Explicit Scaffolding Increases Simple Helping in Younger Infants

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Abstract

Infants become increasingly helpful during the second year. We investigated experimentally whether adults' explicit scaffolding influences this development. Infants (N = 69, 13-18 months) participated in a series of simple helping tasks. Half of infants received explicit scaffolding (encouragement and praise), whereas the other half did not. Among younger infants (below 15 months), infants who received explicit scaffolding helped twice as often as infants in the control group, and helped more also on several subsequent trials when no scaffolding was provided. As predicted, older infants were not affected by explicit scaffolding. These results demonstrate the influence of social experiences in early helping, but also how the effects of scaffolding may depend on the developmental level of the child. Less explicit forms of scaffolding may be effective when children are older.

Keywords: helping, prosocial development, social interaction, infancy

Explicit Scaffolding Increases Simple Helping in Younger Infants

Helping emerges already around the first birthday (Dahl, 2015; Sommerville, Schmidt, Yun, & Burns, 2013; Warneken & Tomasello, 2007). Like many new behaviors, helping others is challenging at first. Fortunately, infants are surrounded by family members who *scaffold* their nascent efforts to help (Dahl, 2015; Dunn & Munn, 1986; Rheingold, 1982; Wood, Bruner, & Ross, 1976). Scaffolding refers to the ways in which others direct children to perform at higher levels than they would show when acting on their own, and include subtle guidance as well as explicit encouragement or praise (Mascolo, 2005). These explicit forms of adult scaffolding may be particularly impactful when infants are mastering a new task, such as the simple helping behavior of handing back a dropped object.

The present study addressed a straightforward question: Does explicit scaffolding increase infants' simple helping early in the second year? We tested the hypothesis that explicit scaffolding (specifically, encouragement and praise) increases simple helping acts *early* in the second year, when infants are just beginning to help (Sommerville et al., 2013; Warneken & Tomasello, 2007). In contrast, we expected explicit scaffolding to have little effect on simple helping *later* in the second year, when most infants readily help in a variety of tasks (Svetlova, Nichols, & Brownell, 2010; Warneken & Tomasello, 2006).

This research was based on the view that helping emerges in infancy through experiences in everyday social interactions. In these interactions, adults and older children scaffold infant involvement in adult activities by building on infants' interest in participation alongside others and mastery of new socio-motoric skills (Brownell, 2011; Carpendale, Hammond, & Atwood, 2013; Dahl, 2015; Dunn & Munn, 1986; Rheingold, 1982). From this perspective, the presence, nature, and function of such social facilitation depends on the relation between infants' skill level and task difficulty (Dahl, 2015).

According to a contrasting proposition, scaffolding does *not* contribute to the emergence of infant helping (Martin & Olson, 2015; Warneken, 2015; Warneken & Tomasello, 2009). Instead, it is argued, infants have a natural tendency to help others that emerges independently of adult scaffolding or socialization. Explicit scaffolding such as encouragement and praise, even when present, are argued to have no effects on infant helping (Warneken, 2015).

In one standard laboratory helping paradigm, an adult experimenter is seated at a table, engaged in a task such as writing with a pen. The experimenter 'accidentally' drops the pen on the floor and reaches for it, but is unable to pick it up. Using this paradigm, Warneken and Tomasello (2007) found that 14-month-olds would often retrieve the pen and hand it back to the experimenter. Later in the second year, infants help in increasingly complex situations (Svetlova et al., 2010; Warneken, 2013; Warneken & Tomasello, 2006).

Few experiments have investigated the effects of parental influences on infant helping. Claims about the inefficacy of adults' explicit scaffolding are largely based on two recent studies in which older infants (20- to 24-month-olds) were encouraged and praised in simple instrumental helping tasks (Warneken & Tomasello, 2008, 2013). During a training phase, infants in an experimental group received encouragement or praise while infants in the control group did not. During a subsequent test phase, no infants received encouragement or praise. Both studies found no effects of encouragement and praise on helping rates. The findings have led to the conclusion that encouragement and praise generally have no effect on infant helping (Martin & Olson, 2015; Warneken, 2015). By 20 months of age, however, most infants have already mastered simple instrumental helping tasks (Svetlova et al., 2010; Warneken & Tomasello, 2006). By 25 months of age, children are so proficient that they help even when recipients have not yet recognized their need for help (Warneken, 2013).

