



## Brief report

# Bare fingers, but no obvious influence of “prickly” Velcro! In the absence of parents’ encouragement, it is not clear that “sticky mittens” provide an advantage to the process of learning to reach



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## ABSTRACT

In their critique of our mittens study, Needham et al. (2015. *Infant Behavior and Development*) describe our findings as “surprising.” Further; they suggest that babies in our “sticky mittens” condition may have been discouraged from reaching because, in our study, infants may have touched “prickly” Velcro with their bare fingers. In this response, we present data analyses that do not support the interpretation that finger contact with our Velcroed toy surfaces was associated with poor reaching performance in our “sticky” mittens group. We also clarify that our toys were mainly covered with “non-prickly” Velcro. To explain discrepancies between studies, we restate the original intent of our study and reasons for our methodological modifications. We point to confounds and lack of critical control conditions in the Needham et al. studies, which prevent the making of firm inferences about the effectiveness of the “sticky mittens experience” on the learning to reach process. We also present additional analyses on our “sticky” mittens group showing that the increasing rate of finger touch on the toy leads to greater reaching performance while the rate of toy sticking to the mittens does not. We discuss the importance of sensory-motor experience on the development of learning to reach in infancy and conclude that our results are not surprising.

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In a recent study, we investigated the effects of modified “sticky” and “non-sticky” mittens on the progression of intentional reaching in 24 non-reaching infants that were 2 months and 21 days at the onset of the study (Williams, Corbetta, & Guan, 2015). After a 16-day intervention aimed at assessing infants’ self-guided movement exploration and selection in a single target reaching task exposure, the “sticky” mittens group, that received the grasping simulation through hand-to-toy contact, did not perform differently from the control group on their number of target contacts. However, the “non-sticky” group, in which infants did not experience the grasping simulation via “sticky” mittens during the 16-day self-guided, single target, reaching task exposure, performed significantly more goal-directed hand-object contacts compared to the control group. Needham, Wiesen, and Libertus (2015) reacted to our findings and described our results as surprising.

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The Needham group is well known for its inception and use of the “sticky” mittens paradigm to study the development of reaching and object exploration in infants. These researchers have now published several manuscripts using this paradigm (Needham, Barrett, & Peterman, 2002; Libertus & Needham, 2010, 2011, 2014; see also Libertus & Landa, 2014) in which they consistently report significant effects of the “sticky” mittens training over controls that did not receive any training (Needham et al., 2002), or, over other intervention groups that received other kinds of daily trainings (i.e. “passive” training Libertus & Needham, 2010, 2011, and “encouragement experience” or “movement experience” Libertus & Needham, 2014). In their written reaction to our paper, Needham et al. (2015) describe several methodological differences between their studies and ours. Many of these methodological differences are clearly stated in our manuscript – we never claimed that we were trying to replicate their studies – rather, we presented our work as an extension of the “sticky” mittens paradigm to explicitly compare reaching groups and tease out the influence of the grasping simulation on the development of reaching. One contentious point raised by Needham and colleagues relates to our redesigned open fingers mittens. They infer that our open fingers mittens affected the number of object contacts in our “sticky” mittens group, because, they write, “the toys were covered with strips of prickly Velcro hook,” and thus, “infants in the sticky mittens group of WCG (2015) were likely to be discouraged from further reaching attempts due to the unpleasant sensory feedback they received from the objects”.

