Cognitive Imitation

Francys Subiaul
George Washington University, Washington, DC, USA

Synonyms
Imitation; Non-motor imitation; Observational learning; Social learning

Definition
Cognitive imitation is a type of social learning; specifically, a subtype of imitation that involves copying abstract – inferred – rules rather than observed – concrete – motor or oral responses.

Introduction
Cognitive imitation is typically contrasted with other subtypes of imitation including, motor and vocal or oral imitation. Like all forms of imitation, cognitive imitation involves vicariously learning and replicating specific abstract rules inferred from observation. The main difference between cognitive and motor imitation, for example, is that whereas in the typical imitation learning experiment, subjects must copy representations of novel responses or sequences of specific actions (novel motor imitation), and in a novel cognitive imitation paradigm, subjects have to learn and copy abstract representations or rules. In such a paradigm, while the actions themselves may be familiar (e.g., pressing a button), the rule organizing those actions is new.

The following example illustrates the difference between cognitive and motor imitation: Imagine someone overlooking someone’s shoulder and stealing their automated teller machine (ATM) password. As with all forms of imitation, in this example, the thief learns and successfully reproduces the observed sequence. The thief in our example, like most of us, presumably knows how to operate an ATM. As such, the actions associated with operating an ATM isn’t what the thief is learning (or copying). Instead, the thief is likely to learn and copy one of two abstract rules: spatial or cognitive. For example, the thief may learn and subsequently copy the following spatial rule: touch the button in the bottom left, followed by button on the bottom right, then the button in the top right, and finally the one in the middle. This would be an example of motor-spatial imitation, because the thief’s response is guided by an abstract spatial rule. Alternatively, the thief may ignore the spatial patterning of the observed responses and instead focus on the particular markings on buttons (i.e., numbers) that were touched, generating the following abstract numerical (cognitive) rule: 7-9-3-5. Vicariously learning and reproducing this response would be an example of cognitive imitation. Of course, this is not an
ideal example because, in fact, unless you ask the
thief, you would not know if they used a spatial or
cognitive rule given that the numbers are in the
same location with every attempt. However, if the
numbers appeared in a new position every time
you tried to enter the password – the thief using a
cognitive rule would, nonetheless, reproduce the
target password.

Cognitive Imitation in Rhesus Monkeys

The term “cognitive imitation” was first intro-
duced by Subiaul and his colleagues (Subiaul
et al. 2004). In their original paper, they defined
cognitive imitation as “a type of observational
learning in which a naïve student copies an
expert’s use of a rule.” To isolate cognitive from
motor imitation, Subiaul and colleagues trained
two rhesus macaques to respond, in a prescribed
order, to different sets of photographs (serial lists)
that were displayed simultaneously on a touch-
sensitive monitor. The position of the photographs
varied randomly from trial to trial, preventing
subjects from learning a series of motor-spatial
responses (Terrace 2005). Both monkeys learned
new sequences more rapidly after observing an
expert monkey execute those sequences than
when they had to learn new sequences entirely
by trial and error. A microanalysis of each mon-
keys’ performance showed that each monkey
learned the order of two of the four photographs
faster than baseline levels. A second experiment
ruled out social facilitation as an explanation for
these results. A third experiment demonstrated
that monkeys did not learn when the computer
highlighted each picture in the correct sequence
in the absence of a monkey (“ghost control”),
which suggests that monkeys, in contrast to
human children (Hopper 2010; Subiaul et al.
2007, 2011), require an agent to motivate social
learning.

Cognitive Versus Motor-Spatial
Imitation

Subiaul et al. (2012), using two computerized
tasks that measure the learning of two abstract
rules: cognitive rules (e.g., apple-boy-cat) and
motor-spatial-based rules (e.g., up-down-right),
have shown that there are important dissociations
between the imitation of these two types of rules.
Specifically, results have shown that while 3-year-
olds successfully imitate cognitive rules, these
same 3-year-olds fail to imitate motor-spatial
rules (Subiaul et al. 2012). This dissociation is
not because there is something inherently harder
about learning spatial versus cognitive rules.
A series of follow-up studies showed that
3-year-olds correctly recall spatial rules learned
by trial and error following a 30s delay (Exp. 2).
This result demonstrates that 3-year-olds’ motor-
spatial imitation problems are not due to difficulty
learning new spatial rules in general. But perhaps,
3-year-olds have a problem learning vicariously
from a model. To test this hypothesis, a follow-up
study had 3-year-olds observe a model correctly
touch the first item (e.g., Top Right) in the
sequence, but then skip the middle item (e.g., top
left picture) and, instead, touch the last item in the
sequence (e.g., bottom left picture), resulting in an
error. Upon making this error, the model said,
“What’s not right?” This highlighted
that the error was unintentional. This is a goal
emulation learning condition, as the child has to
copy the model’s intended goal (top-right,
bottom-left, top-left), rather than the observed
(correct) response (top-right, top-left). In this
study, 3-year-olds generated the intended (rather
than the observed) sequence (Exp. 3). Three-year-
old’s success in the goal emulation condition
excludes the possibility that 3-year-olds’ motor-
spatial imitation problem is due to difficulty vicar-
iously learning (i.e., because of a lack of interest,
failure to attend, problems inferring goals, etc.) a
novel spatial rule from a model. Children’s
success in the goal emulation condition suggests that social learning may be achieved by social reasoning (inferring goals) and causal inferences (error detection), independently of any domain-specific imitation learning mechanism.

**Domain-Specificity in Imitation Learning**

To further explore this dissociation between cognitive- and motor-spatial imitations, Subiaul et al. (2015) tested preschoolers (2–6 years) on a variety of learning conditions using the cognitive and motor-spatial tasks. Results demonstrated that there was no significant relationship between imitation in the cognitive and the motor-spatial task. Analyses showed that only age predicted improved imitation performance in each task. Moreover, children’s ability to individually learn in each task by trial and error did not predict their ability to imitate those same rules in either task. However, goal emulation in the motor-spatial task did predict imitation learning in the same task. This result is surprising because, children can infer the spatial rules from a model’s error before they can imitate spatial rules (Subiaul et al. 2012: Exp. 3). The association between goal emulation and imitation in the motor-spatial tasks suggests that goal emulation scaffolds the development of imitation in the motor-spatial domain, but critically, it does not seem to do so in the cognitive domain. These patterns of results support the hypothesis that distinct cognitive processes underlie cognitive versus motor-spatial imitation.

**References**


