroop task (Stroop, 1935)

Word meaning impacts processing of the word's print color – and vice versa

RED RED

BLUE BLUE



Response times

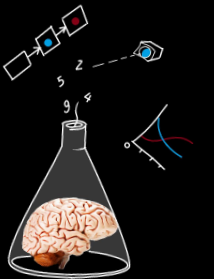
Let's check it out ourselves with a (simulated) experiment

Participants saw the words RED and BLUE, in red or blue print.
In one block, they responded the meaning of the word. In
another block, they responded the print colour of the word.

H: slower responses when the meaning and color don't match

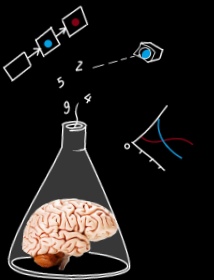
RED RED

BLUE BLUE



Response times

data_21_09.txt on Canvas in today's module
Analyses_lecture_21_09.R in today's module



Response times

data_21_09.txt on Canvas in today's module
Analyses_lecture_21_09.R in today's module

When calculating the mean response times (RTs) in each condition, we indeed see effects of meaning/print congruency:

meaning decision

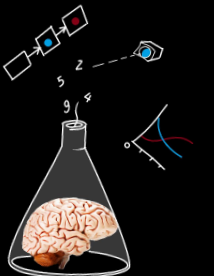
congruent: 587 ms

incongruent: 611 ms

print decision

congruent: 489 ms

incongruent: 510 ms



Response times

data_21_09.txt on Canvas in today's module
Analyses_lecture_21_09.R in today's module

Are these two effects the same thing, cognitively speaking?

→ Let's look at some density plots

meaning decision

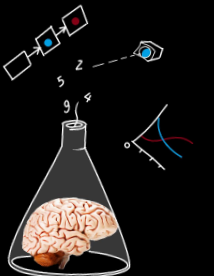
congruent: 587 ms

incongruent: 611 ms

print decision

congruent: 489 ms

incongruent: 510 ms

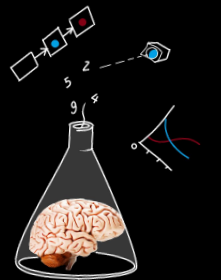
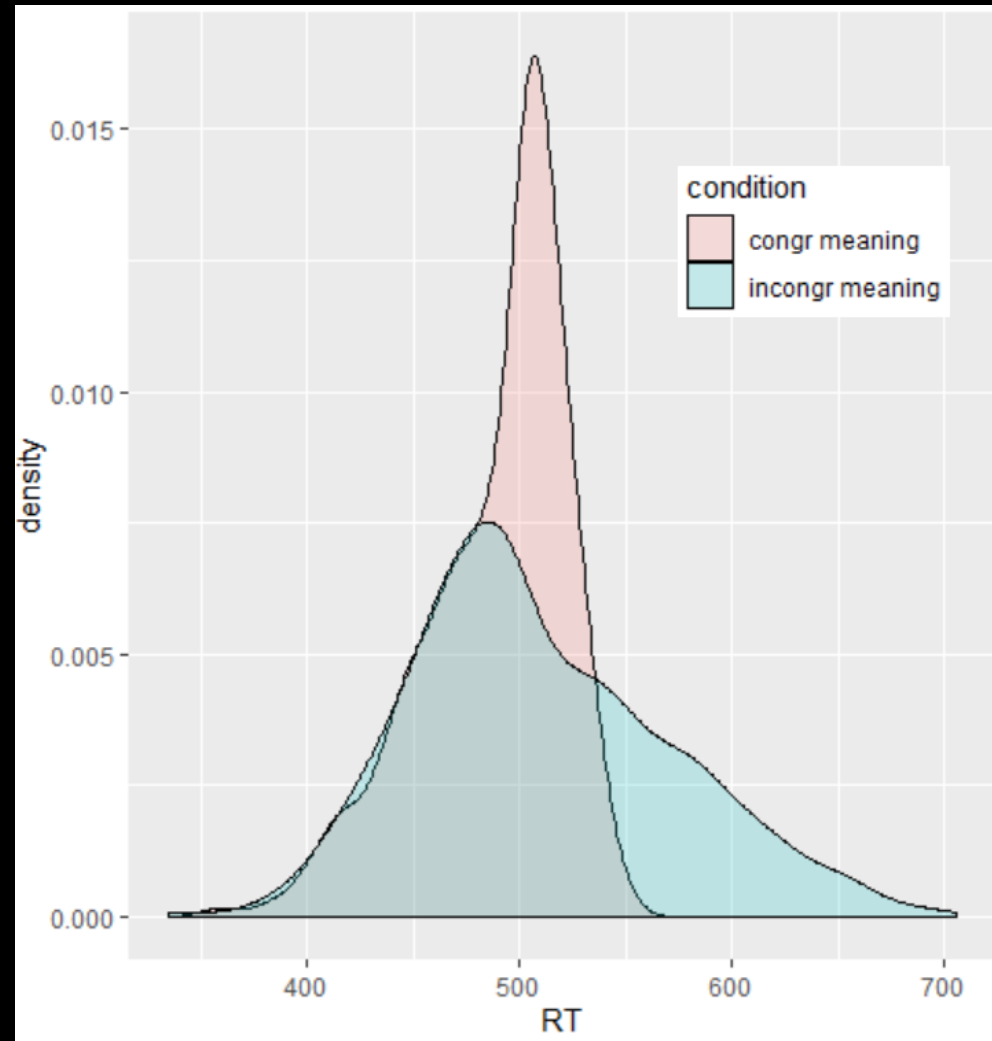


Response times

Early RTs are very similar between conditions, late RTs differ a lot.

...so this effect has a late temporal locus.

Decisions about stimulus color

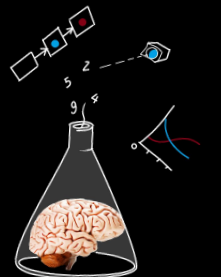
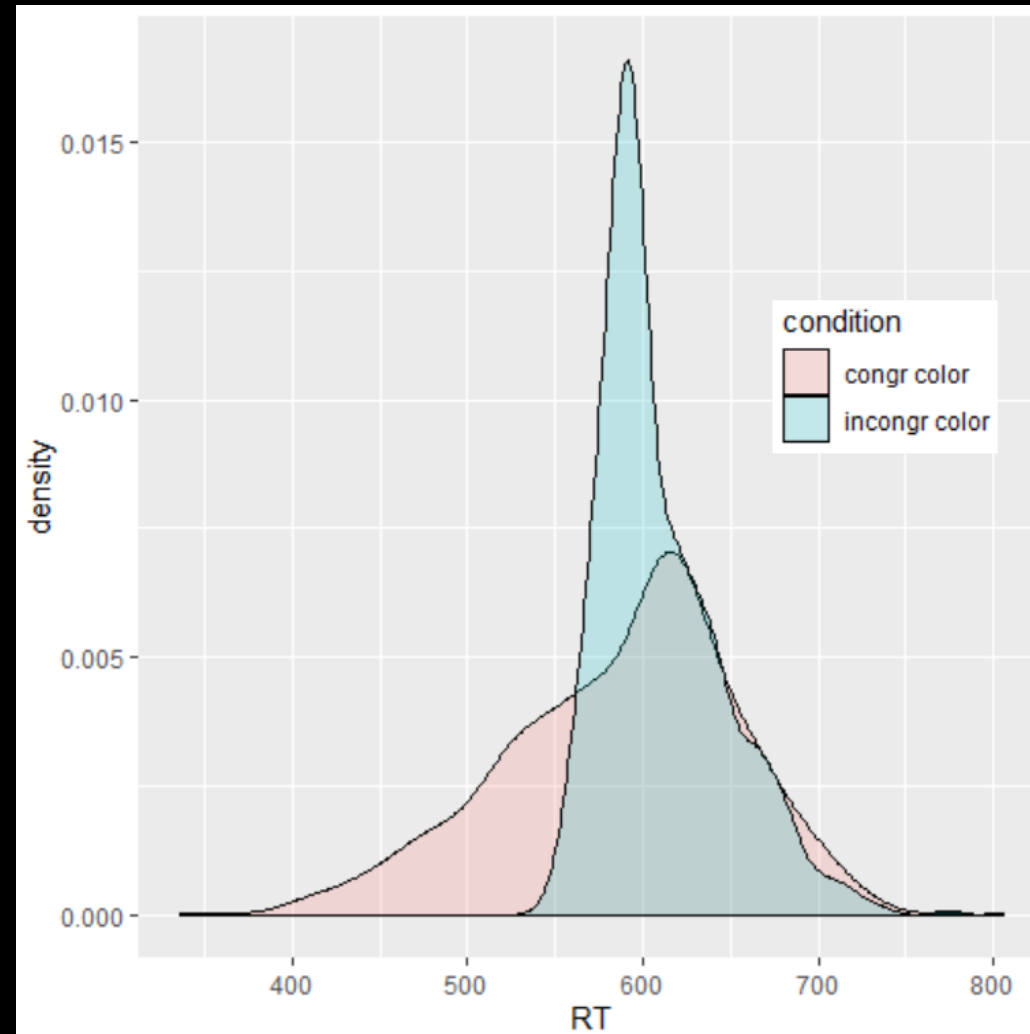


Response times

Late RTs are very similar between conditions, early RTs differ a lot

...so this effect has an early temporal locus.

Decisions about word meaning

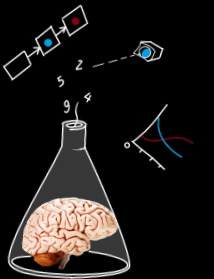


Accuracy

Analyses of accuracy are often regarded as being interchangeable with analyses of RT. (better performance: shorter RTs and fewer errors)

In most behavioral tasks we look at both. Having more measures provides a broader picture.

Sometimes we only look at one measure. (e.g., many lines of memory research)



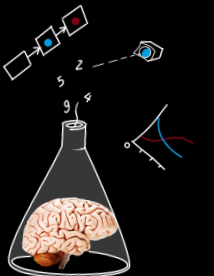
Accuracy

Is it problematic if we find an effect in accuracy but not in RTs?

→ No.

Persons A and B are equally fast, but A is more accurate: A performed better

A and B are equally accurate, but A did it quicker: A performed better.

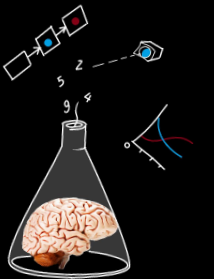


Accuracy

Is it problematic if opposite effects are found in accuracy and RT?

→ Yes.

Person A is better at shooting, but person B is better at skiing. We cannot tell who is the better biathlete.



Combining RTs and accuracy

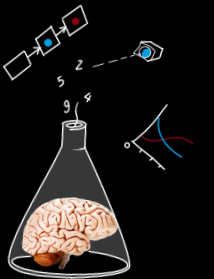
Inverse efficiency scores

Combining RTs and accuracy into one measure (IES) may allow us to make better direct comparisons.

$$\text{IES} = \text{RT} / P_{(\text{correct})}$$

RT = 500 ms, accuracy = 0.90 \rightarrow IES = $500/0.90 = 556$ ms.

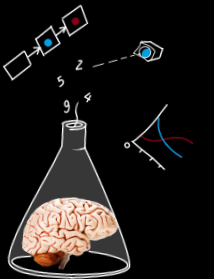
RT = 480 ms, accuracy = 0.80 \rightarrow IES = $480/0.80 = 600$ ms.



A deeper look into accuracy

Signal detection theory

Only applicable in the context of binary decisions



A deeper look into accuracy

Signal detection theory

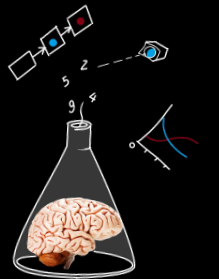
A more elaborate measure of accuracy: *Sensitivity*

The world around us is noisy

→ How well can we distinguish
the relevant from the irrelevant?

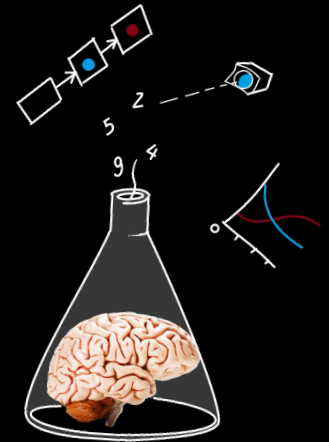


Sensitivity doesn't only look at our ability to spot the
relevant, but also at our ability to ignore the irrelevant



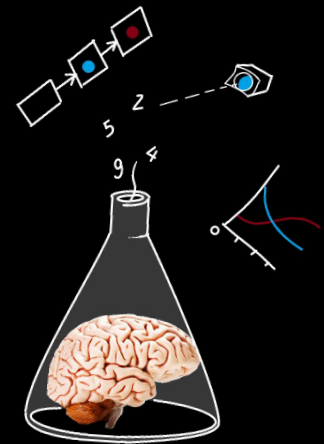
What is the key challenge in perception?

To resolve ambiguity



What is the key challenge in perception?

To resolve ambiguity; and to distinguish the relevant from the irrelevant



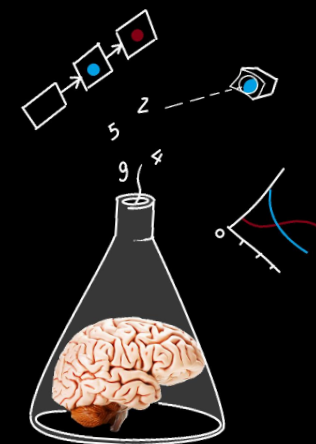
Signal Detection Theory:

A way to quantify perceptual skill

Why do we need to do this?



NEW YORK, 1999. Amadou Diallo, a 22-year-old immigrant from Guinea, was shot and killed by four white police officers. The officers fired a combined total of 41 shots. The officers claimed they misperceived Diallo's wallet as being a gun.



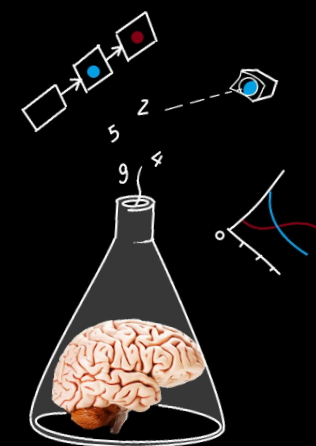
Signal Detection Theory:

A way to quantify perceptual skill

Why do we need to do this?



London, 2005. Jean Charles de Jimenez (27), a Brazilian immigrant, was shot eight times while boarding the underground at Stockwell Underground Station. The shooters were special ops police officers looking for a known terrorist who had bombed the underground the week before. *The police admitted its mistake but reported that the victim resembled the terrorist.*



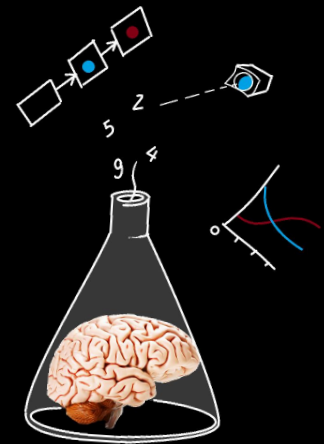
Signal Detection Theory:

A way to quantify perceptual skill

Task: push button when detecting an unnatural source of light

– “Simple! Simulate situation, test soldiers 100 times. If Observer A responds more often to the light than Observer B, then Observer A is the better soldier.

