The type of irrelevant action affects overimitation: Effects of target, tool, and object’s function

Keyword: overimitation, imitation, objects, development, children

Introduction
Overimitation is defined as the imitation of a series of actions, including causally irrelevant ones. Overimitation increases from childhood to adulthood (Horner & Whiten, 2005). Although previous studies have indicated that children’s overimitation tends to be flexible to contextual factors (e.g., absence or presence of the model, live, or video), there is no research directly comparing children’s and adult’s overimitation occurrences due to non-contextual factor, such as the target of irrelevant action, tool use, and object’s function. To identify the effect of the non-contextual factor, the overall aim of the present study was to comprehensively investigate the effect of non-contextual factors: the target of irrelevant action in Study 1, tool-use in Study 2, and object’s function in Study 3. Additionally, Study 4 focused on the effect of non-contextual factors used in Studies 1–3 on adults’ overimitation.

Study 1
Study 1 established three types of irrelevant actions regarding the target of irrelevant action in previous studies. The first was an irrelevant action toward a connected apparatus involving the use of tools in reaching the final goal (e.g., using a tool to tap on the main apparatus). The second was an irrelevant action toward a different (disconnected) apparatus from that involved in the final goal with tools (Different Apparatus - Tool). The third was irrelevant toward the actor’s own body using tools (Actor - Tool).

Method

Participant

Design
Study 1 was within-subjects design. The experimenter demonstrated three types of irrelevant actions and observed children’s response. First action was toward a connected apparatus involving the use of tools in reaching the final goal (Same Apparatus-Tool). Second action toward a different (disconnected) apparatus from that involved in the final goal with tools (Different Apparatus - Tool). Third action was irrelevant toward the actor’s own body using tools (Actor - Tool).

The experiment was conducted with each participant individually in a room of the participants’ nursery school. The experimenter showed the participant one irrelevant action (one of the three conditions), and then one relevant action to achieve the final goal (retrieving a reward from the apparatus using a tool). The experimenter put the main apparatus, subapparatus, and the tool in front of the child, asked the child to retrieve the reward and then observed the child’s performance. This sequence was conducted three times. After demonstrating all conditions, the experimenter switched to the second main apparatus after conducting all three conditions (one trial per condition) with the first main apparatus. All participants completed six trials (three trials with each main apparatus), which resulted in two possible instances of overimitation per condition (which were then combined into the number of overimitation trials of 0–2 per condition).

Age, trial, and condition comparisons were primarily conducted using generalized linear mixed models (GLMM). The response variable was the number of overimitation trials. The predictor variables were age, condition, trial number, and the interaction between age and condition. Subject was included as a random effect.

Results
GLMM analyses were conducted for the number of overimitation trials. GLMM results showed that age and condition differed significantly for the number of overimitation trials ($p < .01$, $p < .001$, respectively). Children overimitated as age increased. Bonferroni-corrected pairwise comparisons revealed that the number of overimitation trials
in the Same Apparatus condition and in the Different Apparatus-Tool condition were observed to be more than that in the Actor-Tool condition ($p < .01$, $p < .01$, respectively). No differences between trial orders and no significant interactions were found for the number of overimitation trials ($p > .05$, $p > .05$, respectively).

**Discussion**

Study 1 examined whether overimitation occurrence is different for the three types of irrelevant actions in relation to the target. Children overimitated more in the Same Apparatus-Tool and Different Apparatus-Tool conditions than in the Actor-Tool. In summary, overimitation was affected by the target of irrelevant actions, that is, objects or an actor’s body.

**Study 2**

In addition to the target of irrelevant action, tool use is another non-contextual factor that may affect overimitation. Previous studies have also demonstrated irrelevant actions without tool use, such as clapping and pushing the lever with one’s hand (Hoehl et al., 2014). It is unclear whether actions without tool use also show the same differences between those toward an apparatus versus those toward an actor’s body, in terms of overimitation. Thus, Study 2 added two new conditions of a manual movement (without tools) toward the apparatus (Different Apparatus-No tool)/actor’s body (Actor-No tool) to Study 1’s condition.

**Method**

**Participants**

In Study 2, 24 children were included in the final sample.

**Design**

The general procedure was the same as in Study 1, except for adding new two types of actions (Different Apparatus/Actor – No tool) and eliminating one action (Same Apparatus-Tool).

**Procedure**

The general procedure was the same as in Study 1, except for the number of conditions.

**Results**

GLMM analyses were conducted for the number of overimitation trials. GLMM results showed that condition differed significantly in the number of overimitation trials ($p < .01$). Bonferroni-corrected pairwise comparisons revealed that the number of overimitation trials in the Different Apparatus-Tool was observed more than in the Actor-Tool, Actor-No Tool, and Different-No Tool conditions (all $ps < .05$; see Figure 3). No difference between trial orders was found for the number of overimitation trials.

**Discussion**

The results of Study 2 showed that children overimitated the action toward the apparatus with a tool more than other types of action. Thus, both the action toward the apparatus and the action with the tool affected overimitation. The causal overimitation boundary did exist for the combination of the target (object or person) of the action and tool use.

**Study 3**

Study 3 focused on the new factor, the object’s function. The irrelevant actions in previous studies should be classified also into actions regarding the object’s function (e.g., pushing the button; Nielsen, Mushin, Tomaselli, and Whiten, 2014) and actions unconcerned with object’s function (e.g., pushing the apparatus forward; Vivanti, Fanning, & Dissanayake, 2017). In the case of imitation of relevant action, Öturai (2012) has shown that the action regarding the object’s function prompt children’s imitation. This is why the actions may prompt children’s overimitation, even if actions regarding the object’s function are irrelevant to the final goal. Therefore, Study 3 aimed to investigate the effect of irrelevant actions concerned with the object’s function.