In this response, we begin by addressing Needham et al.’s (2015) “prickly” Velcro concern. We show that bare fingers contact with our Velcroed toys (“prickly” and “non-prickly”) does not support Needham et al.’s performance interpretation of our “sticky” mittens group. On the contrary, our analyses show quite the opposite and point to the importance of bare fingers contact for learning to reach. We also clarify that most of our target objects were covered by a type of Velcro that was smooth and not “prickly.” Then, we restate in more detail the original intent of our study and the reasons for all of our methodological modifications. Particularly, we point to a number of confounds and lack of critical group controls in the Needham studies that preclude making firm conclusions about the role of the “sticky mittens experience” on learning to reach. We further present additional analyses weighing the respective impact of toy sticking to the mittens versus bare fingers contact with the toy on reaching performance in our “sticky” group. These analyses do not support a specific influence of the grasping simulation on learning to reach, but reveal a positive effect of bare finger touch on reaching performance. In light of these results, we discuss the multileveled processes and importance of touch for perceptual-motor exploration and learning to reach. In the end, we conclude that our results are not surprising, and that the discrepancies in results with the Needham et al. studies might be accounted for by their parent-led training, not their “sticky mittens” intervention.

### 1. Bare fingers, but no obvious effect of “prickly Velcro”

Here we begin by addressing the criticism raised by Needham et al. about our redesigned open fingers mittens, particularly in the “sticky” mittens group which was presented with toys with added Velcro on their surface. The decision to open the thumb and finger tips for all infants wearing mittens was made because our “non-sticky” group was not being given the possibility to experience simulated grasping. All we knew from prior published reports was that the “sticky mittens experience” helped learning to reach; hence, we were concerned that, by decreasing haptic feedback using closed mittens without grasping simulation, we were setting that group at a greater disadvantage for learning to reach. Touch is important for reaching, object exploration, and object manipulation (Corbetta & Snapp-Childs, 2009; Gibson, 1988; Gibson & Pick, 2000; Klatzky & Lederman, 2002; Lederman & Klatzky, 1993; Pick, 1992; Winges, 2015) thus, our solution was to allow some extent of direct haptic contact to occur for all infants (see also Lobo & Galloway, 2013, for another design of toy attachment to the hand allowing haptic contact). Also, non-Velcroed toys were used for the “non-sticky” mittens group, because the Velcro we used on the toys was strong enough to cling to the mittens made of bobby-socks. To avoid confounds, it was important that this “non-sticky” group did not experience the toy clinging to their mittens.

The 20 objects that we used for the “sticky” mittens group were mainly covered with a type of Velcro that was not “prickly” (VELCRO Brand Industrial Strength). The hard side of this type of Velcro has more holding power than the everyday VELCRO Brand Hook and Loop, and contrary to what its industrial strength labeling may suggest, it is actually flat, “non-prickly” and smooth to the touch (see Fig. 1A for a close up picture). The soft side of the Velcro which we applied to the mittens is the same as the standard Hook and Loop Velcro. However, five out of these 20 objects also had a few penny size dots of the more standard Hook and Loop Velcro that was applied to one side of the object and could have felt “prickly.” Fig. 1B shows a few exemplars of Velcroed toys from our study. The toy on the left of Fig. 1B is one of the 5 toys that had the dots of standard Velcro attached to one side. Each day, we used 10 randomly selected toys out of the 20 Velcroed toys available (see Method section of Williams, Corbetta, & Guan, 2015, pp. 86–87), thus the number of trials per day using toys having the penny size and potentially more “prickly” Velcro to one side could vary from 0 to 5, and the type and frequency of the different types of toy presentations varied for each infant.

To address Needham et al.’s (2015) criticism, we went back to our daily video recordings of our “sticky” mittens group to assess exactly how many times finger contact on the toy occurred between day 2 and day 15. We focused on these 14 days, because these were the only days infants wore the mittens and were presented with the Velcroed toys. For this analysis, we considered *all* toy contacts, whether they were goal-directed, happened by chance without looking at the target, happened while the toy was stuck to the mitten, or happened when the other hand touched the toy stuck to one mitten. In all those instances, if bare finger contact (thumb, knuckle, or finger tips) occurred on the toy, we coded on which surface it occurred; “prickly” Velcro, “smooth” Velcro, or no Velcro. Finally, for every contact, goal-directed or not, we coded if the toy stuck to the mittens. If it did not, we noted if it was because of bare fingers touch, or because of no adherence to the mittens (Fig. 1B

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