A crucial, and yet unresolved, question is how infants develop this proficiency: Is infant helping generally unaffected by parental encouragement and praise, as some have argued, or do parents gradually scaffold infants until they can provide simple instrumental help on their own? Correlational research suggests that both the nature of parental scaffolding and its association with infant helping are age-specific. In naturalistic observations of infants at home, Dahl (2015) found positive associations between encouragement, praise, and helping early in the second year. About half of helping situations included *both* encouragement and praise. Later in the second year and into the third, as infants become more skilled helpers, parents rely increasingly on more implicit forms of scaffolding, such as references to needs of the recipient, reasoning, and negotiation (Pettygrove, Hammond, Karahuta, Waugh, & Brownell, 2013; Waugh, Brownell, & Pollock, 2015). At these older ages, these implicit forms of scaffolding, but not explicit encouragement and praise, are associated with higher helping rates (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013; Dahl, 2015; Eisenberg, Wolchik, Goldberg, & Engel, 1992; Hammond & Carpendale, 2015; Pettygrove et al., 2013).

These findings suggest that explicit scaffolding, specifically encouragement and praise, increases simple instrumental helping early in the second year, when infant helping is just emerging. In contrast, encouragement and praise are expectably less effective later in the second year, when basic helping skills are already in place (Warneken & Tomasello, 2008, 2013). However, the correlational nature of these data prevents firm conclusions about how (if at all) parental scaffolding influences infant helping.

The Present Study

The present experimental study was designed to test whether explicit scaffolding (encouragement and praise) increases simple helping early, but not later, in the second year. If explicit scaffolding were to have an effect on simple infant helping it would have to occur between the age at which infants first show simple helping behaviors in the laboratory (12-14 months: Sommerville et al., 2013; Warneken & Tomasello, 2007) and the age at which encouragement and praise are unrelated, or even negatively related, to simple helping behaviors (19-24 months: Dahl, 2015; Eisenberg et al., 1992; Warneken & Tomasello, 2008, 2013). Hence, we recruited infants from 13- to 18-months, hypothesizing that explicit scaffolding would increase simple helping in the younger infants, but not the older infants within this age range.

Infants saw an adult unsuccessfully reach for several accidentally dropped objects. Half of the infants were encouraged to help and praised when they did so, while the other half received no such support. All infants then completed a second series of helping tasks without encouragement or praise. It was expected that explicit scaffolding would increase helping among younger infants but not among older infants, and that this effect would generalize to subsequent helping tasks in which infants received no scaffolding.

The study investigated the joint effects of encouragement and praise, rather than their separate effects, for two reasons. The first reason was ecological. In everyday life, the use of encouragement and praise are positively associated, and when adults encourage infant helping they typically provide praise as well (Dahl, 2015). The second reason was theoretical. It has been proposed that neither encouragement nor praise (nor other forms of scaffolding) influences the earliest forms of helping (Martin & Olson, 2015; Warneken & Tomasello, 2009, 2013), implying that early helping behaviors would develop normally in the absence of scaffolding of infant helping, barring pathological cases. The joint manipulation of encouragement and praise – two common and associated forms of explicit scaffolding – provides a test case for this proposal.

Method

Participants

Sixty-nine infants (31 female, M_{age} = 15.1 months, SD_{age} = 1.4 months) aged 13 to 18 months comprised the final sample.[1] Four additional infants were recruited but ultimately excluded due to failure to warm up to experimenters (N = 2), child distress (N = 1), or experimenter error (N = 1). Participants were recruited from participant databases at two research universities, one in a metropolitan area in the Western U.S. and one in a medium-sized city in the mid-Atlantic U.S. Eight percent of caregivers had a high school degree, 37% had a college degree, and 47% had a graduate degree. Sixty-seven percent of participants reported being white non-hispanic, 15% reported Asian American, 6% reported Hispanic, and 4% reported African American.

