

Exercise 1: Experimental Designs

The purpose of this exercise is to (a) design simple experiments, (b) practice writing a methods section, and (c) take some time out for whimsy.

The primary investigator (G. Ollivander) has thought of several research questions to follow up on the study discussed during Session 1 (whether dragon or unicorn wands are more effective for levitating feathers). A brief sketch of each research question is given below. Your job is to design these studies, and to elaborate one of them into a brief methods section (of the kind that would be appropriate for a short-form journal such as *Psychological Science*). Below is an example of a methods section, using the study used in the examples for Session 1:

Participants ($N = 100$) were recruited from the Hogwarts subject pool, and ranged in grade level from the second to fifth year. Participants were pre-screened for basic knowledge of the *wingardium leviosa* charm (a spell commonly used to levitate objects) and no participant used either a dragon- or a unicorn-core wand as their everyday working wand.

Participants were tested individually in a quiet room by an unfamiliar experimenter. After a brief (five minute) refresher lesson on the charm, using the participant's working wand, the participant completed both the *Dragon* and the *Unicorn* conditions in a counterbalanced order. In the Dragon condition, the participant was given a dragon-core wand and asked to levitate a feather for as long as possible. Participants were incentivized to maximize levitation duration with monetary incentives (1 knut per 5 seconds). The Unicorn condition was the same, except the participant used a unicorn-core wand.

The design therefore consisted of the single factor of wand core (dragon vs. unicorn wand) which was manipulated within-subjects. The dependent variable was levitation time.

The portion in regular (non-italic) typeface represents a typical level of detail for a journal article. The italic portion is sometimes included (though not usually for a simple study with two conditions), but we would like you to include this so that you can practice thinking about the designs of studies. When describing the design, make sure you clarify (a) what are the factors (here, just wand core), (b) what are the levels of each factor (here, dragon vs. unicorn wand), (c) which variables are manipulated between- or within-subjects (here, wand core is manipulated within), and (d) what is/are the key dependent variable(s). For example, if we were also interested in the age of the wizards as an additional independent variable, we might write instead:

The design was 2 (age: younger student or older student) x 2 (wand core: dragon or unicorn wand), with age a between-subjects factor and wand core manipulated within-subjects.

If we also included adult wizards as a comparison group, we could instead specify the first factor as "3 (age: younger student, older student, or adult)."

This exercise has three parts. Brevity is encouraged!

- A. For one of Mr. Ollivander's research questions below, write a brief methods section (of similar length to the example above), including a short description of the design (like the italicized paragraph above). Writing briefly and clearly is a critical skill. Do not include details that would be unnecessary to reproduce your experiment or that would be unlikely to influence the outcome. If a peer-reviewer of your paper wouldn't care about something, no one else will either.

Each of these designs has a *broad research question* (a question of general scientific interest) and one or more *narrow research questions* (a more concrete question that we can answer in a single experiment). When designing these experiments, feel free to use the narrow question provided, but also feel free to be creative in thinking of a different way to address the broad question.

1. Do different wands perform better for different spells? For example, the summoning (*accio*) charm can be used to move objects, and its difficulty increases with distance. Can people summon objects from farther away with a dragon versus a unicorn wand?
2. Does the intensity of the spell influence the relative effectiveness of different wands? For example, even if dragon and unicorn wands are of equal suitability for levitating a feather, would a dragon wand outperform a unicorn wand for levitating an anvil?
3. Let's operationalize *wand-differentiation* as the absolute *difference* in levitation times between the dragon and unicorn wand. (That is, an individual has low wand-differentiation if she has similar levitation times for both wands, and high wand-differentiation if she has a much higher levitation time for one wand versus the other.)

What individual-level factors are associated with greater (or lesser) wand-differentiation? For example, are younger students less differentiated than older students? Are students who are more predisposed toward the dark arts (as measured on the standardized Dark Arts Affinity Inventory [DAAI]) more differentiated than low-dark-arts students? Is the effect of age on differentiation smaller for those who are high-dark-arts? (By the way, this last question asks about the *interaction* between age and dark arts affinity, while the former two ask about the *main effects*.)

- B. For the two research questions above that you did *not* write a methods section for, write only the short description of the design.
- C. Choose a study that you are working on with your mentor, and describe the broad and narrow research questions (in a similar level of detail to Mr. Ollivander's research questions above). Then write a short description of the design you are using to test this question. If you are weighing different possible designs, please feel free to write down two or more possibilities.