**Method**

**Participants**

The present study recruited 55 five-year-old children.

**Design**

Study 3 was between-subjects design. Study 3 demonstrated two types of irrelevant actions. One action is regarding the object’s function (Functional action). Other action is not regarding the object’s function (Arbitrary action).

**Procedure**

The experimenter showed one irrelevant action (one of the two conditions: functional or arbitrary action condition), and then one relevant action to achieve the final goal. The experimenter put all apparatuses in front of the participant, asked children to retrieve the reward,” and then observed the child’s performance. Next, the experimenter changed the second main apparatus after conducting the sequence and conducted the same sequence. This sequence was conducted five times with five apparatus. Thus, all participants completed five trials which resulted in 0–5 overimitation trials per condition.

**Results**

Data were collapsed across gender and order because the
preliminary analysis showed that the order and sex did not affect the overimitation performance (all $p$s > .05). Study 3 analyzed which action children overimitated more, the functional or arbitrary action. Children were found to overimitate the functional action more than the arbitrary action ($t(53) = 8.4261$, $p < .001$, paired samples t-test, two-tailed). To investigate whether the functional action affected all items or only certain items an analysis on the item level was conducted and showed that children overimitate the functional action more than the arbitrary action in all items.

Discussion

The results of Study 3 showed that children overimitated the functional irrelevant actions more than the arbitrary irrelevant action. Functional action affects children’s imitation even when the functional action is not only causally relevant (Öturai et al., 2012) but also irrelevant to the final goal.

Study 4

Children’s overimitation is affected by non-contextual factors. Studies 1–3 paid attention to children’s overimitation. However, both children and adults overimitate demonstrated actions (Mcguigan et al., 2011). It is not clear whether adults’ overimitation is affected by the factors used in Study 1-3, the boundaries of overimitation in adults may be same as in children. Study 4 targeted adults and conducted the same tasks as Study 2 and Study 3 to investigate the effect of non-contextual factors (targets, tool-use, and the object’s function).

Method

Participants

The present study recruited 33 adults from a university in Japan

Procedure

The procedures were the same as Study 2 and Study 3. Participants conducted Task1 (Study 2’s task) and Task 3 (Study 3’s task). These tasks were counterbalanced within participant.

Results

In Task 1, GLMM analyses were conducted for the number of overimitation trials. GLMM results showed that condition did not differ significantly in the number of overimitation trials ($p = 0.278$, see Table 6). No difference was found between trial orders for the number of overimitation trials ($p = 0.359$).

In Task 2, data were collapsed across gender and order because the preliminary analysis showed that the order and sex did not affect the overimitation performance (all $p$s > .05). The present study analyzed which action adults overimitated more, the functional or arbitrary action. Adults were found to overimitate the functional action and the arbitrary action equally ($t(31) = 0.96$, $p = 0.172$ , paired samples t-test, two-tailed). Additionally, an analysis on the item level showed that, in all items, adults equally overimitated the functional action and the arbitrary action.

Discussion

The result of Study 4 revealed that adults equally overimitate all types of irrelevant actions. This result is different from children’s overimitation. Adults’ overimitation is not affected by factors such as the target, tool-use, and the object’s function.

General Discussion

Children do not always overimitate and contextual/non-contextual factors have been assumed to affect overimitation; thus, as to one of non-contextual factors, previous studies have considered the presence of direct contact with the apparatus as one influential factor in overimitation occurrence (Hoehl et al., 2014; Lyons et al., 2007). The present study comprehensively investigated the effect of non-contextual factors on overimitation. As Study 1 focused on the target of irrelevant action with tool use, Study 2 examined the effect on overimitation in the case of no tool use. In addition to the effect of the target of irrelevant action (apparatus), Study 2 showed the effect of tool use as compared to that of no tool use. Study 3 focused on the object’s function and examined its effect on overimitation. The results showed that children overimitated the irrelevant action regarding the object’s function (functional action) more than the irrelevant action disregarding the object’s function (arbitrary action). Study 4 investigated whether the non-contextual factors investigated in Study 1, Study 2, and Study 3 affect adults’ overimitation. Adults’ overimitation were not affected by all non-contextual factors and the overimitated all types of the irrelevant action equally.

The present study was the first attempt to compare directly the overimitation of irrelevant actions. In Study 1 and Study 2, the irrelevant actions are conducted toward an apparatus versus an actor’s own body, or those conducted using a tool versus a simple manual movement. In Study 3, the irrelevant actions are regarding the object’s function versus requiring distinctive object properties. The present study addressed additional points that should receive more attention.
with respect to both the Normative and ACE accounts. Specifically, ACE assumes that the contact principle is influential in the occurrence of overimitation (Lyons et al., 2007); the present findings suggest that the contact principle is not always influential under some contextual factors. The Normative account assumes the flexibility of overimitation in a context (Keupp et al., 2015); the present findings add to evidence concerning the flexibility of overimitation in terms of action type (target, tool use, and object’s function; non-contextual factors). This is why these results are potentially of value in advancing our understanding of overimitation. The present findings highlight additional aspects that should receive more attention, which may contribute to knowledge about non-contextual factors. Further, imitation, including overimitation, involves certain aspects of the learning process, including the integrity of children’s causal knowledge (Lyons et al., 2007). Based on the present results, children may imitate and/or overimitate selectively on the basis of the action’s target, tool use, and the object’s function.

References


