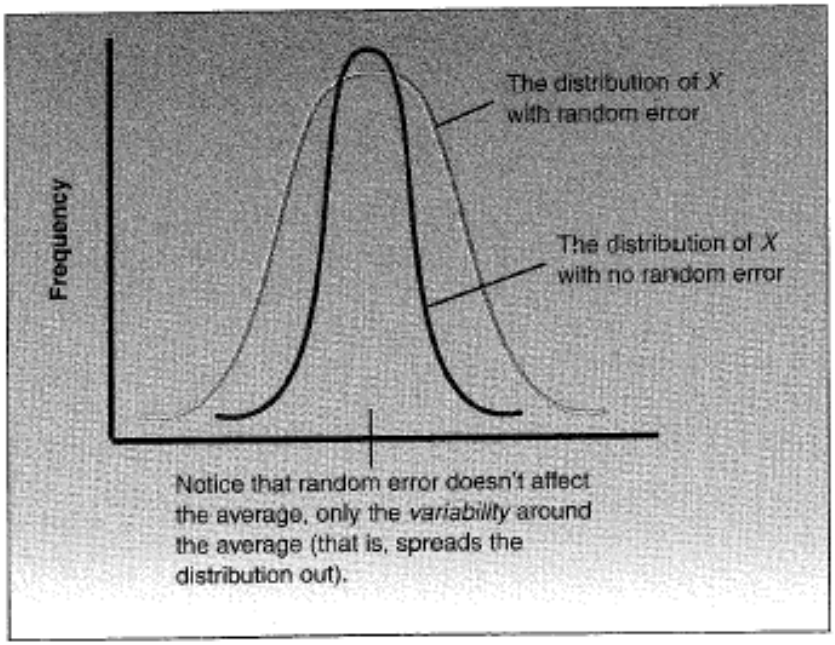
Reliability & Logic

Reliability and true score theory

- Reliability is the degree to which a measure is consistent or dependable; the degree to which it would give you the same result over and over again, assuming the underlying phenomenon is not changing
- True score theory maintains that every measurement is an additive composite of two components: the true ability of the respondent (or experiment etc) and the random error

Random error

- Random error adds variability to a distribution but does not affect the central tendency or the average (randomly affecting measurement of the variable across the sample)



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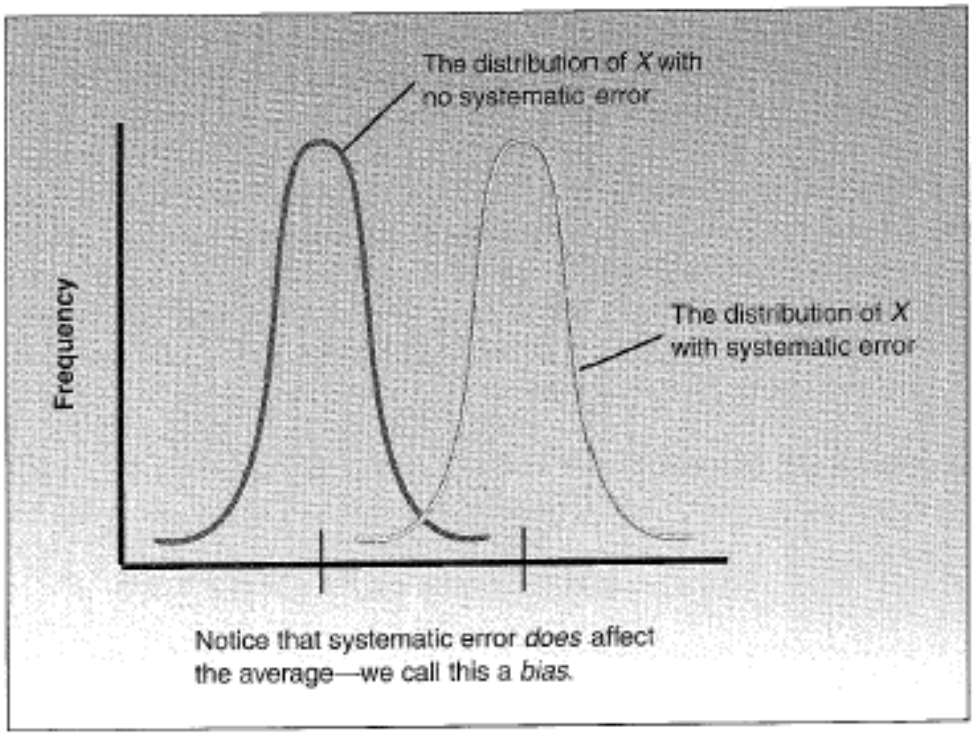
Systematic error