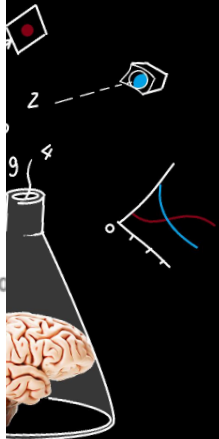
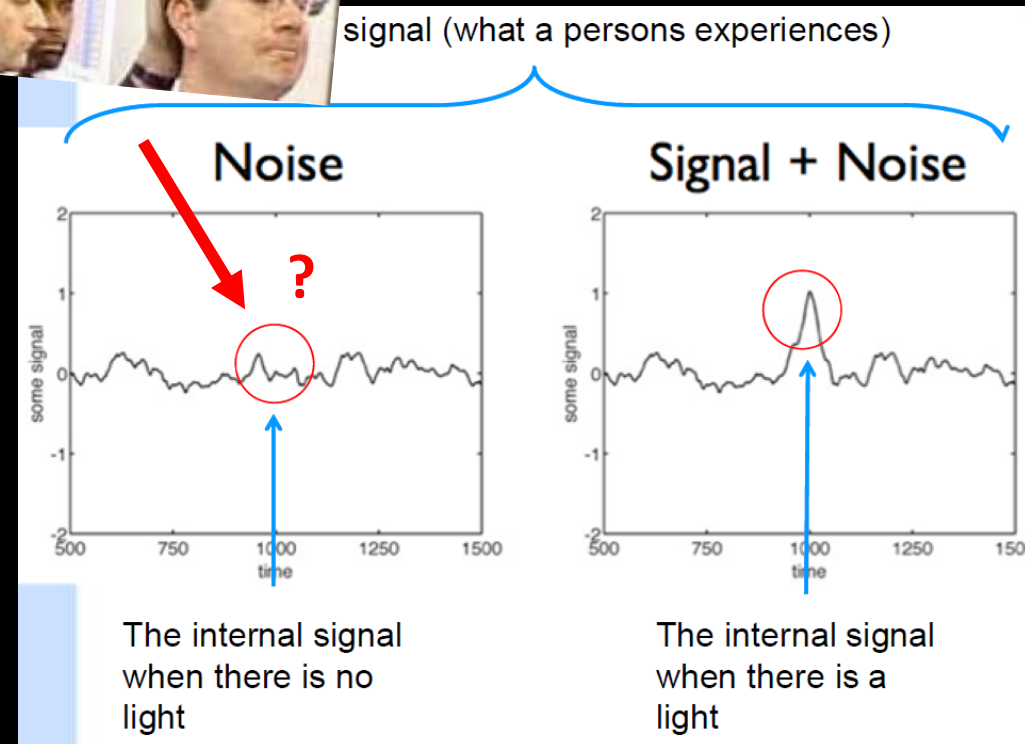
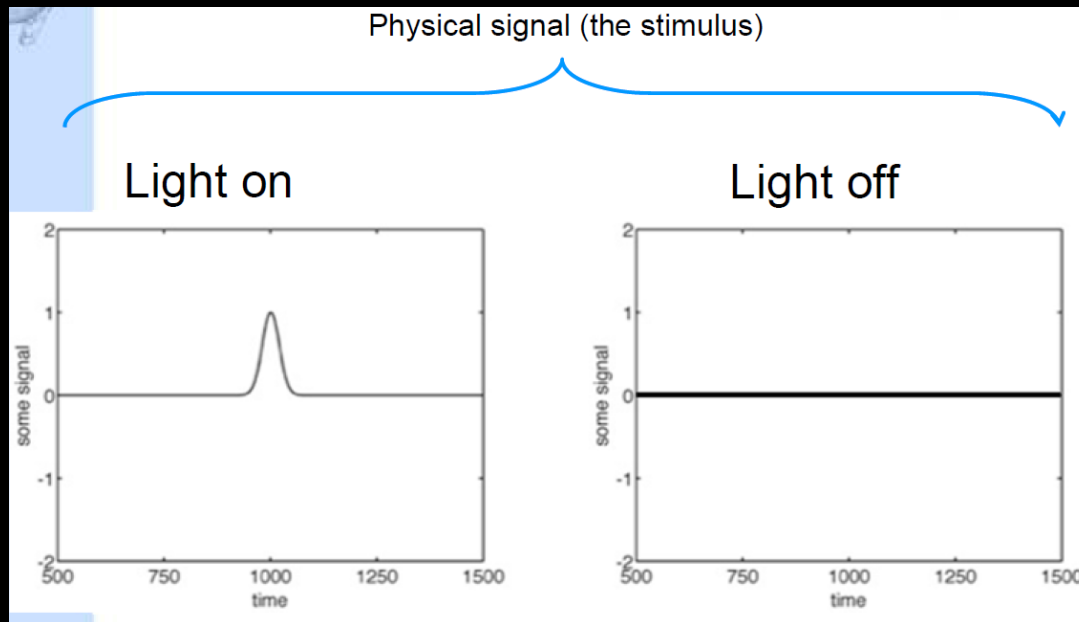
	Observer A	Observer B
Light on	Responded 81 times	Responded 62 times



Signal Detection Theory:

A way to quantify perceptual skill

BUT... the universe is noisy
and so are our senses



Signal Detection Theory:

A way to quantify perceptual skill

Who is the better observer now?



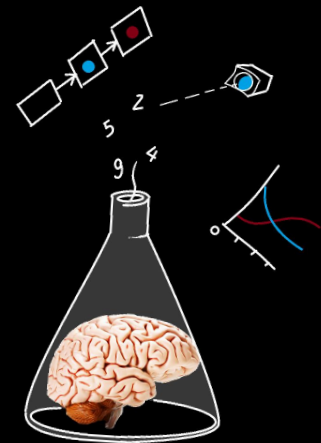
– “Simple! Simulate situation, test soldiers 100 times. If Observer A responds more often to the light than Observer B, then Observer A is the better soldier.

	Observer A	Observer B
Light on	Responded 81 times	Responded 62 times

	Observer A	Observer B
Light present	81 times	62 times
Light absent	78 times	4 times

= hits

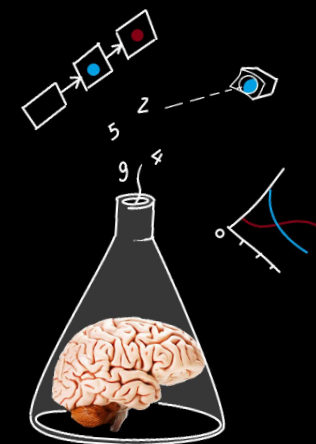
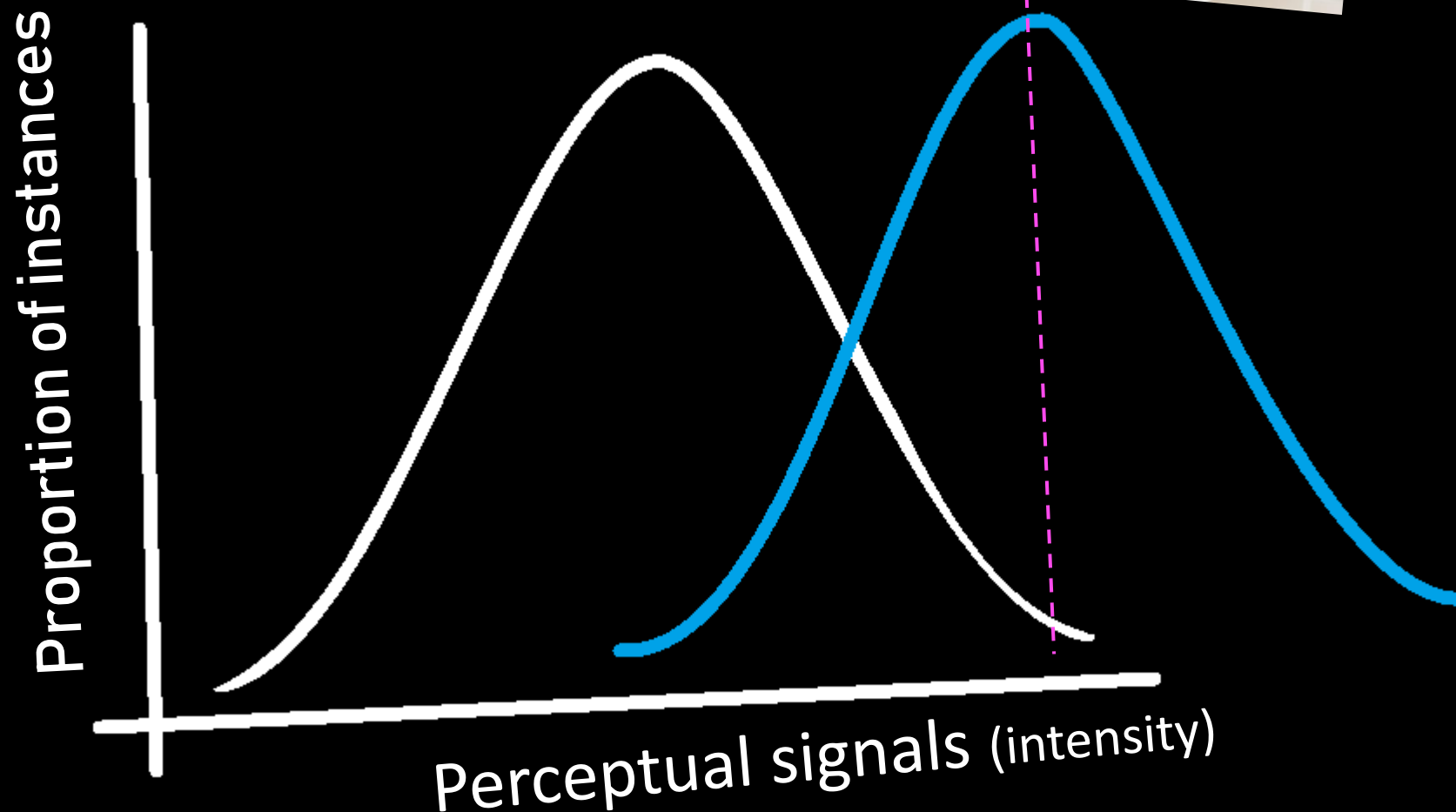
= false alarms



Sound intensity without vs. with alarm

NOISE

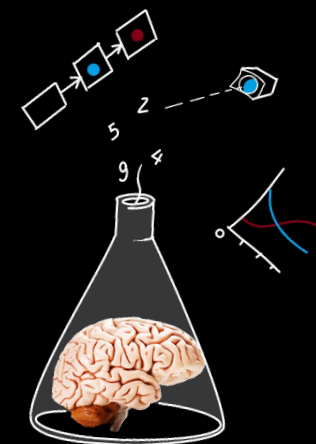
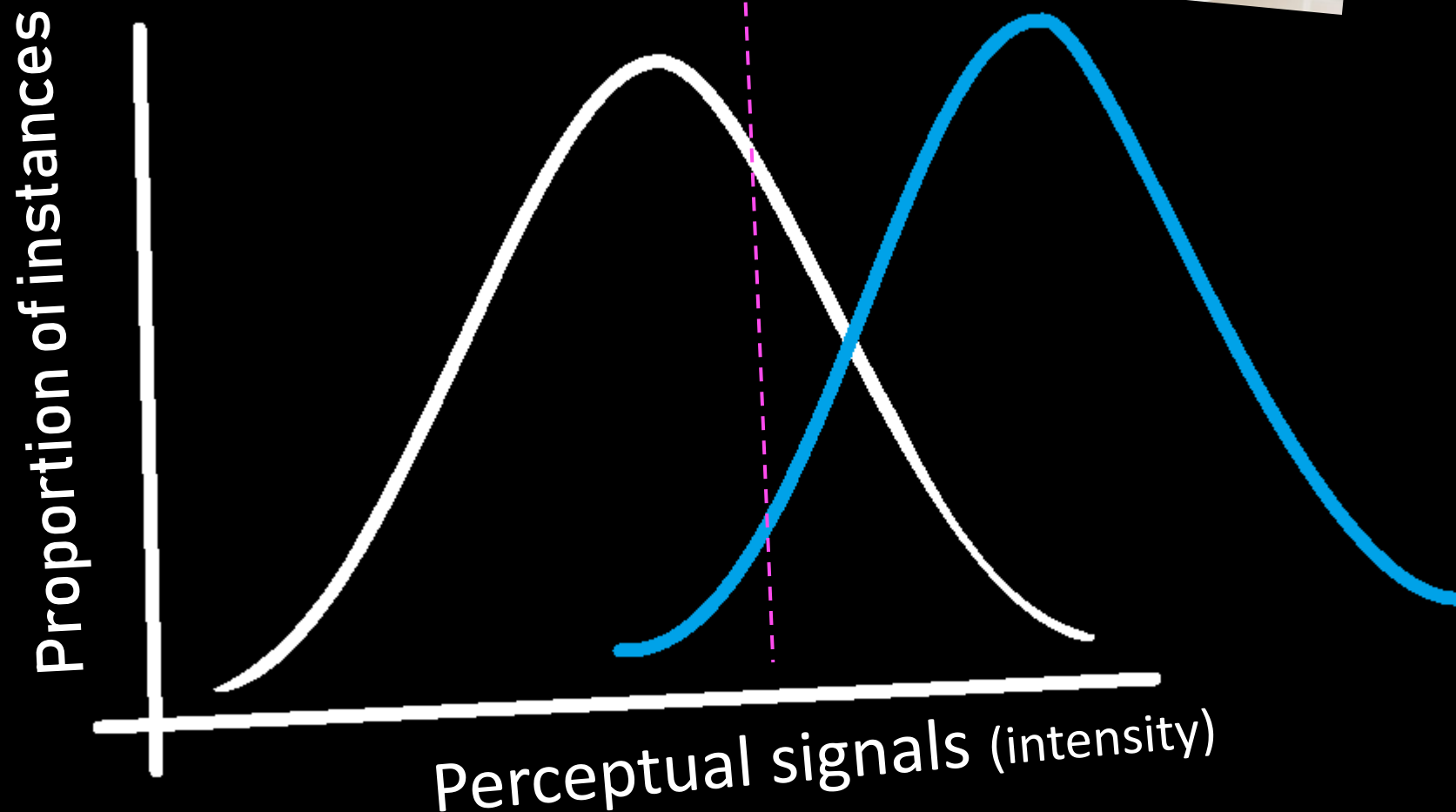
SIGNAL



