Cognitive Construals Metadata

This document contains a description of instrument items and coding schemes applied to analyze participant responses. For more details see Gouvea & Simon, 2018.

Survey Items

	Original Statement	Explicit Statement	Corrected Statement
Teleology	Plants produce oxygen so that animals can breathe.	Animals' need to breathe is what causes plants to produce oxygen.	Plants produce oxygen and then animals are able to breathe it.
	Species adapt to the environment in order to survive.	The need to survive is what causes species to adapt.	Increased survival can be an outcome of adaptation.
	Many species develop protective "camouflage" to avoid predators.	The need to avoid predators is what causes species to develop protective "camouflage."	Having protective "camouflage" allows species to avoid predators.
	Genes turn on so that a cell can develop properly.	The need to develop properly is what causes genes to turn on.	Proper cell development occurs when genes are able to turn on.
Anthropo-centrism	Humans have caused the majority of extinctions.	Humans have caused the majority of extinctions that have ever occurred on Earth.	Humans have caused some, but not the majority of extinctions on Earth.
	Plants get their food from the soil.	Plants eat soil. It is their food.	Plants take in water and minerals from the soil, but not food
	The heart decides how much blood is needed throughout the body and adjusts the rate at which it beats accordingly.	The heart is able to make informed decisions how much blood is needed throughout the body, and make adjustments to the rate at which it beats accordingly.	The heart adjusts the rate at which it beats in response to changes throughout the body.
	Competition between organisms involves direct, aggressive interactions.	Competition between organisms always involves some kind of direct, aggressive, physical interactions (like kicking or punching).	Competition sometimes, but not often, involves direct aggressive interactions.
Essentialism	Homeostasis keeps the body static and unchanging.	If homeostasis is working properly, the body cannot change.	During homeostasis, changes in the body occur.
	Apart from difference due to age and sex, members of the same species are essentially identical; any variability is biologically unimportant.	Members of the same species (of the same age and sex) must share identical traits and characteristics.	In addition to differences in age and sex, members of the same species are variable in biologically important ways.
	Different cells in an organism (e.g. skin, muscle, nerve) contain different DNA.	Different cells in an organism (e.g. skin, muscle, nerve) must share identical traits and characteristics.	Different cells in an organism (e.g. skin, muscle, nerve) contain the same DNA.
	Without outside influences, ecological communities will remain stable indefinitely.	Ecological communities must remain stable.	Ecological communities are dynamic.

The table above summarizes pool of statements from which survey instruments were constructed. Statements are grouped by category (teleology, anthropocentrism, essentialism). Columns contain modifications of the original statements used in a prior study (Coley & Tanner, 2015) along with modifications that either made the flaw in the original statements more explicit or corrected it.

Survey Versions
These items were used to create two versions of a survey administered to study participants.

Version A first presented participants with the original statements and asked students whether or not they agreed with the statement on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). This version then presented participants with pairs of statements, one explicit and one corrected and asked students which they agreed with more (1 = explicit statement, 2 = corrected statement, 3 = neither). Version A is the 'uncued' condition because students were asked to indicate their agreement with the Likert question before encountering the paired choice cue.

Version B first presented participants with the paired choice questions and then presented the original Likert statements. Version B is the 'cued' condition, because students were exposed to the paired statements designed to cue their attention prior to encountering the Likert statements. In both versions, all participants were asked to "explain their choice" in writing after the second set of questions.

Study Population
The dataset holds the anonymized responses of 262 undergraduate students enrolled in an introductory biology course at a private university. Half of the students were randomly assigned version A and half were randomly assigned to version B. Each individual participant was presented with a subset of randomly selected statement types (2 teleology, 2 anthropocentric, 2 essentialist).

Coding of written responses
Written responses were coded according to the coding scheme described in Table 2 below. Two coders independently coded 20% of responses for each of the twelve prompts and then compared codes. Inter-rater reliability was consistently over 90% and consensus was established through discussion. A single coder then coded the remaining responses.

References

Coley, J. D., & Tanner, K. D. (2015). Relations between Intuitive Biological Thinking and Biological Misconceptions in Biology Majors and Nonmajors. CBE—Life Sciences Education, 14, 1–19. http://doi.org/10.1187/cbe.14-06-0094

Gouvea, J. & Simon, M. (2018). Challenging claims of cognitive stability: Dynamic alternatives to intuitive biological frameworks. CBE - Life Sciences Education.