

CS/PSYCH L271 – Intro to Cognitive Science – Fall 2009

Instructor: Marc Pomplun

Assignment #2 Sample Solutions

Posted on October 10 – due by October 20, 4pm

Question 1:

It was about five years ago that you last talked to your high school friend Mike. It seemed that he had suddenly disappeared, and nobody knew where he was. There were some rumors that he had been on an expedition in some African jungle and never returned, but these rumors were hard to believe.

One day you suddenly receive a phone call – it's Mike! While you are telling him about your groundbreaking studies in the field of linguistics, he lets you in on the secret of his whereabouts: He has spent the past five years in a remote village in Central Africa, training a female chimpanzee named Zaza to speak and understand a subset of American Sign Language (ASL)!

He claims that Zaza is actually speaking a language and is not just repeating gestures in specific contexts for which she has been rewarded before. In order to prove this claim, he invites you to Africa to test Zaza's linguistic abilities. You know ASL very well and always wanted a free trip to Africa, and so you accept Mike's invitation.

How will you test Zaza to determine whether she is really speaking a language, according to our definition discussed in class? Describe all the tests that you are going to perform, and indicate what type of results (e.g., answers from Zaza) you would require in order to confirm that Zaza is really speaking a language. Are there any aspects of speaking a language whose presence in Zaza you could not test experimentally?

Sample Answer Question 1:

According to Clark & Clark (1977), a language has to meet five criteria: It has to be communicative, arbitrary, structured, generative, and dynamic. In the following, we will discuss how to assess each criterion in Zaza.

1. Communicative: Language enables communication between individuals (production, transmission, comprehension of information).

Zaza has to be able to communicate her wishes, observations, and questions through her language, and she has to be able to understand such language when produced by others. We could, for example, ask Zaza very simple questions such as “Do you like bananas?” or “Is there a plate on the table?” Then we evaluate Zaza’s answers. She must be able to understand and convey at least such elementary information.

2. Arbitrary: Language consists of arbitrary symbolic elements that refer to “things” in the world.

In other words, Zaza’s ASL gestures must refer to things in arbitrary ways. Of course, not all ASL gestures are entirely arbitrary; they often reflect an “intuitive” description of things in the world. However, this is not always possible, and so we would require Zaza to understand and produce gestures that refer to things in a purely symbolic way, i.e., they do not imitate the way a thing looks or is used. For example, let us assume that the gesture for “ball” is entirely arbitrary. Then, we ask Zaza whether there is a ball in the room, with the correct answer being “no,” so there is no way to refer to a ball by pointing. We could also ask her to get a ball from another room or ask about the color of a ball she owns. If she can perform communication in this way, then her language meets this criterion.

3. Structured: The ordering of symbols follows rules.

Here we have to test whether Zaza simply associates individual gestures with specific things or actions, or whether she uses sequences of gestures in a structured way. We can ask Zaza questions that require more than individual gestures, for example, “What would you like to do now?” and see whether she is able to produce multi-gesture sentences, and whether these sentences consistently show the correct order of gestures.

4. Generative: The symbols can be combined to create a very large number of meanings.

We need to verify that Zaza is not simply always combining the same symbols but is able to combine them in new ways to express meaning that she has never communicated about before. At the very least, she must be able to combine different adjectives and nouns. For example, if she knows all colors and only has a red spoon, and she has never talked about any other spoons, we could show her a blue spoon and ask her “What is this?” Then she should be able to reply correctly that it is a blue spoon.

5. Dynamic: Languages are constantly changing (“email”).

This criterion is difficult to test, since the evolution of languages is happening slowly, and not all individuals actively participate in changing it. What we could test, though, is whether Zaza is able to invent new gestures (possibly combinations of previously learned ones) for things that she has never seen before. That would be an impressive demonstration of the flexibility of her language use.

Question 2:

Why do you think there is memory decay? What factors may influence the speed of this decay, and why? Discuss these issues separately for sensory memory, working memory, and long-term memory.

Sample Answer Question 2:

Basically, our brain's task is to optimize our behavior with regard to our evolutionary goals (survival, reproduction, etc.). Sensing and memorizing information from the environment is crucial for accomplishing this, and ideally we should memorize every piece of information that we perceive. However, the resources for memorization in our brain are limited; carrying a giant brain would be counterproductive regarding our goals. Therefore, some information has to be filtered out.

Regarding sensory memory, its capacity is enormous and encompasses basically all visual input, and therefore, the duration of storage has to be severely limited, otherwise it would require too much resources. Decay is complete after 100 to 200 ms, and any change in the visual input, maybe just by making a saccade, will override sensory memory content; there simply are not enough resources to allow a more robust or longer storage of this information.

Working memory is needed for the completion of (possibly multi-modal) tasks; unlike sensory memory, it can manipulate, i.e., "work with" information. The trade-off, here, is reduced capacity; you can only store several items in working memory at a time. If you try to memory more information than that, other information is discarded, resulting in decay. Temporal decay is very slow as long as we keep on working on the same task. Completing a task or switching to another one usually induces immediate, nearly complete decay of working memory contents.

Long-term memory can store large amounts of information for long durations, possibly across our life span. In order to use its resources efficiently, long-term memory thus has to filter out unimportant information. Greater importance is assigned to information that is used very often or is of particular relevance to our lives. For example, by repeated rehearsal, we can store information for longer durations, and events that significantly influenced our lives will be stored without significant decay. Information that is no longer relevant, for example, things that you learned for an exam but that you are not really interested in or use them anymore, may decay rather quickly. Evidence shows that this much of this filtering of memories and their consolidation occurs while we are sleeping.