Sound intensity without vs. with alarm

NOISE

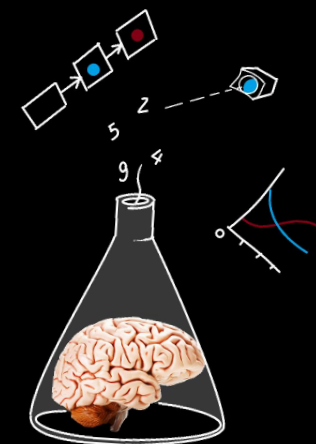
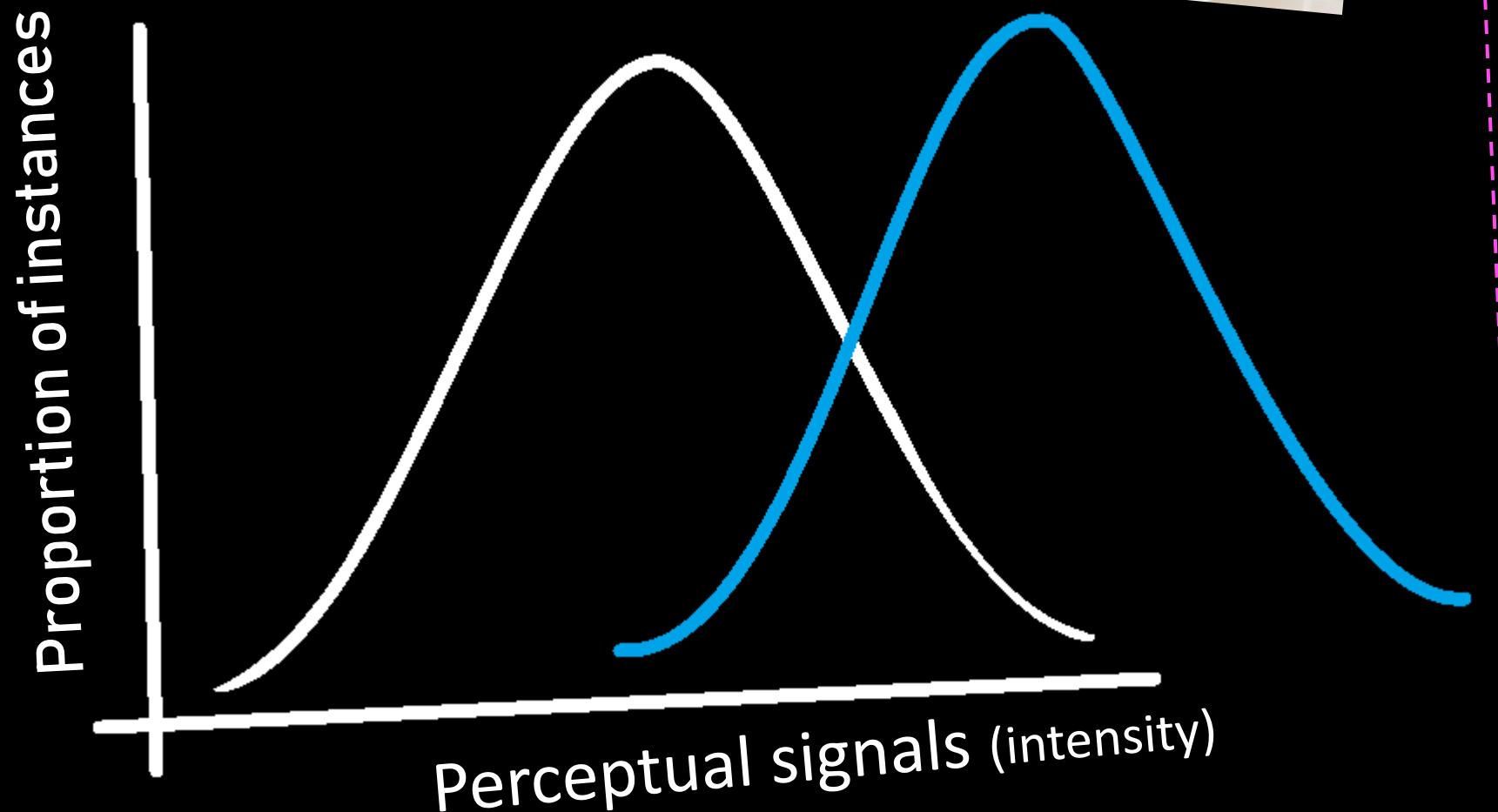
SIGNAL



Sound intensity without vs. with alarm

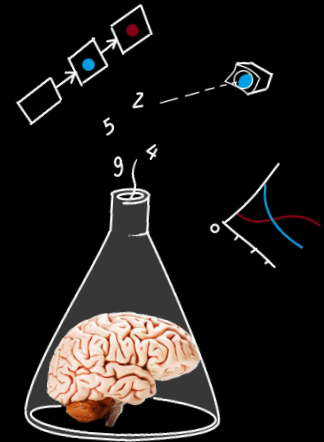
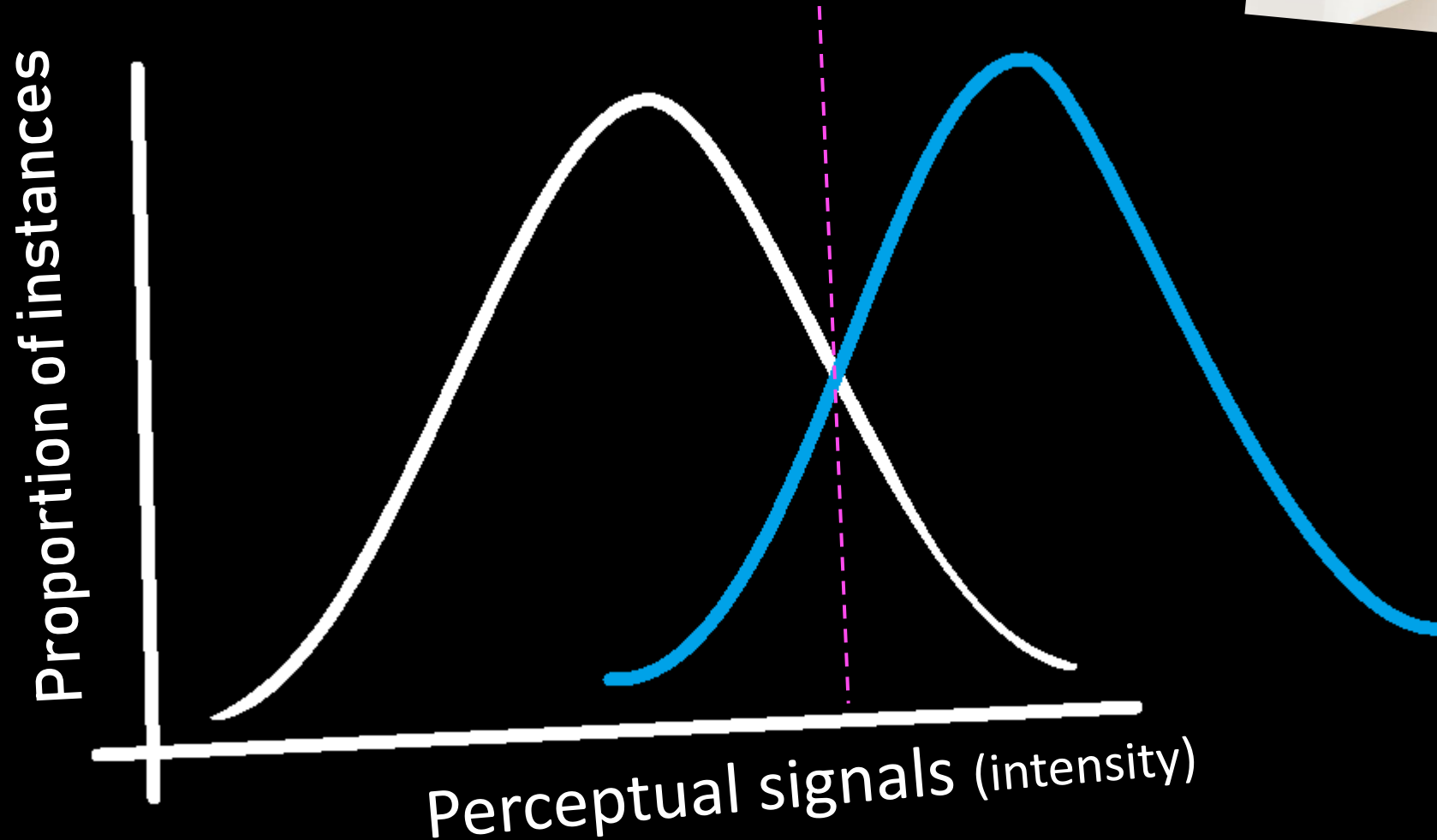
NOISE

SIGNAL

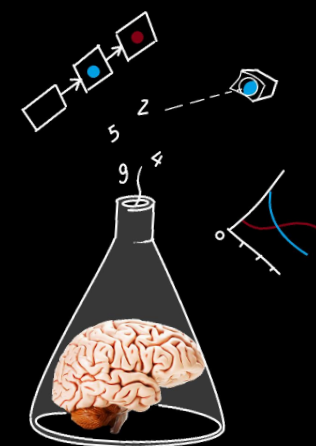
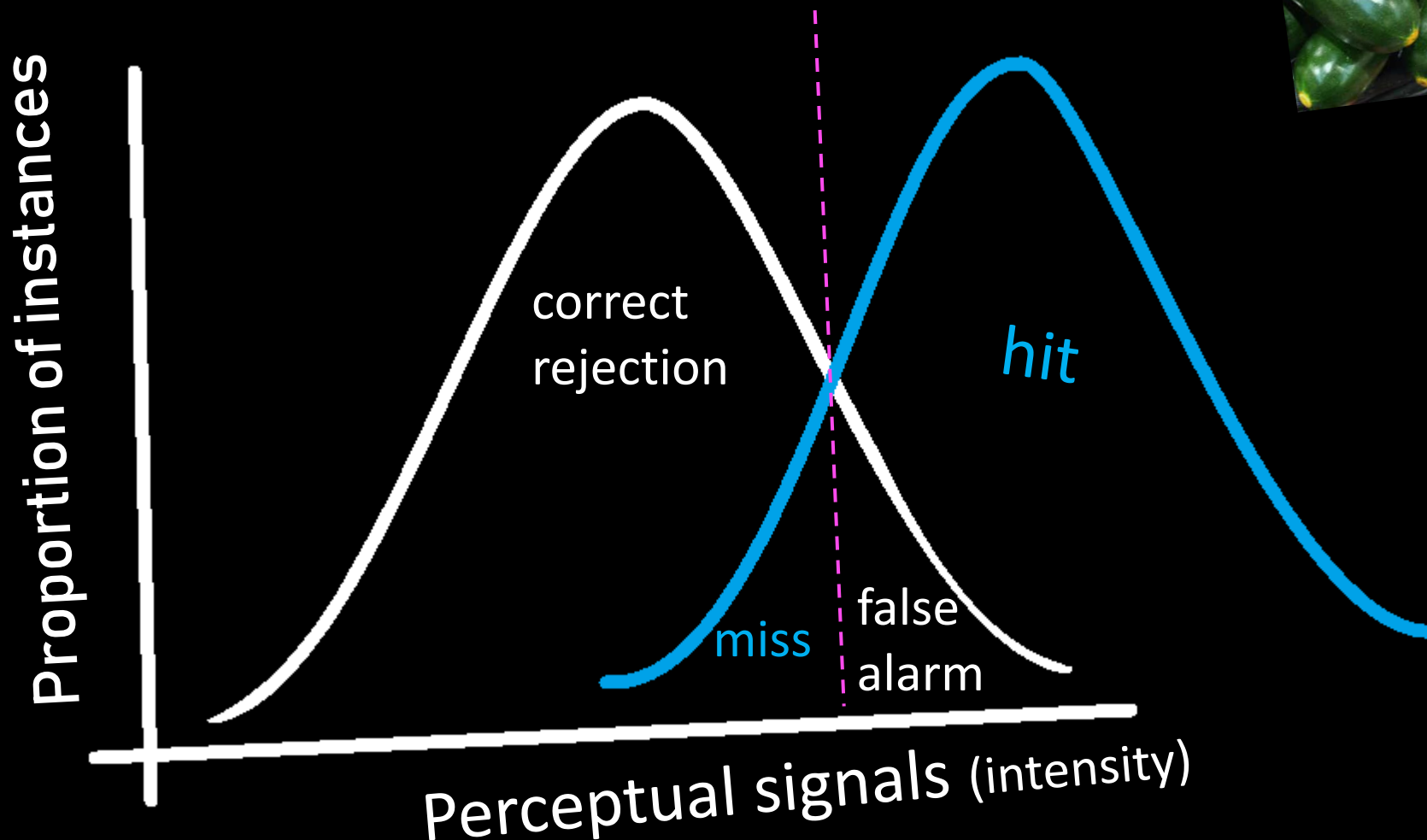


Sound intensity without vs. with alarm

No matter where your threshold is, your ability to distinguish signal from noise is the same!



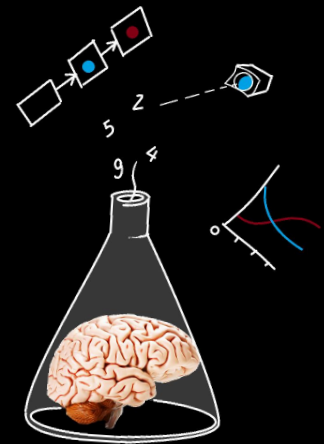
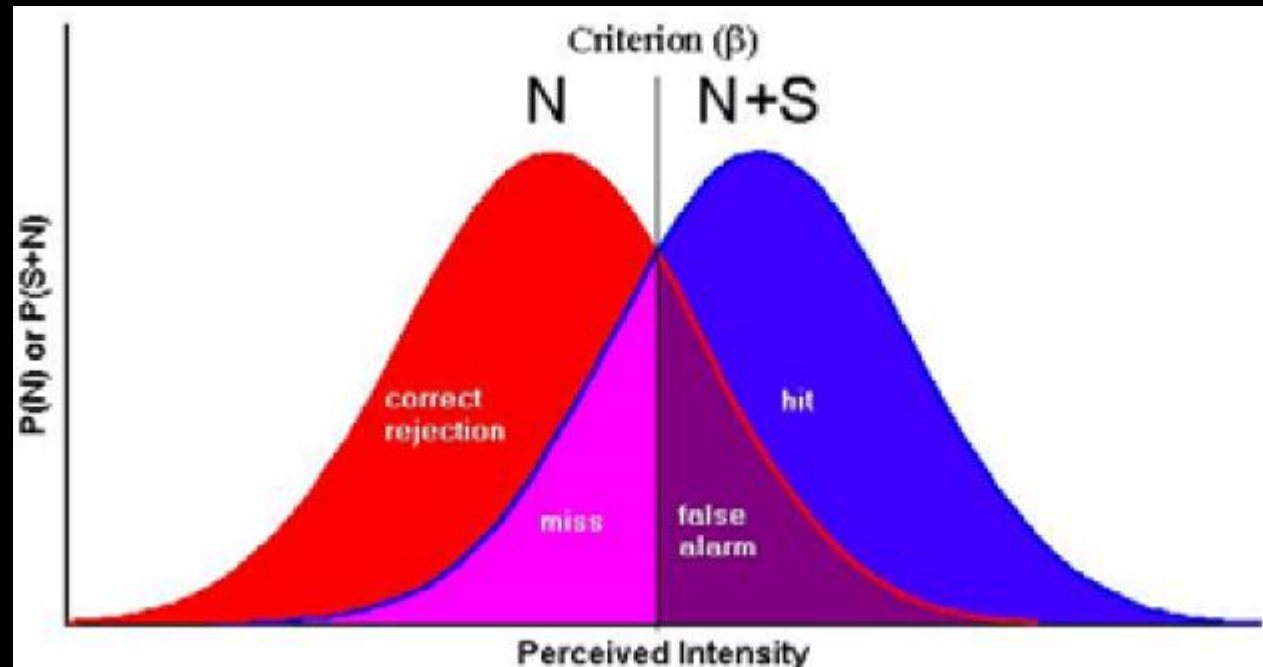
Cucumber neuron's firing rate when seeing a zucchini vs. a cucumber: 4 outcomes