- Systematic error affects the central tendency of a distribution (affecting measurement of the variable across the sample)



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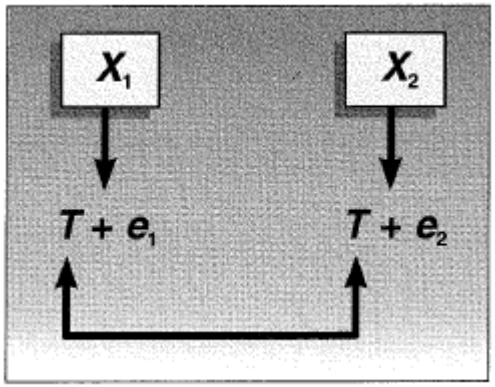
Reliability and true score theory

- Even if scores are the same, the error will differ for different people, time and places!

- Reliability is the ratio of to true level of the measure to that found in the study!



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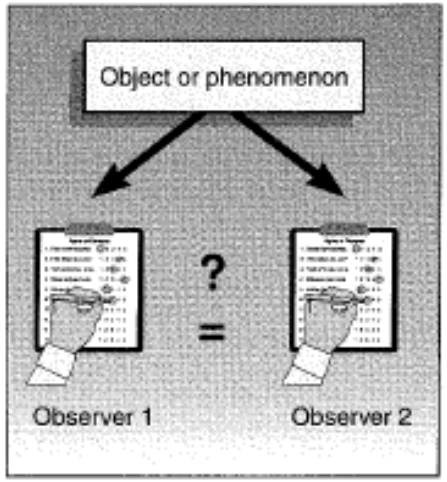
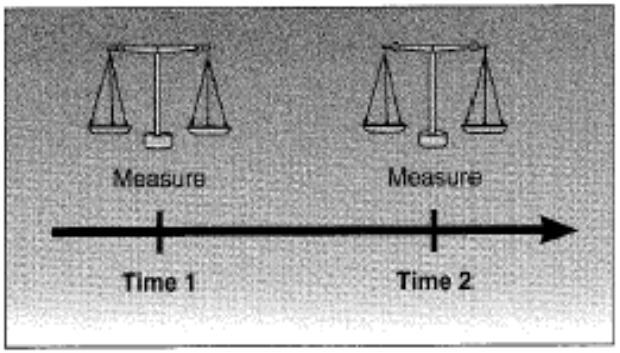
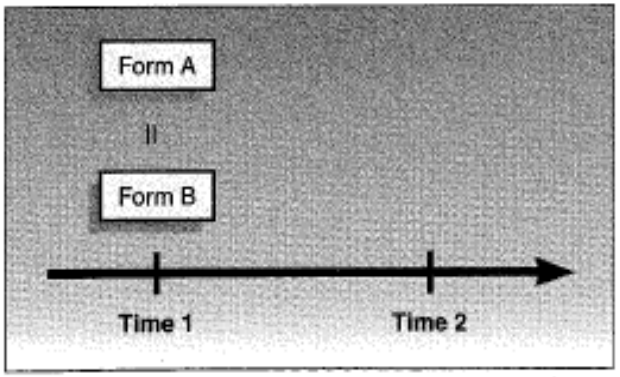
Types of reliability

- Inter-observer reliability (people are notorious for inconsistency!)
- Test-retest reliability (two different occasions!)
- Parallel-forms reliability (same construct different test – split half reliability !)







