

Subject variables

Psychological studies require individual differences

Memory and Attention

Last fall, an investigator was interested in the effects of time of day upon two types of cognitive performance tasks (a memory task and an attention task). Volunteer subjects were recruited by advertisements in the student newspaper. Volunteers were asked to call the lab and were then asked when they could participate. Times available were 8am, 12 noon, 4 pm, and 8pm. Upon their arrival at the lab, participants first did a choice reaction time task for 15 minutes and then spent 15 minutes doing a working memory task. Accuracy measures were taken for both tasks. 120 subjects participated.

The results were:

	8 am	12 noon	4 pm	8 pm
choice % correct	95	95	95	95
Memory % recalled	80	80	80	80

Although there was no effect for time of day, the % correct for the attention task was greater than the % recalled for the memory task.

From this pattern of results, the investigator concluded that time of day does not effect cognitive performance, and that choice reaction time is easier than working memory.

Are these conclusions justified?

What is a plausible alternative hypothesis for the rt-memory difference?

Memory and attention

This winter, another investigator was interested in the effects of time of day upon two types of cognitive performance tasks (a memory task and an attention task). Volunteer subjects were recruited by advertisements in the student newspaper. Volunteers were asked to call the lab and were then randomly assigned by blocks to one of 4 conditions. Times available were 8am, 12 noon, 4 pm, and 8pm.

Upon their arrival at the lab, participants first did a choice reaction time task for 15 minutes and then spent 15 minutes doing a working memory task. Accuracy measures were taken for both tasks.

Of the 120 subjects who volunteered and were assigned to the four conditions, 80 actually participated and the losses were uniform from the four cells of the design.

	8 am	12 noon	4 pm	8 pm
choice % correct	90	90	90	90
Memory % recalled	70	70	70	70

Although there was no effect for time of day, the % correct for the attention task was greater than the % recalled for the memory task.

From this pattern of results, the investigator concluded that time of day does not effect cognitive performance, and that choice reaction time is easier than working memory. Are these conclusions justified?

Meta analytic research

In a reanalysis of the data from the first and second of these experiments, a meta-analyst noticed that the means were lower for the second study than the first, and also noticed that while the first study had been done in the fall, the second study had been done in the winter.

Fall

	8 am	12 noon	4 pm	8 pm
choice % correct	95	95	95	95
Memory % recalled	80	80	80	80

Winter

	8 am	12 noon	4 pm	8 pm
choice % correct	90	90	90	90
Memory % recalled	70	70	70	70

This meta-analyst interpreted these data as showing seasonal effects rather than time of day effects and made the additional claim that seasonal effects have a greater impact upon memory than reaction time accuracy.

Are these two conclusions justified?

What is a plausible rival hypothesis?

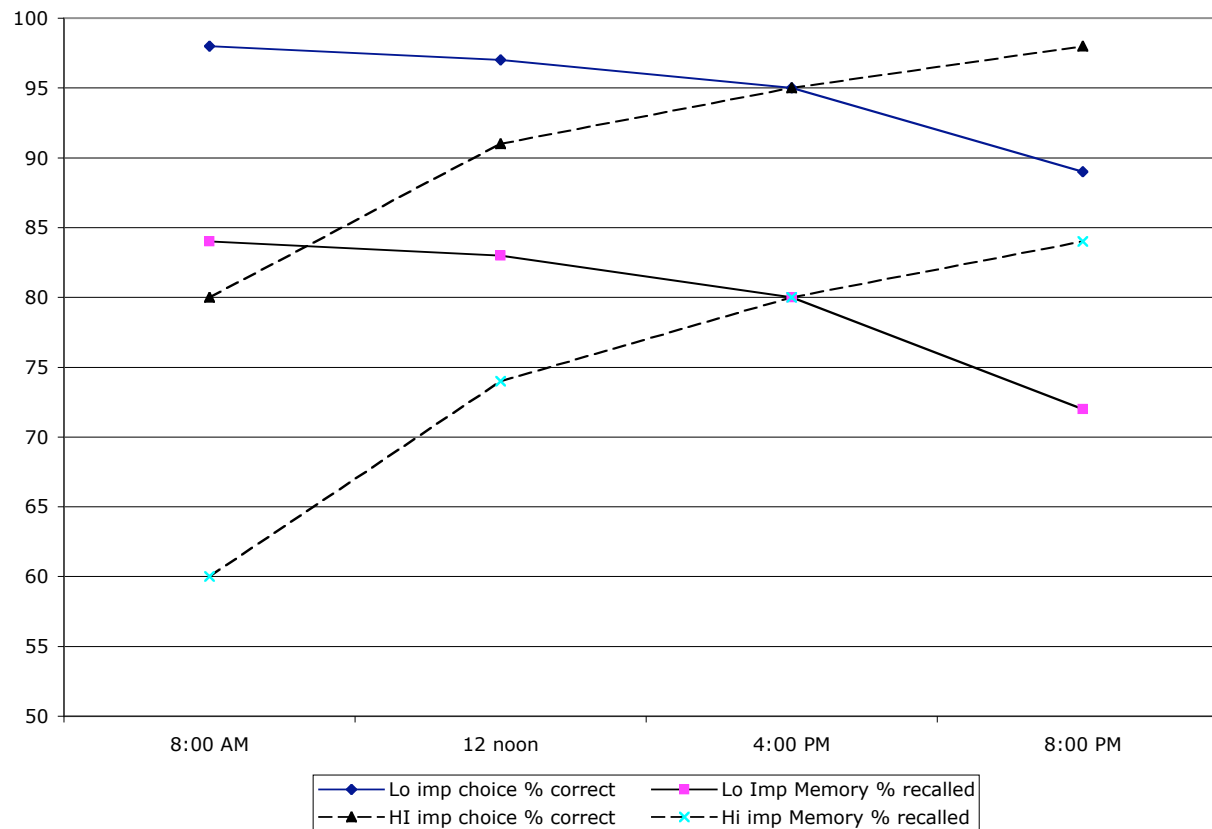
Design a study that would test this rival hypothesis.