The response matrix: the proportions of hits, misses, false alarms and correct rejections depend on:

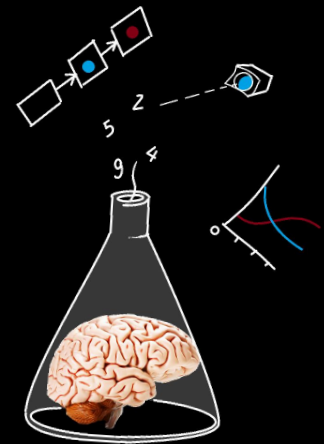
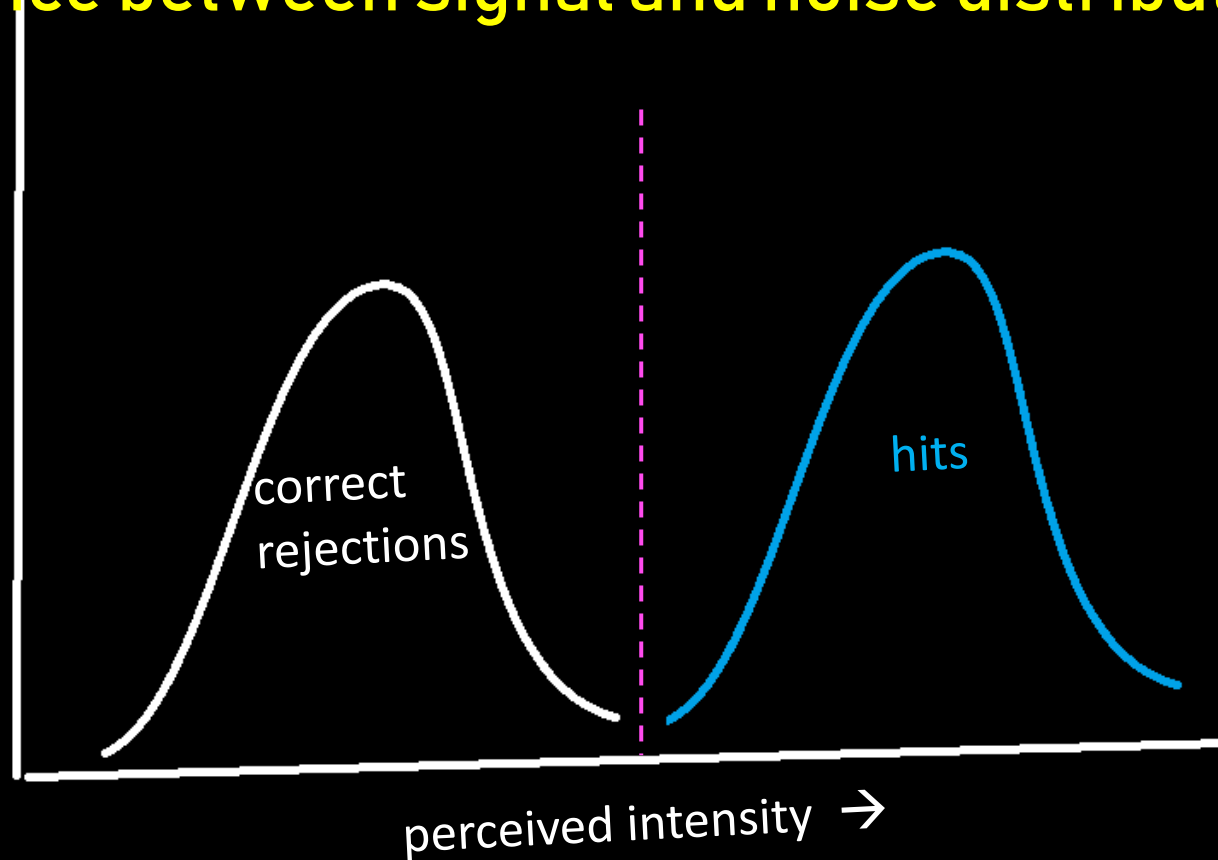
- your threshold
- the distance between signal and noise distributions

		State of the world	
		Signal	Noise
Response	Yes	Hit	False alarm
	No	Miss	Correct rejection

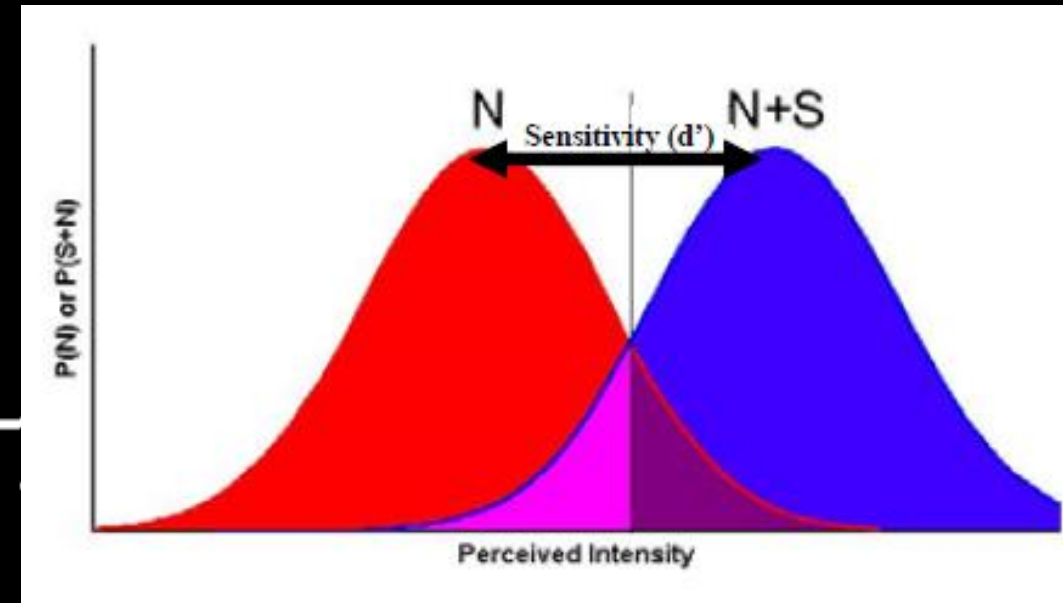


The response matrix: the proportions of hits, misses, false alarms and correct rejections depend on:

- your threshold
- the distance between signal and noise distributions



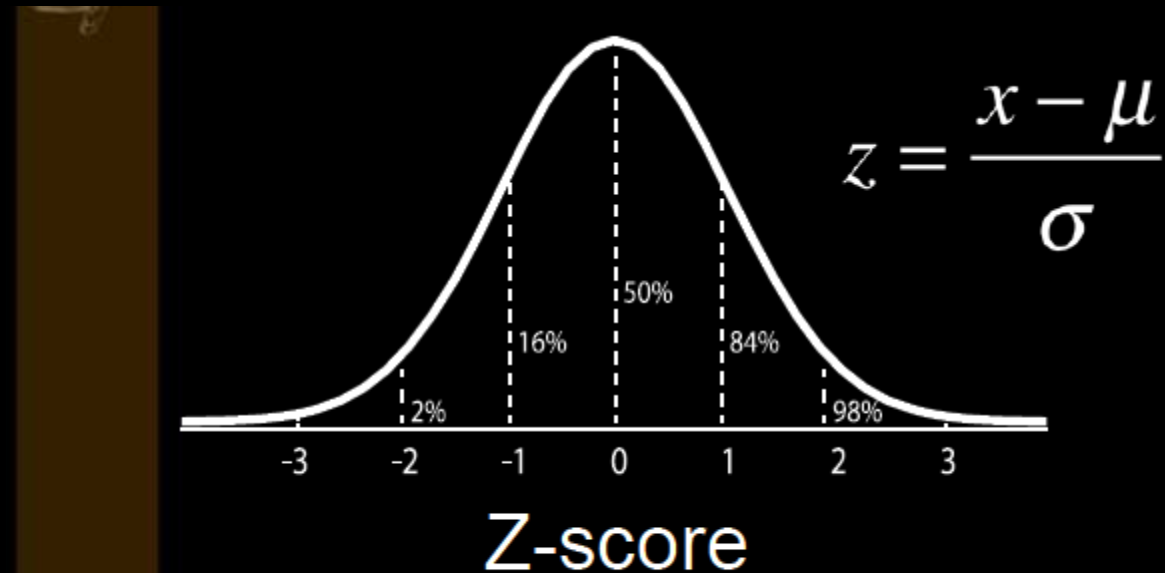
The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)



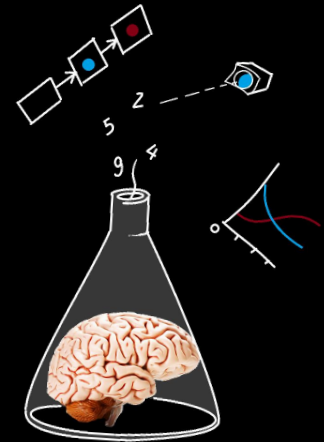
The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

How do we measure this distance?

We cannot measure 'perceived intensity'!
... or can we?



Direct relation between proportion observations (rate / probability) and standard deviations (Z-score) = probability expressed as standard deviations

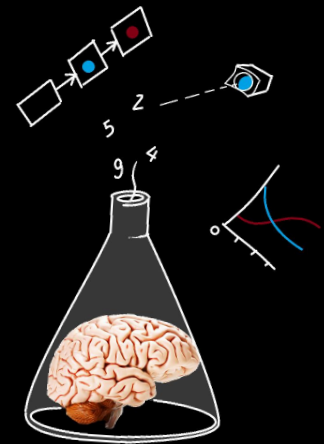
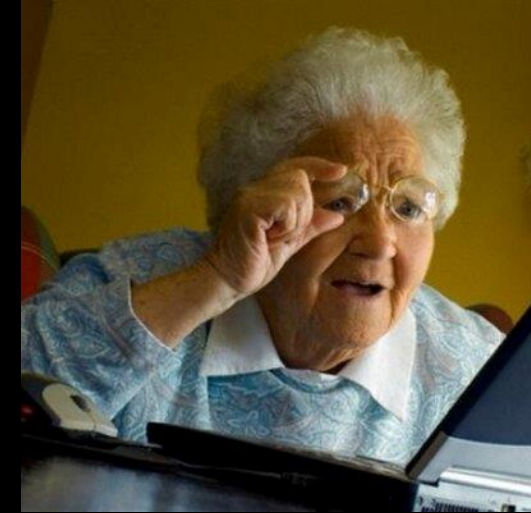
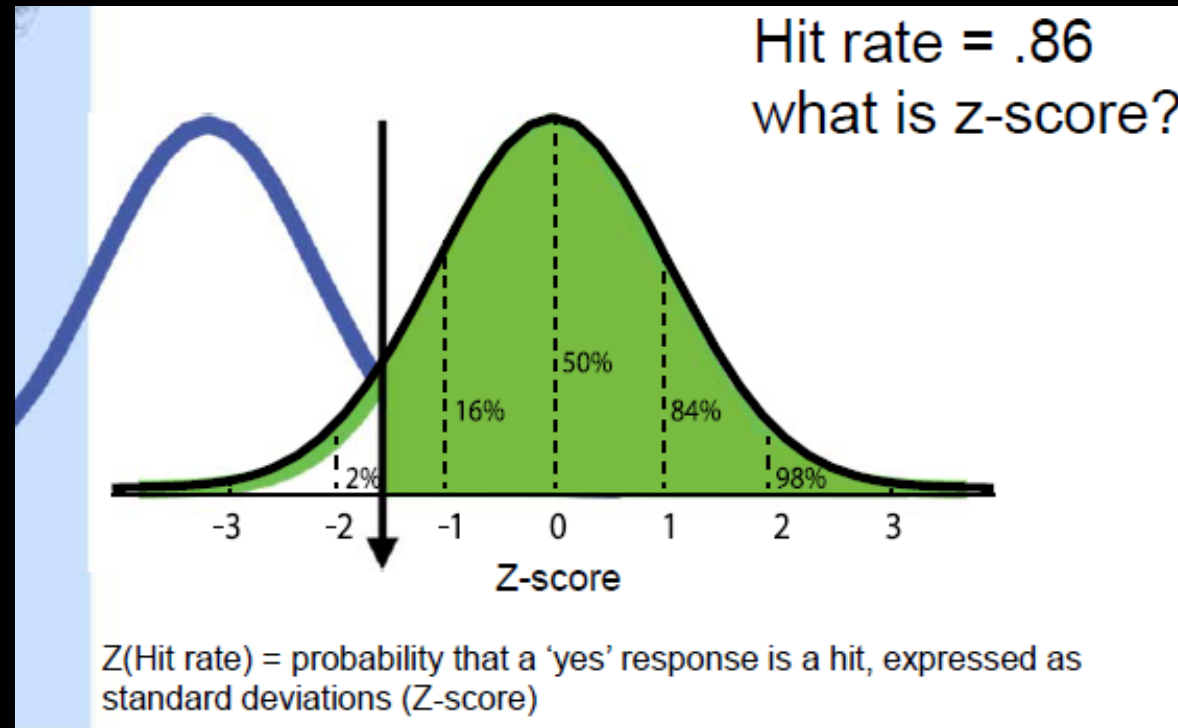


The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!*)

How do we measure this distance?

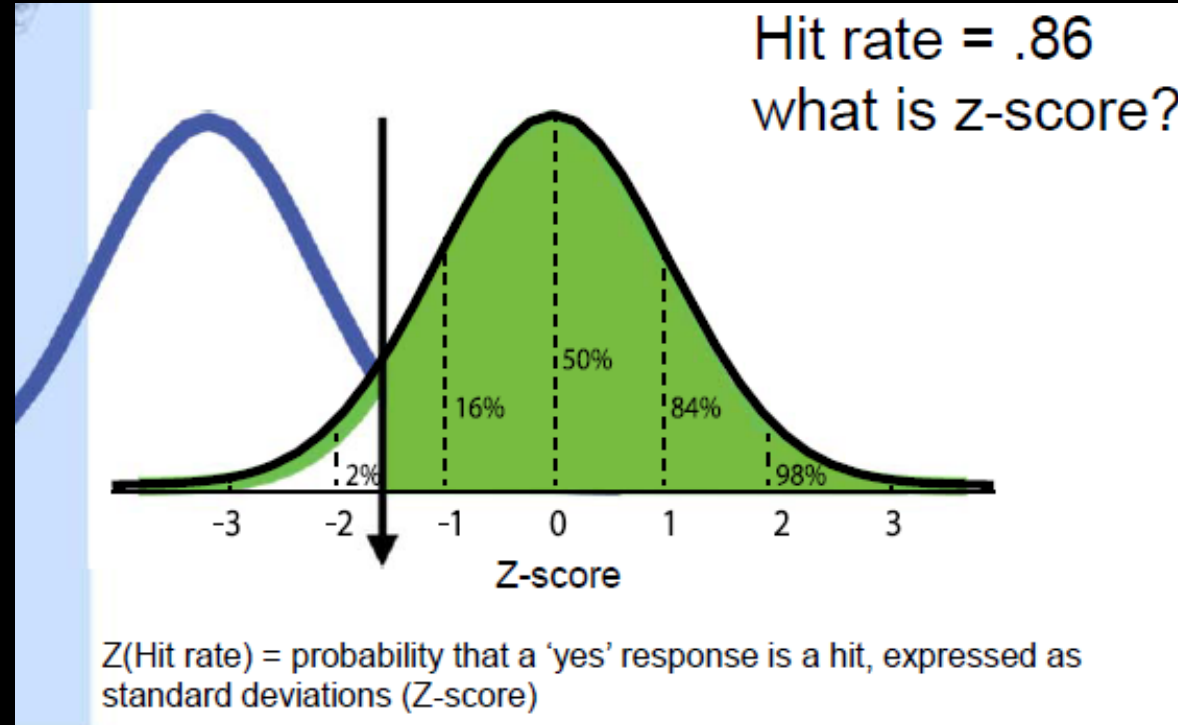
We cannot measure 'perceived intensity'!

