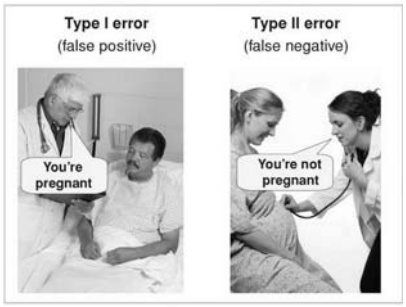
Power analysis: Motivation

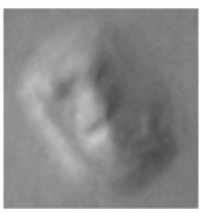
Ellis (2010)

Remember this?

- Type I error: Seeing something when there is nothing
- Type II error: Seeing nothing when there is something



- False positive



Ellis (2010)

Power analysis

- Asymptotic approximation for statistical power using a randomized intervention with N participants in a N/2 binary treatment

$$Poder\ estadístico = \Phi\left(\frac{|\mu_t - \mu_c|\sqrt{N}}{2\sigma} - \Phi^{-1}\left(1 - \frac{\alpha}{2}\right)\right)$$

$\Phi(\cdot)$: normal cumulative distribution function (CDF); $\Phi^{-1}(\cdot)$: Inverse of the normal CDF; μ_i: normally distributed outcome with mean μ_i for the treatment and control group $i = \{t,c\}$; σ: pooled standard deviation; α: level of statistical significance

  - You can try this in Excel (e.g., use N = 500; $\mu_c = 60$; $\mu_t = 65$; $\sigma = 20$; $\alpha = 0.05 \Rightarrow 1\text{-}\beta = 0.80$)

- What's the interpretation of this?

Power analysis: Practical issues

- Remember that a certain "power" will tell us the likelihood of making a type II error
- A power analysis should be conducted before a study is conducted → determine sample size
  - This depends on the effect size (from previous study, from experts' judgement). This may difficult for new studies, online and lab studies.
- We may start by answering what's the minimum acceptable sample size?
- What are the ways to increase power?

Power analysis: Sensitivity

- A manufacturing company wants to test a new training program for its workers. They know that in average workers can assemble 78 pieces/day (SD = 4.5), and the new program would be cost-effective if it improves productivity to 80 pieces/day