Personality, time of day, and cognitive performance

Yet another investigator became interested in these time of day data and decided to reanalyze the first two studies looking at possible personality variation in time of day and performance. High and low impulsivity was assessed by questionnaire given as part of another study. These reanalyzed data looked like this:

		8 am	12 noon	4 pm	8 pm
Low Impulsive		N=25	N=20	N=15	N=10
	choice % correct	98	97	95	89
	Memory % recalled	84	83	80	72
High Impulsive		N=5	N=10	N=15	N= 20
	choice % correct	80	91	95	98
	Memory % recalled	60	74	80	84

Personality, time of day and cognitive performance



Introversiion-Extraversiion and GREs

An experimenter was interested in the relationship between introversion-extraversion and intellectual ability. Introversion-extraversion was measured using the Eysenck Personality Inventory, and intellectual ability was measured using the Graduate Record Examination.

For simplicity of presentation, Introversion-Extraversion (I-E) scores were divided into thirds: Introverts, Ambiverts, and Extraverts. All subjects were given the GRE in a relaxed setting and the following data were obtained:

Personality group	GRE score
Introverts	550
Ambiverts	525
Extraverts	500

Noting that these means were significantly different, the investigator concluded that Introverts were more able than extraverts.

Is this conclusion justified?

What are some plausible alternative hypotheses?

Drugs and Performance

Another investigator believed that motivational state affects cognitive performance. Motivational state was manipulated by caffeine and cognitive performance was assessed by GRE performance. 120 subjects were block randomly assigned to 3 conditions: 0 mg/kg of body weight of caffeine, 2 mg/kg, and 4 mg/kg of caffeine. Ability was assessed using the GRE.

Drug condition	GRE score
0 mg/kg	525
2 mg/kg	525
4 mg/kg	525

From these data the investigator concluded that GRE performance was unaffected by motivational state.

Is this conclusion justified from the data?

Can you think of other ways of operationalizing motivational state?

Personality, situation, and performance

Another investigator then used the same tests of I-E and GRE as the previous investigators, but administered placebo (0mg/kg) to one third of the subjects, 2mg/kg and 4 mg/kg of caffeine to the other two thirds (block randomizing the caffeine dosage within personality groups). The data were

	0 mg/kg	2 mg/kg	4 mg/kg
Introverts	550	525	500
Ambiverts	525	525	525
Extraverts	500	525	550

From these data, this investigator concluded that there was no ability difference between introverts and extraverts, and no main effect of caffeine upon performance, but rather a differential response to caffeine depending upon personality.

How does this finding relate to the previous two results? Do these findings change the interpretation of the previous results?

Personality, situation, performance

	0 mg/kg	2 mg/kg	4 mg/kg
Introverts	550	525	500
Ambiverts	525	525	525
Extraverts	500	525	550

Making the assumption that caffeine increased arousal, the investigator claimed that these data supported the hypothesis that introverts are more aroused than extraverts and that performance is a curvilinear (inverted U) function of arousal.

Is there an alternative explanation for these results?

Design a study to test for this alternative interpretation.

Designs- the problems and benefits of subject variables

- Subject variables as necessary in psychological studies
 - if people do not differ on a variable, is it a psychological variable?
 - subject variables are either part of theory or extraneous to theory
- Subject variables as sources of variance
 - noise variance (unsystematic)
 - confounded variance (systematic)
 - subject variables as part of the theory

Controlling unsystematic Subject Variance

- Within subject design controls for ability and motivational differences
 - trait variables
 - ability
 - age
 - prior practice
 - state variables
 - prior practice
 - interest
- within subject designs lead to problems of order, fatigue, practice
 - controlled by counterbalancing
 - does not protect against differential transfer

Subject variables as systematic sources of error

- Subject attrition
- Subject volunteer effects
- Subject by task interactions
- Subject by conditions interactions

Subject variables as of theoretical interest

- Trait variables
 - ability
 - skill/practice
 - trait affectivity (Positive and Negative)
 - motivational interest

Subject variables of theoretical interest

- State variables
 - anxiety, depression, fear
 - positive and negative affect
 - energetic and tense arousal
 - interest