... or can we?

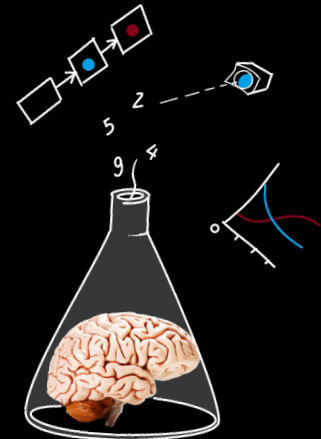


The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

How do we measure this distance?
We cannot measure 'perceived intensity'!
... or can we?

[illegible]

1.08

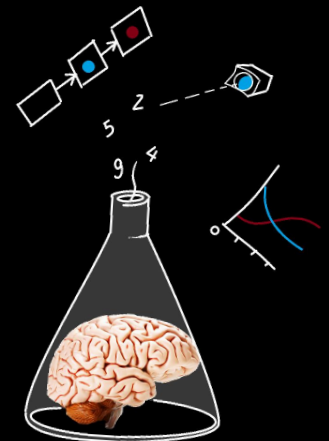
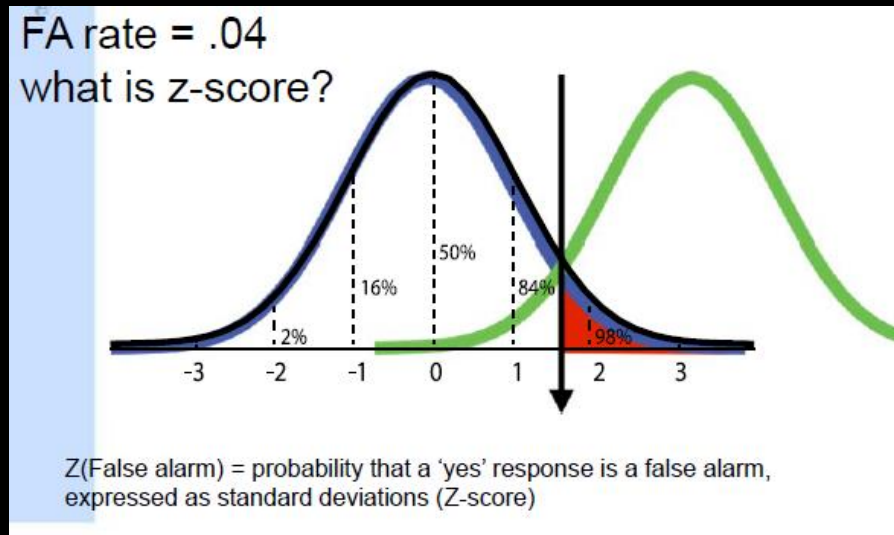


The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

How do we measure this distance?
We cannot measure 'perceived intensity'!
... or can we?



z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$
-3.00	0.001 054	0.004 433	-1.00	0.197 899	0.242 0	1.00	0.000 0399	1.00 841 342	2.00	0.077 047	0.054 008	3.00	0.004 433	0.001 054	4.00	0.000 0399	0.000 004 353
-2.90	0.001 065	0.004 505	-0.90	0.196 553	0.239 0	1.10	0.000 054 0	1.10 837 034	2.10	0.075 520	0.053 371	3.10	0.004 505	0.001 065	4.10	0.000 054 0	0.000 004 505
-2.80	0.001 077	0.004 577	-0.80	0.195 107	0.236 0	1.20	0.000 068 8	1.20 832 068	2.20	0.073 993	0.052 744	3.20	0.004 577	0.001 077	4.20	0.000 068 8	0.000 004 657
-2.70	0.001 089	0.004 649	-0.70	0.193 661	0.233 0	1.30	0.000 083 6	1.30 827 083	2.30	0.072 466	0.052 117	3.30	0.004 649	0.001 089	4.30	0.000 083 6	0.000 004 809
-2.60	0.001 101	0.004 721	-0.60	0.192 215	0.230 0	1.40	0.000 098 4	1.40 822 098	2.40	0.070 939	0.051 490	3.40	0.004 721	0.001 101	4.40	0.000 098 4	0.000 004 961
-2.50	0.001 113	0.004 793	-0.50	0.190 769	0.227 0	1.50	0.000 113 2	1.50 817 113	2.50	0.069 412	0.050 863	3.50	0.004 793	0.001 113	4.50	0.000 113 2	0.000 005 113
-2.40	0.001 125	0.004 865	-0.40	0.189 323	0.224 0	1.60	0.000 128 0	1.60 812 128	2.60	0.067 885	0.050 236	3.60	0.004 865	0.001 125	4.60	0.000 128 0	0.000 005 265
-2.30	0.001 137	0.004 937	-0.30	0.187 877	0.221 0	1.70	0.000 142 8	1.70 807 143	2.70	0.066 358	0.049 609	3.70	0.004 937	0.001 137	4.70	0.000 142 8	0.000 005 417
-2.20	0.001 149	0.005 009	-0.20	0.186 431	0.218 0	1.80	0.000 157 6	1.80 802 158	2.80	0.064 831	0.048 982	3.80	0.005 009	0.001 149	4.80	0.000 157 6	0.000 005 569
-2.10	0.001 161	0.005 081	-0.10	0.184 985	0.215 0	1.90	0.000 172 4	1.90 797 173	2.90	0.063 304	0.048 355	3.90	0.005 081	0.001 161	4.90	0.000 172 4	0.000 005 721
-2.00	0.001 173	0.005 153	0.00	0.183 539	0.212 0	2.00	0.000 187 2	2.00 792 187	3.00	0.061 777	0.047 728	4.00	0.005 153	0.001 173	5.00	0.000 187 2	0.000 005 873
-1.90	0.001 185	0.005 225	0.10	0.182 093	0.209 0	2.10	0.000 202 0	2.10 787 202	3.10	0.060 250	0.047 101	4.10	0.005 225	0.001 185	5.10	0.000 202 0	0.000 006 025
-1.80	0.001 197	0.005 297	0.20	0.180 647	0.206 0	2.20	0.000 216 8	2.20 782 217	3.20	0.058 723	0.046 474	4.20	0.005 297	0.001 197	5.20	0.000 216 8	0.000 006 177
-1.70	0.001 209	0.005 369	0.30	0.179 201	0.203 0	2.30	0.000 231 6	2.30 777 232	3.30	0.057 196	0.045 847	4.30	0.005 369	0.001 209	5.30	0.000 231 6	0.000 006 329
-1.60	0.001 221	0.005 441	0.40	0.177 755	0.200 0	2.40	0.000 246 4	2.40 772 247	3.40	0.055 669	0.045 220	4.40	0.005 441	0.001 221	5.40	0.000 246 4	0.000 006 481
-1.50	0.001 233	0.005 513	0.50	0.176 309	0.197 0	2.50	0.000 261 2	2.50 767 262	3.50	0.054 142	0.044 593	4.50	0.005 513	0.001 233	5.50	0.000 261 2	0.000 006 633
-1.40	0.001 245	0.005 585	0.60	0.174 863	0.194 0	2.60	0.000 276 0	2.60 762 277	3.60	0.052 615	0.043 966	4.60	0.005 585	0.001 245	5.60	0.000 276 0	0.000 006 785
-1.30	0.001 257	0.005 657	0.70	0.173 417	0.191 0	2.70	0.000 290 8	2.70 757 291	3.70	0.051 088	0.043 339	4.70	0.005 657	0.001 257	5.70	0.000 290 8	0.000 006 937
-1.20	0.001 269	0.005 729	0.80	0.171 971	0.188 0	2.80	0.000 305 6	2.80 752 306	3.80	0.049 561	0.042 712	4.80	0.005 729	0.001 269	5.80	0.000 305 6	0.000 007 089
-1.10	0.001 281	0.005 801	0.90	0.170 525	0.185 0	2.90	0.000 320 4	2.90 747 321	3.90	0.048 034	0.042 085	4.90	0.005 801	0.001 281	5.90	0.000 320 4	0.000 007 241
-1.00	0.001 293	0.005 873	1.00	0.169 079	0.182 0	3.00	0.000 335 2	3.00 742 336	4.00	0.046 507	0.041 458	5.00	0.005 873	0.001 293	6.00	0.000 335 2	0.000 007 393
-0.90	0.001 305	0.005 945	1.10	0.167 633	0.179 0	3.10	0.000 350 0	3.10 737 351	4.10	0.044 980	0.040 831	5.10	0.005 945	0.001 305	6.10	0.000 350 0	0.000 007 545
-0.80	0.001 317	0.006 017	1.20	0.166 187	0.176 0	3.20	0.000 364 8	3.20 732 366	4.20	0.043 453	0.040 204	5.20	0.006 017	0.001 317	6.20	0.000 364 8	0.000 007 697
-0.70	0.001 329	0.006 089	1.30	0.164 741	0.173 0	3.30	0.000 379 6	3.30 727 381	4.30	0.041 926	0.039 577	5.30	0.006 089	0.001 329	6.30	0.000 379 6	0.000 007 849
-0.60	0.001 341	0.006 161	1.40	0.163 295	0.170 0	3.40	0.000 394 4	3.40 722 396	4.40	0.040 399	0.038 950	5.40	0.006 161	0.001 341	6.40	0.000 394 4	0.000 007 901
-0.50	0.001 353	0.006 233	1.50	0.161 849	0.167 0	3.50	0.000 409 2	3.50 717 401	4.50	0.038 872	0.038 323	5.50	0.006 233	0.001 353	6.50	0.000 409 2	0.000 008 053
-0.40	0.001 365	0.006 305	1.60	0.160 403	0.164 0	3.60	0.000 424 0	3.60 712 426	4.60	0.037 345	0.037 696	5.60	0.006 305	0.001 365	6.60	0.000 424 0	0.000 008 105
-0.30	0.001 377	0.006 377	1.70	0.158 957	0.161 0	3.70	0.000 438 8	3.70 707 431	4.70	0.035 818	0.037 069	5.70	0.006 377	0.001 377	6.70	0.000 438 8	0.000 008 157
-0.20	0.001 389	0.006 449	1.80	0.157 511	0.158 0	3.80	0.000 453 6	3.80 702 456	4.80	0.034 291	0.036 442	5.80	0.006 449	0.001 389	6.80	0.000 453 6	0.000 008 209
-0.10	0.001 401	0.006 521	1.90	0.156 065	0.155 0	3.90	0.000 468 4	3.90 697 461	4.90	0.032 764	0.035 815	5.90	0.006 521	0.001 401	6.90	0.000 468 4	0.000 008 261
0.00	0.001 413	0.006 593	2.00	0.154 619	0.152 0	4.00	0.000 483 2	4.00 692 486	5.00	0.031 237	0.035 188	6.00	0.006 593	0.001 413	7.00	0.000 483 2	0.000 008 313
0.10	0.001 425	0.006 665	2.10	0.153 173	0.149 0	4.10	0.000 498 0	4.10 687 491	5.10	0.029 710	0.034 561	6.10	0.006 665	0.001 425	7.10	0.000 498 0	0.000 008 365
0.20	0.001 437	0.006 737	2.20	0.151 727	0.146 0	4.20	0.000 512 8	4.20 682 516	5.20	0.028 183	0.033 934	6.20	0.006 737	0.001 437	7.20	0.000 512 8	0.000 008 417
0.30	0.001 449	0.006 809	2.30	0.150 281	0.143 0	4.30	0.000 527 6	4.30 677 521	5.30	0.026 656	0.033 307	6.30	0.006 809	0.001 449	7.30	0.000 527 6	0.000 008 469
0.40	0.001 461	0.006 881	2.40	0.148 835	0.140 0	4.40	0.000 542 4	4.40 672 546	5.40	0.025 129	0.032 680	6.40	0.006 881	0.001 461	7.40	0.000 542 4	0.000 008 521
0.50	0.001 473	0.006 953	2.50	0.147 389	0.137 0	4.50	0.000 557 2	4.50 667 551	5.50	0.023 602	0.032 053	6.50	0.006 953	0.001 473	7.50	0.000 557 2	0.000 008 573
0.60	0.001 485	0.007 025	2.60	0.145 943	0.134 0	4.60	0.000 572 0	4.60 662 576	5.60	0.022 075	0.031 426	6.60	0.007 025	0.001 485	7.60	0.000 572 0	0.000 008 625
0.70	0.001 497	0.007 097	2.70	0.144 497	0.131 0	4.70	0.000 586 8	4.70 657 581	5.70	0.020 548	0.030 799	6.70	0.007 097	0.001 497	7.70	0.000 586 8	0.000 008 677
0.80	0.001 509	0.007 169	2.80	0.143 051	0.128 0	4.80	0.000 601 6	4.80 652 606	5.80	0.019 021	0.030 172	6.80	0.007 169	0.001 509	7.80	0.000 601 6	0.000 008 729
0.90	0.001 521	0.007 241	2.90	0.141 605	0.125 0	4.90	0.000 616 4	4.90 647 611	5.90	0.017 494	0.029 545	6.90	0.007 241	0.001 521	7.90	0.000 616 4	0.000 008 781
1.00	0.001 533	0.007 313	3.00	0.140 159	0.122 0	5.00	0.000 631 2	5.00 642 636	6.00	0.015 967	0.028 918	7.00	0.007 313	0.001 533	8.00	0.000 631 2	0.000 008 833
1.10	0.001 545	0.007 385	3.10	0.138 713	0.119 0	5.10	0.000 646 0	5.10 637 641	6.10	0.014 440	0.028 291	7.10	0.007 385	0.001 545	8.10	0.000 646 0	0.000 008 885
1.20	0.001 557	0.007 457	3.20	0.137 267	0.116 0	5.20	0.000 660 8	5.20 632 666	6.20	0.012 913	0.027 664	7.20	0.007 457	0.001 557	8.20	0.000 660 8	0.000 008 937
1.30	0.001 569	0.007 529	3.30	0.135 821	0.113 0	5.30	0.000 675 6	5.30 627 671	6.30	0.011 386	0.027 037	7.30	0.007 529	0.001 569	8.30	0.000 675 6	0.000 008 989
1.40	0.001 581	0.007 601	3.40	0.134 375	0.110 0	5.40	0.000 690 4	5.40 622 696	6.40	0.010 859	0.026 410	7.40	0.007 601	0.001 581	8.40	0.000 690 4	0.000 009 041
1.50	0.001 593	0.007 673	3.50	0.132 929	0.107 0	5.50	0.000 705 2	5.50 617 701	6.50	0.009 332	0.025 783	7.50	0.007 673	0.001 593	8.50	0.000 705 2	0.000 009 093
1.60	0.001 605	0.007 745	3.60	0.131 483	0.104 0	5.60	0.000 720 0	5.60 612 726	6.60	0.007 805	0.025 156	7.60	0.007 745	0.001 605	8.60	0.000 720 0	0.000 009 145
1.70	0.001 617	0.007 817	3.70	0.130 037	0.101 0	5.70	0.000 734 8	5.70 607 731	6.70	0.006 278	0.024 529	7.70	0.007 817	0.001 617	8.70	0.000 734 8	0.000 009 197
1.80	0.001 629	0.007 889	3.80	0.128 591	0.098 0	5.80	0.000 749 6	5.80 602 746	6.80	0.004 751	0.023 902	7.80	0.007 889	0.001 629	8.80	0.000 749 6	0.000 009 249
1.90	0.001 641	0.007 961	3.90	0.127 145	0.095 0	5.90	0.000 764 4	5.90 597 761	6.90	0.003 224	0.023 275	7.90	0.007 961	0.001 641	8.90	0.000 764 4	0.000 009 301
2.00	0.001 653	0.008 033	4.00	0.125 699	0.092 0	6.00	0.000 779 2	6.00 592 776	7.00	0.001 697	0.022 648	8.00	0.008 033	0.001 653	9.00	0.000 779 2	0.000 009 353
2.10	0.001 665	0.008 105	4.10	0.124 253	0.089 0	6.10	0.000 794 0	6.10 587 791	7.10	0.000 14							