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The shooting target metaphor

- Reliability and validity are closely related to each other!

Logic

"I'm sorry but this computer coupon is good only when printed on a color printer."

Is this valid?

- All men are mortal.
- Socrates is mortal.
- Therefore, Socrates is a man.

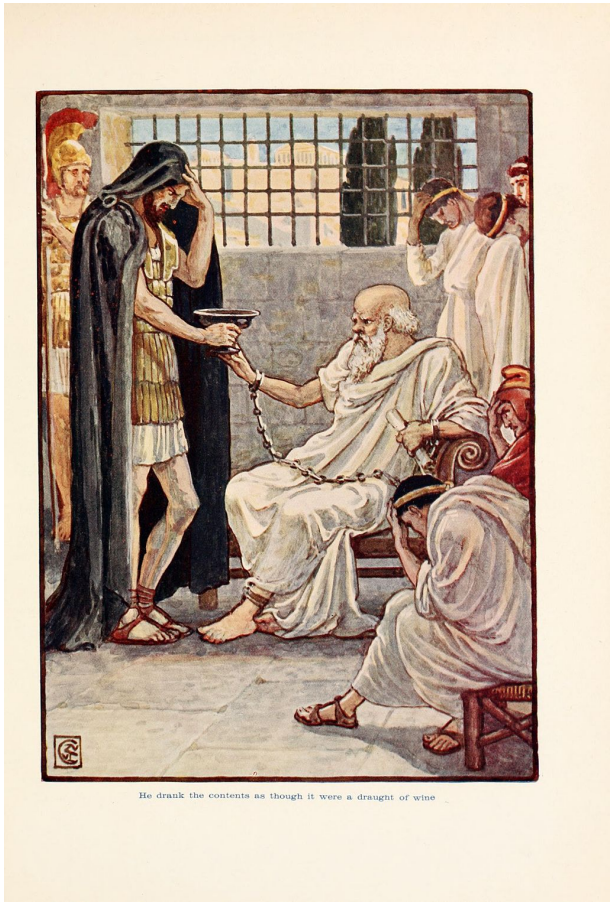
No!

- In this case, the conclusion does not follow inescapably from the premises. All men are mortal, but not all mortals are men. Every living creature is mortal; therefore, even though both premises are true and the conclusion happens to be true in this instance, the argument is invalid.

- It could have been Mrs. Socrates!

Is this the following well-known syllogism valid?

- All men are mortal.
- Socrates is a man.
- Therefore, Socrates is mortal.



Yes!

- What makes this a valid argument is not that it has true premises and a true conclusion, but the logical necessity of the conclusion, given the two premises.

Is this valid?

- All cups are green.
- Socrates is a cup.
- Therefore, Socrates is green.

Yes!

- What makes this a valid argument is not that it has true premises and a true conclusion, but the logical necessity of the conclusion, given the two premises. The argument would be just as valid were the premises and conclusion false. The previous argument is of the same logical form but with false premises and a false conclusion, and yet it is equally valid!

Abstracting

- A standard view is that whether an argument is valid is a matter of the argument's logical form:
  - All P are Q.
  - S is a P.
  - Therefore, S is a Q.
- Similarly, the third argument becomes:
  - All P are Q.
  - S is a Q.
  - Therefore, S is a P.
- An argument is **formally valid** if its form is one such that for each interpretation under which the premises are all true, the conclusion is also true. As already seen, the interpretation given above does cause the second argument form to have true premises and false conclusion, hence demonstrating its invalidity.

Validity and soundness

- Validity of deduction is not affected by the truth of the premise or the truth of the conclusion. The following deduction is perfectly valid:
  - All fire-breathing rabbits live on Mars
  - All humans are fire-breathing rabbits
  - Therefore all humans live on Mars
- The problem with the argument is that it is not *sound*. In order for a deductive argument to be sound, the deduction must be valid and **all** the premises true.