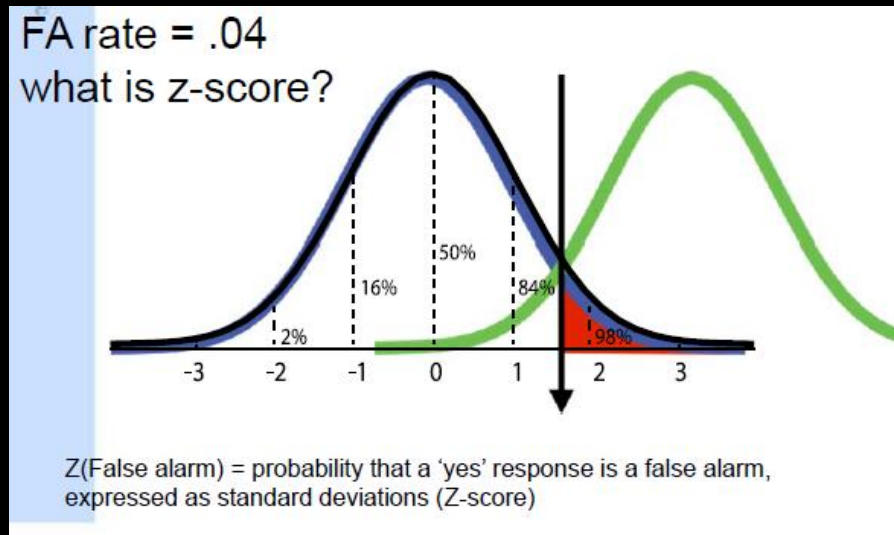


The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

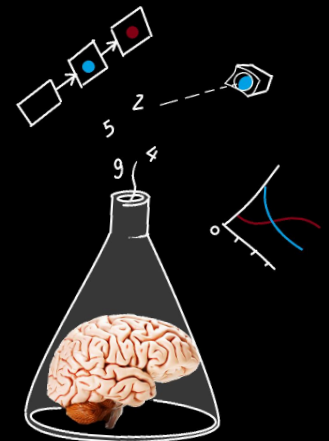
How do we measure this distance?
We cannot measure 'perceived intensity'!
... or can we?



z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$
-3.00	0.001	0.004	-2.00	0.053	0.054	-1.00	0.242	0.242	0.00	0.500	0.399	1.00	0.841	0.542	2.00	0.077	0.054
-2.90	0.001	0.004	-1.90	0.052	0.056	-1.10	0.239	0.239	0.10	0.489	0.399	1.10	0.831	0.539	2.10	0.075	0.056
-2.80	0.001	0.004	-1.80	0.051	0.057	-1.20	0.236	0.236	0.20	0.479	0.399	1.20	0.821	0.536	2.20	0.073	0.057
-2.70	0.001	0.004	-1.70	0.050	0.058	-1.30	0.233	0.233	0.30	0.469	0.399	1.30	0.811	0.533	2.30	0.071	0.058
-2.60	0.002	0.005	-1.60	0.049	0.059	-1.40	0.230	0.230	0.40	0.459	0.399	1.40	0.801	0.530	2.40	0.069	0.059
-2.50	0.002	0.005	-1.50	0.048	0.060	-1.50	0.227	0.227	0.50	0.449	0.399	1.50	0.791	0.527	2.50	0.067	0.060
-2.40	0.002	0.005	-1.40	0.047	0.061	-1.60	0.224	0.224	0.60	0.439	0.399	1.60	0.781	0.524	2.60	0.065	0.061
-2.30	0.002	0.005	-1.30	0.046	0.062	-1.70	0.221	0.221	0.70	0.429	0.399	1.70	0.771	0.521	2.70	0.063	0.062
-2.20	0.002	0.005	-1.20	0.045	0.063	-1.80	0.218	0.218	0.80	0.419	0.399	1.80	0.761	0.518	2.80	0.061	0.063
-2.10	0.002	0.005	-1.10	0.044	0.064	-1.90	0.215	0.215	0.90	0.409	0.399	1.90	0.751	0.515	2.90	0.059	0.064
-2.00	0.002	0.005	-1.00	0.043	0.065	-2.00	0.212	0.212	1.00	0.399	0.399	2.00	0.741	0.512	3.00	0.057	0.065
-1.90	0.002	0.005	-0.90	0.042	0.066	-2.10	0.209	0.209	1.10	0.389	0.399	2.10	0.731	0.509	3.10	0.055	0.066
-1.80	0.002	0.005	-0.80	0.041	0.067	-2.20	0.206	0.206	1.20	0.379	0.399	2.20	0.721	0.506	3.20	0.053	0.067
-1.70	0.003	0.005	-0.70	0.039	0.068	-2.30	0.203	0.203	1.30	0.369	0.399	2.30	0.711	0.503	3.30	0.051	0.068
-1.60	0.003	0.005	-0.60	0.038	0.069	-2.40	0.200	0.200	1.40	0.359	0.399	2.40	0.701	0.500	3.40	0.049	0.069
-1.50	0.003	0.005	-0.50	0.037	0.070	-2.50	0.197	0.197	1.50	0.349	0.399	2.50	0.691	0.497	3.50	0.047	0.070
-1.40	0.003	0.005	-0.40	0.036	0.071	-2.60	0.194	0.194	1.60	0.339	0.399	2.60	0.681	0.494	3.60	0.045	0.071
-1.30	0.003	0.005	-0.30	0.035	0.072	-2.70	0.191	0.191	1.70	0.329	0.399	2.70	0.671	0.491	3.70	0.043	0.072
-1.20	0.003	0.005	-0.20	0.034	0.073	-2.80	0.188	0.188	1.80	0.319	0.399	2.80	0.661	0.488	3.80	0.041	0.073
-1.10	0.003	0.005	-0.10	0.033	0.074	-2.90	0.185	0.185	1.90	0.309	0.399	2.90	0.651	0.485	3.90	0.039	0.074
-1.00	0.003	0.005	0.00	0.032	0.075	-3.00	0.182	0.182	2.00	0.299	0.399	3.00	0.641	0.482	4.00	0.037	0.075
-0.90	0.003	0.005	0.10	0.031	0.076	-3.10	0.179	0.179	2.10	0.289	0.399	3.10	0.631	0.479	4.10	0.035	0.076
-0.80	0.003	0.005	0.20	0.030	0.077	-3.20	0.176	0.176	2.20	0.279	0.399	3.20	0.621	0.476	4.20	0.033	0.077
-0.70	0.003	0.005	0.30	0.029	0.078	-3.30	0.173	0.173	2.30	0.269	0.399	3.30	0.611	0.473	4.30	0.031	0.078
-0.60	0.003	0.005	0.40	0.028	0.079	-3.40	0.170	0.170	2.40	0.259	0.399	3.40	0.601	0.470	4.40	0.029	0.079
-0.50	0.003	0.005	0.50	0.027	0.080	-3.50	0.167	0.167	2.50	0.249	0.399	3.50	0.591	0.467	4.50	0.027	0.080
-0.40	0.003	0.005	0.60	0.026	0.081	-3.60	0.164	0.164	2.60	0.239	0.399	3.60	0.581	0.464	4.60	0.025	0.081
-0.30	0.003	0.005	0.70	0.025	0.082	-3.70	0.161	0.161	2.70	0.229	0.399	3.70	0.571	0.461	4.70	0.023	0.082
-0.20	0.003	0.005	0.80	0.024	0.083	-3.80	0.158	0.158	2.80	0.219	0.399	3.80	0.561	0.458	4.80	0.021	0.083
-0.10	0.003	0.005	0.90	0.023	0.084	-3.90	0.155	0.155	2.90	0.209	0.399	3.90	0.551	0.455	4.90	0.019	0.084
0.00	0.003	0.005	1.00	0.022	0.085	-4.00	0.152	0.152	3.00	0.199	0.399	4.00	0.541	0.452	5.00	0.017	0.085
0.10	0.003	0.005	1.10	0.021	0.086	-4.10	0.149	0.149	3.10	0.189	0.399	4.10	0.531	0.449	5.10	0.015	0.086
0.20	0.003	0.005	1.20	0.020	0.087	-4.20	0.146	0.146	3.20	0.179	0.399	4.20	0.521	0.446	5.20	0.013	0.087
0.30	0.003	0.005	1.30	0.019	0.088	-4.30	0.143	0.143	3.30	0.169	0.399	4.30	0.511	0.443	5.30	0.011	0.088
0.40	0.003	0.005	1.40	0.018	0.089	-4.40	0.140	0.140	3.40	0.159	0.399	4.40	0.501	0.440	5.40	0.009	0.089
0.50	0.003	0.005	1.50	0.017	0.090	-4.50	0.137	0.137	3.50	0.149	0.399	4.50	0.491	0.437	5.50	0.007	0.090
0.60	0.003	0.005	1.60	0.016	0.091	-4.60	0.134	0.134	3.60	0.139	0.399	4.60	0.481	0.434	5.60	0.005	0.091
0.70	0.003	0.005	1.70	0.015	0.092	-4.70	0.131	0.131	3.70	0.129	0.399	4.70	0.471	0.431	5.70	0.003	0.092
0.80	0.003	0.005	1.80	0.014	0.093	-4.80	0.128	0.128	3.80	0.119	0.399	4.80	0.461	0.428	5.80	0.001	0.093
0.90	0.003	0.005	1.90	0.013	0.094	-4.90	0.125	0.125	3.90	0.109	0.399	4.90	0.451	0.425	5.90	0.000	0.094
1.00	0.003	0.005	2.00	0.012	0.095	-5.00	0.122	0.122	4.00	0.099	0.399	5.00	0.441	0.422	6.00	0.000	0.095
1.10	0.003	0.005	2.10	0.011	0.096	-5.10	0.119	0.119	4.10	0.089	0.399	5.10	0.431	0.419	6.10	0.000	0.096
1.20	0.003	0.005	2.20	0.010	0.097	-5.20	0.116	0.116	4.20	0.079	0.399	5.20	0.421	0.416	6.20	0.000	0.097
1.30	0.003	0.005	2.30	0.009	0.098	-5.30	0.113	0.113	4.30	0.069	0.399	5.30	0.411	0.413	6.30	0.000	0.098
1.40	0.003	0.005	2.40	0.008	0.099	-5.40	0.110	0.110	4.40	0.059	0.399	5.40	0.401	0.410	6.40	0.000	0.099
1.50	0.003	0.005	2.50	0.007	0.100	-5.50	0.107	0.107	4.50	0.049	0.399	5.50	0.391	0.407	6.50	0.000	0.100
1.60	0.003	0.005	2.60	0.006	0.101	-5.60	0.104	0.104	4.60	0.039	0.399	5.60	0.381	0.404	6.60	0.000	0.101
1.70	0.003	0.005	2.70	0.005	0.102	-5.70	0.101	0.101	4.70	0.029	0.399	5.70	0.371	0.401	6.70	0.000	0.102
1.80	0.003	0.005	2.80	0.004	0.103	-5.80	0.098	0.098	4.80	0.019	0.399	5.80	0.361	0.398	6.80	0.000	0.103
1.90	0.003	0.005	2.90	0.003	0.104	-5.90	0.095	0.095	4.90	0.009	0.399	5.90	0.351	0.395	6.90	0.000	0.104
2.00	0.003	0.005	3.00	0.002	0.105	-6.00	0.092	0.092	5.00	0.000	0.399	6.00	0.341	0.392	7.00	0.000	0.105
2.10	0.003	0.005	3.10	0.001	0.106	-6.10	0.089	0.089	5.10	0.000	0.399	6.10	0.331	0.389	7.10	0.000	0.106
2.20	0.003	0.005	3.20	0.001	0.107	-6.20	0.086	0.086	5.20	0.000	0.399	6.20	0.321	0.386	7.20	0.000	0.107
2.30	0.003	0.005	3.30	0.000	0.108	-6.30	0.083	0.083	5.30	0.000	0.399	6.30	0.311	0.383	7.30	0.000	0.108
2.40	0.003	0.005	3.40	0.000	0.109	-6.40	0.080	0.080	5.40	0.000	0.399	6.40	0.301	0.380	7.40	0.000	0.109
2.50	0.003	0.005	3.50	0.000	0.110	-6.50	0.077	0.077	5.50	0.000	0.399	6.50	0.291	0.377	7.50	0.000	0.110
2.60	0.003	0.005	3.60	0.000	0.111	-6.60	0.074	0.074	5.60	0.000	0.399	6.60	0.281	0.374	7.60	0.000	0.111
2.70	0.003	0.005	3.70	0.000	0.112	-6.70	0.071	0.071	5.70	0.000	0.399	6.70	0.271	0.371	7.70	0.000	0.112
2.80	0.003	0.005	3.80	0.000	0.113	-6.80	0.068	0.068	5.80	0.000	0.399	6.80	0.261	0.368	7.80	0.000	0.113
2.90	0.003	0.005	3.90	0.000	0.114	-6.90	0.065	0.065	5.90	0.000	0.399	6.90	0.251	0.365	7.90	0.000	0.114
3.00	0.003	0.005	4.00	0.000	0.115	-7.00	0.062	0.062	6.00	0.000	0.399	7.00	0.241	0.362	8.00	0.000	0.115
3.10	0.003	0.005	4.10	0.000	0.116	-7.10	0.059	0.059	6.10	0.000	0.399	7.10	0.231	0.359	8.10	0.000	0.116
3.20	0.003	0.005	4.20	0.000	0.117	-7.20	0.056	0.056	6.20	0.000	0.399	7.20	0.221	0.356	8.20	0.000	0.117
3.30	0.003	0.005	4.30	0.000	0.118	-7.30	0.053	0.053	6.30	0.000	0.399	7.30	0.211	0.353	8.30	0.000	0.118
3.40	0.003	0.005	4.40	0.000	0.119	-7.40	0.050	0.050	6.40	0.000	0.399	7.40	0.201	0.350	8.40	0.000	0.119
3.50	0.003	0.005	4.50	0.000	0.120	-7.50	0.047	0.047	6.50	0.000	0.399	7.50	0.191	0.347	8.50	0.000	0.120
3.60	0.003	0.005	4.60	0.000	0.121	-7.60	0.044	0.044	6.60	0.000	0.399	7.60	0.181	0.344	8.60	0.000	0.121
3.70	0.003	0.005	4.70	0.000	0.122	-7.70	0.041	0.041	6.70	0.000	0.399	7.70	0.171	0.341	8.70	0.000	0.122



-1.75

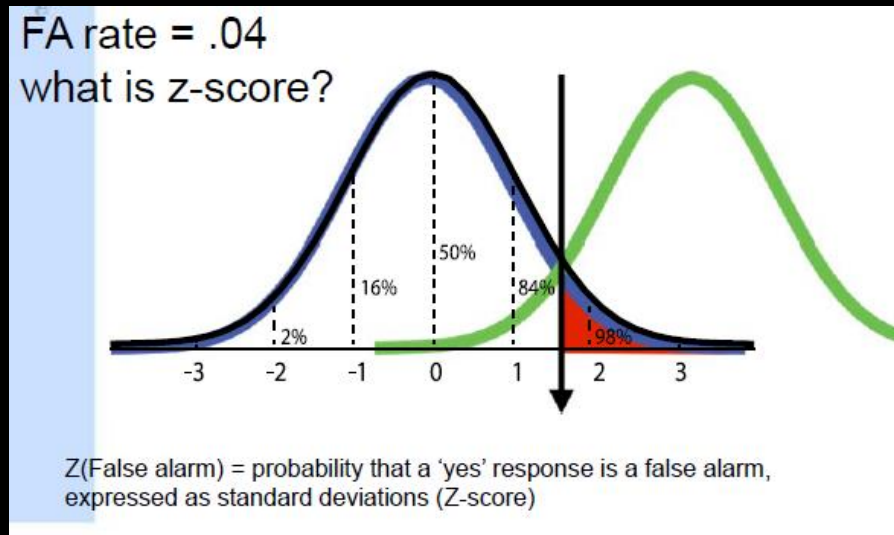


The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

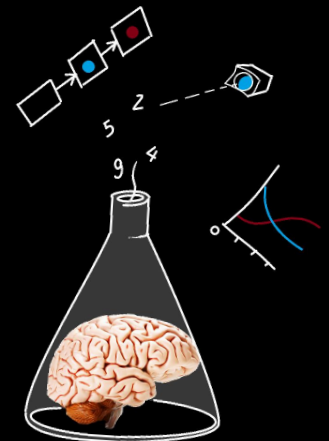
Sensitivity = z-score for hits minus z-score for false alarms: $1.08 - -1.75 = 2.83$



z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$	z	$p(z)$	$f(z)$
-3.00	0.001	0.0044	-2.00	0.053	0.054	-1.00	0.242	0.242	0.00	0.500	0.399	1.00	0.841	0.542	2.00	0.077	0.054
-2.90	0.001	0.0043	-1.90	0.052	0.053	-1.10	0.239	0.239	0.10	0.489	0.397	1.10	0.831	0.539	2.10	0.075	0.053
-2.80	0.001	0.0042	-1.80	0.051	0.052	-1.20	0.236	0.236	0.20	0.479	0.395	1.20	0.821	0.536	2.20	0.073	0.052
-2.70	0.001	0.0041	-1.70	0.050	0.051	-1.30	0.233	0.233	0.30	0.469	0.393	1.30	0.811	0.533	2.30	0.071	0.051
-2.60	0.002	0.0040	-1.60	0.049	0.050	-1.40	0.230	0.230	0.40	0.459	0.391	1.40	0.801	0.530	2.40	0.069	0.050
-2.50	0.002	0.0039	-1.50	0.048	0.049	-1.50	0.227	0.227	0.50	0.449	0.389	1.50	0.791	0.527	2.50	0.067	0.049
-2.40	0.002	0.0038	-1.40	0.047	0.048	-1.60	0.224	0.224	0.60	0.439	0.387	1.60	0.781	0.524	2.60	0.065	0.048
-2.30	0.002	0.0037	-1.30	0.046	0.047	-1.70	0.221	0.221	0.70	0.429	0.385	1.70	0.771	0.521	2.70	0.063	0.047
-2.20	0.002	0.0036	-1.20	0.045	0.046	-1.80	0.218	0.218	0.80	0.419	0.383	1.80	0.761	0.518	2.80	0.061	0.046
-2.10	0.002	0.0035	-1.10	0.044	0.045	-1.90	0.215	0.215	0.90	0.409	0.381	1.90	0.751	0.515	2.90	0.059	0.045
-2.00	0.002	0.0034	-1.00	0.043	0.044	-2.00	0.212	0.212	1.00	0.399	0.379	2.00	0.741	0.512	3.00	0.057	0.044
-1.90	0.002	0.0033	-0.90	0.042	0.043	-2.10	0.209	0.209	1.10	0.389	0.377	2.10	0.731	0.509	3.10	0.055	0.043
-1.80	0.002	0.0032	-0.80	0.041	0.042	-2.20	0.206	0.206	1.20	0.379	0.375	2.20	0.721	0.506	3.20	0.053	0.042
-1.70	0.003	0.0031	-0.70	0.039	0.040	-2.30	0.203	0.203	1.30	0.369	0.373	2.30	0.711	0.503	3.30	0.051	0.040
-1.60	0.003	0.0030	-0.60	0.038	0.039	-2.40	0.200	0.200	1.40	0.359	0.371	2.40	0.701	0.500	3.40	0.049	0.039
-1.50	0.003	0.0029	-0.50	0.037	0.038	-2.50	0.197	0.197	1.50	0.349	0.369	2.50	0.691	0.497	3.50	0.047	0.038
-1.40	0.003	0.0028	-0.40	0.036	0.037	-2.60	0.194	0.194	1.60	0.339	0.367	2.60	0.681	0.494	3.60	0.045	0.037
-1.30	0.003	0.0027	-0.30	0.035	0.036	-2.70	0.191	0.191	1.70	0.329	0.365	2.70	0.671	0.491	3.70	0.043	0.036
-1.20	0.003	0.0026	-0.20	0.034	0.035	-2.80	0.188	0.188	1.80	0.319	0.363	2.80	0.661	0.488	3.80	0.041	0.035
-1.10	0.003	0.0025	-0.10	0.033	0.034	-2.90	0.185	0.185	1.90	0.309	0.361	2.90	0.651	0.485	3.90	0.039	0.034
-1.00	0.003	0.0024	0.00	0.032	0.033	-3.00	0.182	0.182	2.00	0.299	0.359	3.00	0.641	0.482	4.00	0.037	0.033
-0.90	0.003	0.0023	0.10	0.031	0.032	-3.10	0.179	0.179	2.10	0.289	0.357	3.10	0.631	0.479	4.10	0.035	0.032
-0.80	0.003	0.0022	0.20	0.030	0.031	-3.20	0.176	0.176	2.20	0.279	0.355	3.20	0.621	0.476	4.20	0.033	0.031
-0.70	0.003	0.0021	0.30	0.029	0.030	-3.30	0.173	0.173	2.30	0.269	0.353	3.30	0.611	0.473	4.30	0.031	0.030
-0.60	0.003	0.0020	0.40	0.028	0.029	-3.40	0.170	0.170	2.40	0.259	0.351	3.40	0.601	0.470	4.40	0.029	0.029
-0.50	0.003	0.0019	0.50	0.027	0.028	-3.50	0.167	0.167	2.50	0.249	0.349	3.50	0.591	0.467	4.50	0.027	0.028
-0.40	0.003	0.0018	0.60	0.026	0.027	-3.60	0.164	0.164	2.60	0.239	0.347	3.60	0.581	0.464	4.60	0.025	0.027
-0.30	0.003	0.0017	0.70	0.025	0.026	-3.70	0.161	0.161	2.70	0.229	0.345	3.70	0.571	0.461	4.70	0.023	0.026
-0.20	0.003	0.0016	0.80	0.024	0.025	-3.80	0.158	0.158	2.80	0.219	0.343	3.80	0.561	0.458	4.80	0.021	0.025
-0.10	0.003	0.0015	0.90	0.023	0.024	-3.90	0.155	0.155	2.90	0.209	0.341	3.90	0.551	0.455	4.90	0.019	0.024
0.00	0.003	0.0014	1.00	0.022	0.023	-4.00	0.152	0.152	3.00	0.199	0.339	4.00	0.541	0.452	5.00	0.017	0.023
0.10	0.003	0.0013	1.10	0.021	0.022	-4.10	0.149	0.149	3.10	0.189	0.337	4.10	0.531	0.449	5.10	0.015	0.022
0.20	0.003	0.0012	1.20	0.020	0.021	-4.20	0.146	0.146	3.20	0.179	0.335	4.20	0.521	0.446	5.20	0.013	0.021
0.30	0.003	0.0011	1.30	0.019	0.020	-4.30	0.143	0.143	3.30	0.169	0.333	4.30	0.511	0.443	5.30	0.011	0.020
0.40	0.003	0.0010	1.40	0.018	0.019	-4.40	0.140	0.140	3.40	0.159	0.331	4.40	0.501	0.440	5.40	0.009	0.019
0.50	0.003	0.0009	1.50	0.017	0.018	-4.50	0.137	0.137	3.50	0.149	0.329	4.50	0.491	0.437	5.50	0.007	0.018
0.60	0.003	0.0008	1.60	0.016	0.017	-4.60	0.134	0.134	3.60	0.139	0.327	4.60	0.481	0.434	5.60	0.005	0.017
0.70	0.003	0.0007	1.70	0.015	0.016	-4.70	0.131	0.131	3.70	0.129	0.325	4.70	0.471	0.431	5.70	0.003	0.016
0.80	0.003	0.0006	1.80	0.014	0.015	-4.80	0.128	0.128	3.80	0.119	0.323	4.80	0.461	0.428	5.80	0.001	0.015
0.90	0.003	0.0005	1.90	0.013	0.014	-4.90	0.125	0.125	3.90	0.109	0.321	4.90	0.451	0.425	5.90	0.000	0.014
1.00	0.003	0.0004	2.00	0.012	0.013	-5.00	0.122	0.122	4.00	0.099	0.319	5.00	0.441	0.422	6.00	0.000	0.013
1.10	0.003	0.0003	2.10	0.011	0.012	-5.10	0.119	0.119	4.10	0.089	0.317	5.10	0.431	0.419	6.10	0.000	0.012
1.20	0.003	0.0002	2.20	0.010	0.011	-5.20	0.116	0.116	4.20	0.079	0.315	5.20	0.421	0.416	6.20	0.000	0.011
1.30	0.003	0.0001	2.30	0.009	0.010	-5.30	0.113	0.113	4.30	0.069	0.313	5.30	0.411	0.413	6.30	0.000	0.010
1.40	0.003	0.0000	2.40	0.008	0.009	-5.40	0.110	0.110	4.40	0.059	0.311	5.40	0.401	0.410	6.40	0.000	0.009
1.50	0.003	0.0000	2.50	0.007	0.008	-5.50	0.107	0.107	4.50	0.049	0.309	5.50	0.391	0.407	6.50	0.000	0.008
1.60	0.003	0.0000	2.60	0.006	0.007	-5.60	0.104	0.104	4.60	0.039	0.307	5.60	0.381	0.404	6.60	0.000	0.007
1.70	0.003	0.0000	2.70	0.005	0.006	-5.70	0.101	0.101	4.70	0.029	0.305	5.70	0.371	0.401	6.70	0.000	0.006
1.80	0.003	0.0000	2.80	0.004	0.005	-5.80	0.098	0.098	4.80	0.019	0.303	5.80	0.361	0.398	6.80	0.000	0.005
1.90	0.003	0.0000	2.90	0.003	0.004	-5.90	0.095	0.095	4.90	0.009	0.301	5.90	0.351	0.395	6.90	0.000	0.004
2.00	0.003	0.0000	3.00	0.002	0.003	-6.00	0.092	0.092	5.00	0.000	0.299	6.00	0.341	0.392	7.00	0.000	0.003
2.10	0.003	0.0000	3.10	0.001	0.002	-6.10	0.089	0.089	5.10	0.000	0.297	6.10	0.331	0.389	7.10	0.000	0.002
2.20	0.003	0.0000	3.20	0.001	0.001	-6.20	0.086	0.086	5.20	0.000	0.295	6.20	0.321	0.386	7.20	0.000	0.001
2.30	0.003	0.0000	3.30	0.000	0.001	-6.30	0.083	0.083	5.30	0.000	0.293	6.30	0.311	0.383	7.30	0.000	0.000
2.40	0.003	0.0000	3.40	0.000	0.000	-6.40	0.080	0.080	5.40	0.000	0.291	6.40	0.301	0.380	7.40	0.000	0.000
2.50	0.003	0.0000	3.50	0.000	0.000	-6.50	0.077	0.077	5.50	0.000	0.289	6.50	0.291	0.377	7.50	0.000	0.000
2.60	0.003	0.0000	3.60	0.000	0.000	-6.60	0.074	0.074	5.60	0.000	0.287	6.60	0.281	0.374	7.60	0.000	0.000
2.70	0.003	0.0000	3.70	0.000	0.000	-6.70	0.071	0.071	5.70	0.000	0.285	6.70	0.271	0.371	7.70	0.000	0.000
2.80	0.003	0.0000	3.80	0.000	0.000	-6.80	0.068	0.068	5.80	0.000	0.283	6.80	0.261	0.368	7.80	0.000	0.000
2.90	0.003	0.0000	3.90	0.000	0.000	-6.90	0.065	0.065	5.90	0.000	0.281	6.90	0.251	0.365	7.90	0.000	0.000
3.00	0.003	0.0000	4.00	0.000	0.000	-7.00	0.062	0.062	6.00	0.000	0.279	7.00	0.241	0.362	8.00	0.000	0.000
3.10	0.003	0.0000	4.10	0.000	0.000	-7.10	0.059	0.059	6.10	0.000	0.277	7.10	0.231	0.359	8.10	0.000	0.000
3.20	0.003	0.0000	4.20	0.000	0.000	-7.20	0.056	0.056	6.20	0.000	0.275	7.20	0.221	0.356	8.20	0.000	0.000
3.30	0.003	0.0000	4.30	0.000	0.000	-7.30	0.053	0.053	6.30	0.000	0.273	7.30	0.211	0.353	8.30	0.000	0.000
3.40	0.003	0.0000	4.40	0.000	0.000	-7.40	0.050	0.050	6.40	0.000	0.271	7.40	0.201	0.350	8.40	0.000	0.000
3.50	0.003	0.0000	4.50	0.000	0.000	-7.50	0.047	0.047	6.50	0.000	0.269	7.50	0.191	0.347	8.50	0.000	0.000
3.60	0.003	0.0000	4.60	0.000	0.000	-7.60	0.044	0.044	6.60	0.000	0.267	7.60	0.181	0.344	8.60	0.000	0.000
3.70	0.003	0.0000	4.70	0.000	0.000	-7.70	0.041	0.041	6.70	0.000							



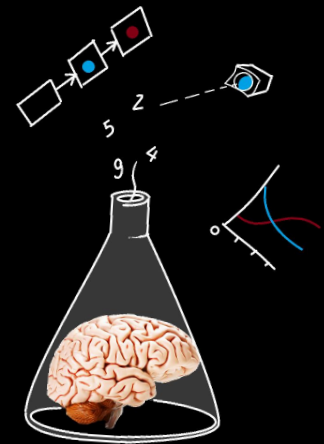
-1.75



The distance between signal and noise distributions varies among individuals and is called *sensitivity* (= *perceptual skill!!*)

All that we need to measure sensitivity are the proportions

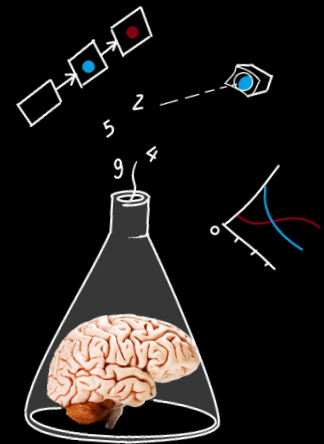
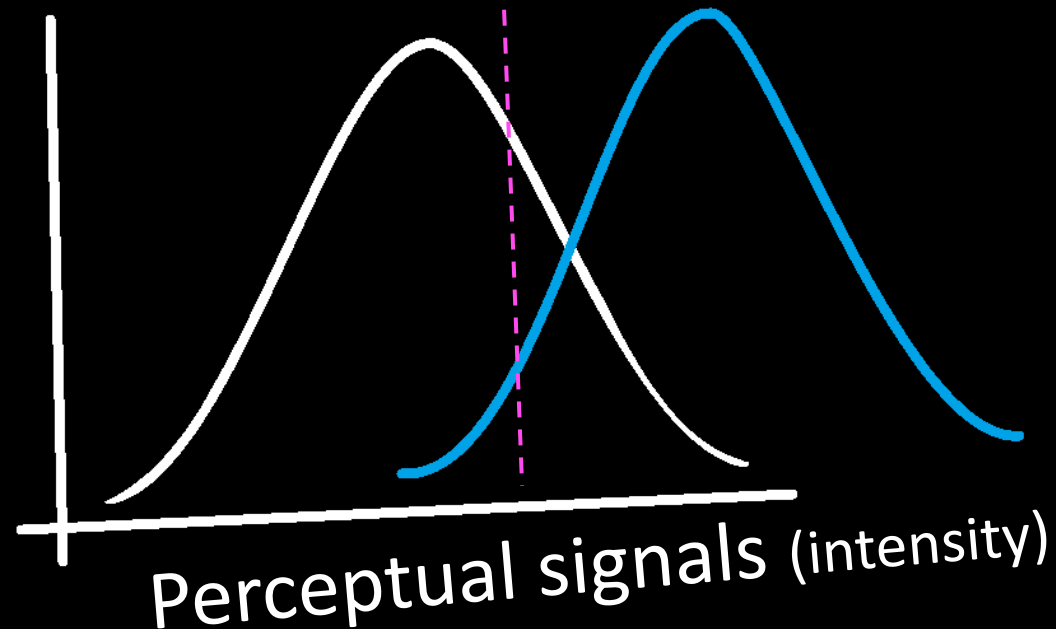
		State of the world	
		Signal	Noise
Response	Yes	P(Hit) 0.66	P(False alarm) 0.14
	No	P(Miss) 0.34	P(Correct rejection) 0.86



The distance between signal and noise distributions varies among individuals and is called *sensitivity*
(= *perceptual skill!!*)

**Not affected by
response threshold
(criterion) !**

$z(\text{hits}) - z(\text{false alarms})$ remains same

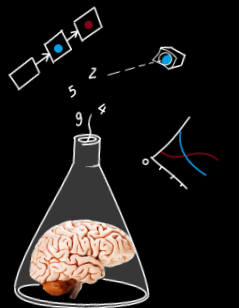
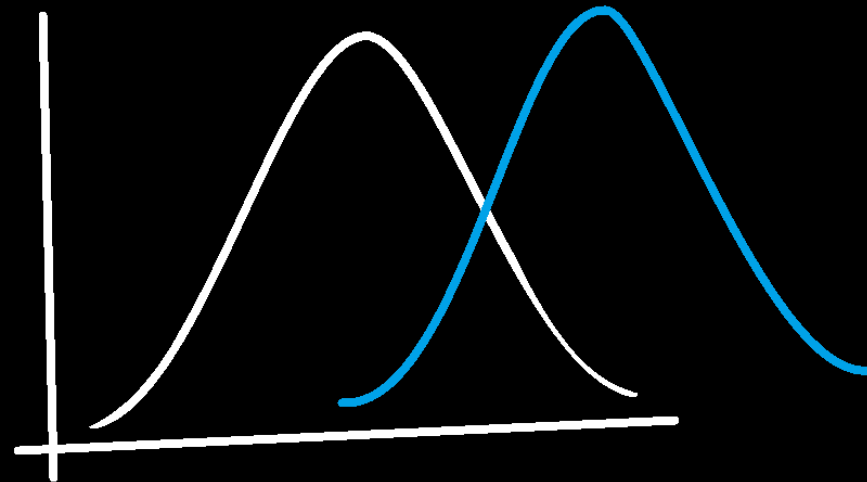


Staircase procedures

What if we want to measure performance irrespective of these subjective perceptual processes?

e.g., a person is slightly color-blind in our Stroop task

RED BLUE BLUE RED

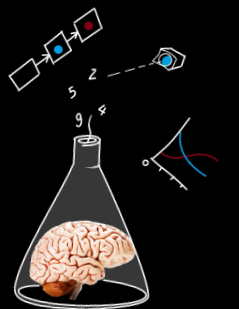
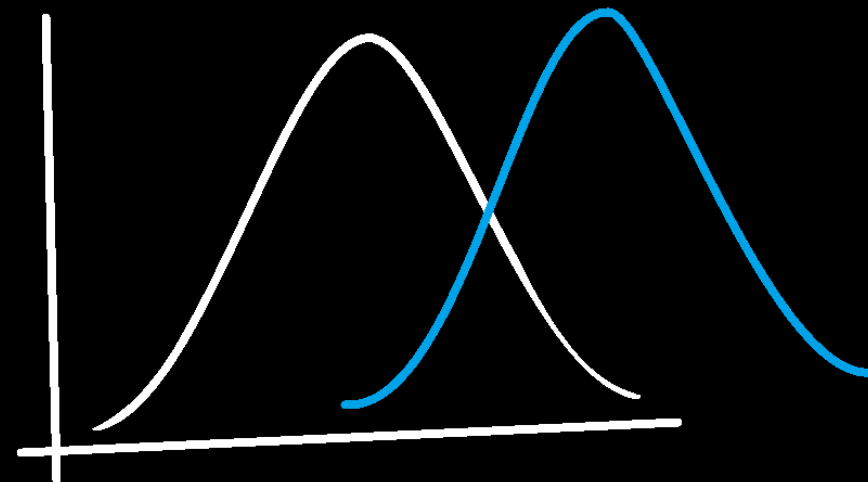


Staircase procedures

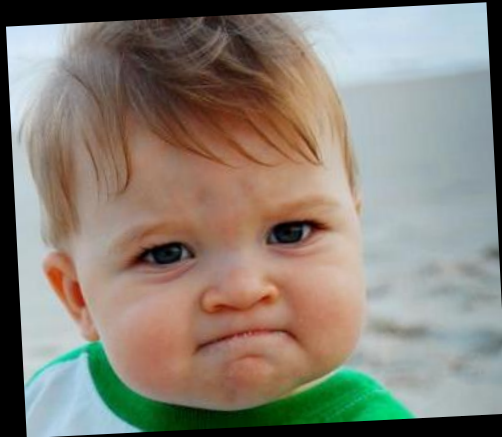
a.k.a.: Controlling the subjective distance between the relevant and the irrelevant

→ adjust stimulus intensity, duration, etc., on the basis of incoming responses

→ so that all subjects perform equally

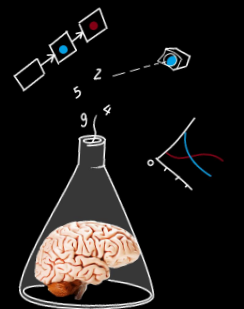
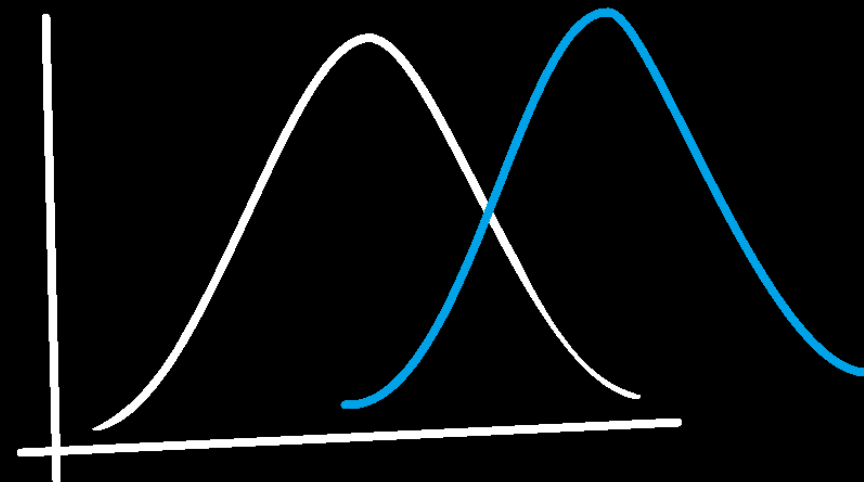
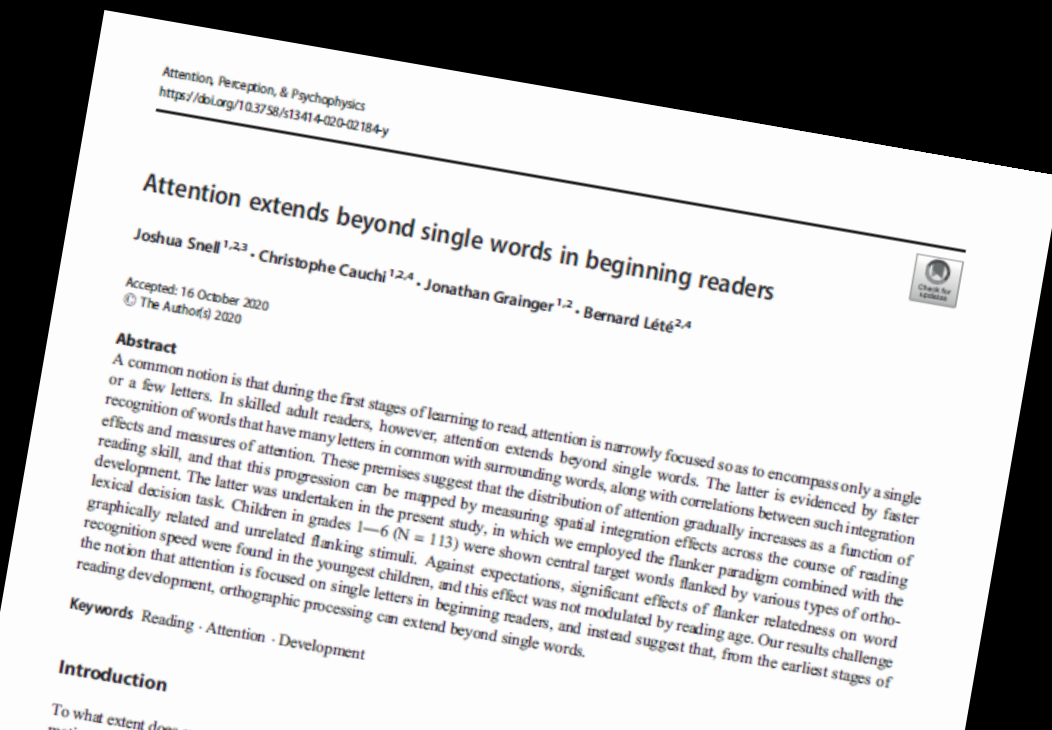


Staircase procedures



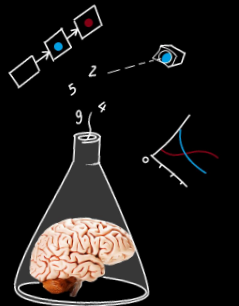
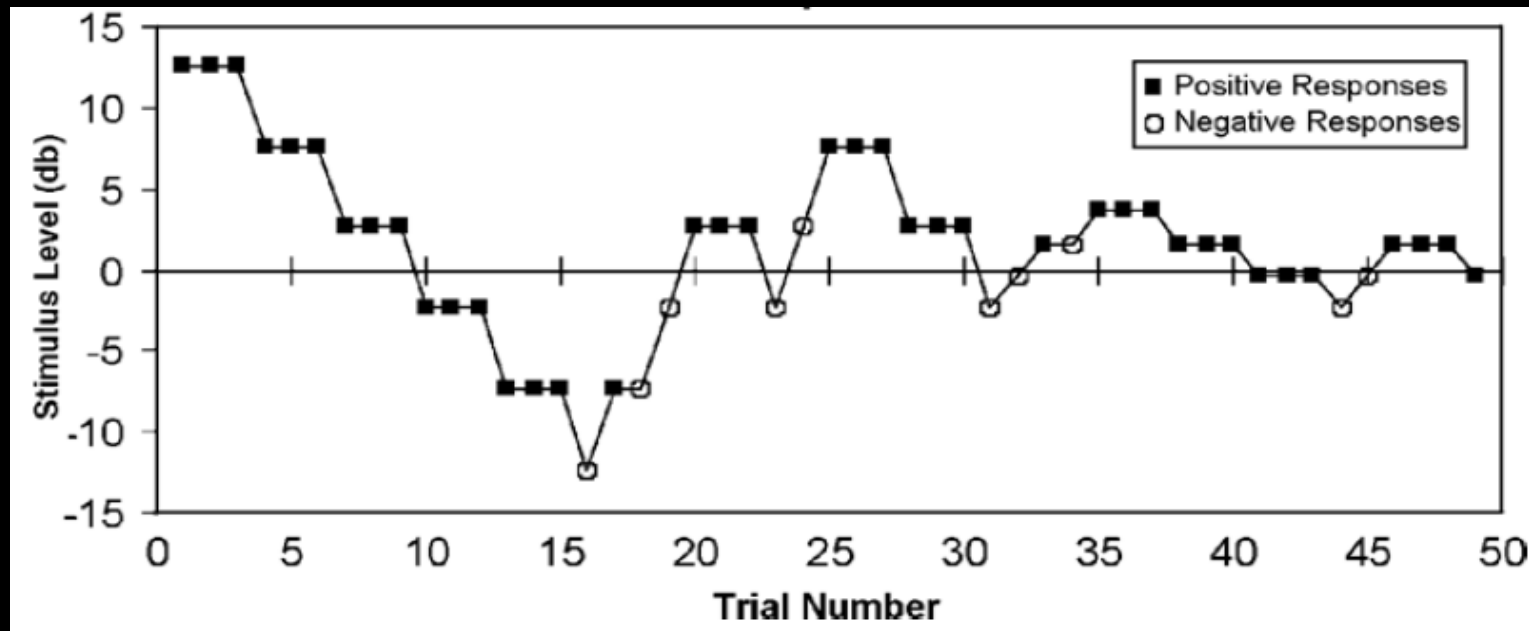
“Words are impacted by surrounding words”
“What is the developmental trajectory of this?”

Standard paradigm: show words for 150 ms
“Uh oh, kids can’t even recognize single words in 150 ms”



Staircase procedures : example

- After X correct trials, decrease stimulus duration by β
- After Y incorrect trials, increase stimulus duration by β
- After each oscillation, decrease β a bit (until it hits 0)



Next Monday