Children below the median age (14.8 months) were categorized as *younger* (14 female, M_{age} = 14.0 months) and children at or above the median age were placed in the *older* group (17 female, M_{age} = 16.2 months. See Data Analysis section for justification of the decision to split children into these two age groups.)

Procedures

Children and their accompanying caregivers first played with two experimenters who conducted the study (E1 and E2) for 10-15 minutes. During this warm-up period, caregivers completed a demographics questionnaire and the short-form version of the MacArthur Communicative Development Inventory (CDI) assessing children's receptive and productive vocabulary (Fenson et al., 2000). Along with age, the language assessment served as an indicator of the child's developmental level, and thus allowed for an additional check of whether the experimental and control groups were developmentally comparable prior to the experimental manipulation. During the study procedures, E1 was seated behind a small table, E2 was seated on the floor with a few toys, and the parent was seated in the corner of the room. Parents were instructed to remain uninvolved and not to encourage or praise the child's helping efforts and all parents followed these instructions.

Children had a total of 18 opportunities (trials) to help by handing an out-of-reach object back to E1 (following procedures in Warneken and Tomasello [2008]). Each trial began by E1 engaging in some task with an object (e.g. writing with a pen) and then "accidentally" dropping the object on the floor. When the object fell, E1 exclaimed: "Uh-oh!" and unsuccessfully reached for the object. For the first 20 seconds, E1 continuously reached for the object on the floor while making sounds of effort and looking at the object. For the next 25 seconds, E1 reached for the object while labelling the object (e.g. "The pen") and alternating her gaze between the child and the object. The trial ended when either 45 sec had passed after the object was dropped or when the child handed the object back to E1, whichever happened first. E1 used a total of six objects divided into two blocks: Block A (markers, paperballs, paperclips) and Block B (pen, bowls, clothespins). As in past studies of infant helping (Warneken & Tomasello, 2006, 2007, 2013), E1 dropped each object three separate times (i.e. for three trials) before moving on to the next one. All children received both blocks and the order of the two blocks was counterbalanced.

Prior to each trial, E2 played with the child and a standard set of toys on the floor in front of the table at which E1 was seated. E2 continued playing with the child until E1 had dropped an object on the floor, at which point E2 looked briefly toward the dropped object and stopped playing. E2's subsequent behavior depended on the condition to which the child had been assigned, as described next.

Children were assigned to an experimental (explicit scaffolding) condition (17 younger infants, 18 older infants, 16 female) or a control (no scaffolding) condition (17 younger infants, 17 older infants, 15 female). Children in the experimental condition received encouragement and praise during the first nine trials (the "training phase"). In this phase, after E1 dropped the object, E2 repeatedly encouraged the children to help using a series of standardized vocalizations such as "Look, [E1] dropped something! [Points to dropped object.] She can't reach it. Do you want to help her?" If the child handed the object to E1, E1 and E2 alternated between praising the child for helping using standardized vocalizations such as "Thank you! You're such a great helper!" During the subsequent nine trials (the "test phase"), children in the experimental condition did not receive any explicit (verbal) encouragement or praise for helping. If the child handed the object to E1, E1 looked at the object and smiled, before resuming her activity. During the test phase, while E1 was reaching for the dropped object, E2 looked down and did not initiate interactions with the child or playing with the toys. If the child handed an object to E2 or otherwise tried to engage E2, E2 responded briefly, for instance by receiving the object, but sought to avoid drawing the child's attention away from E1. Children in the control condition received no encouragement or praise for helping in training and test phases. E2's behavior during the training and test phases for the control group was identical to her behavior during the test phase for the experimental group. On all trials for both conditions, if the child did not help E2 discretely removed the dropped object from the floor and placed in an opaque container behind her.

There were three main reasons for having E2, rather than E1, provide encouragement. First, this design was used by the preceding experimental study of encouragement of helping (Warneken & Tomasello, 2013), making comparisons between results easier. Second, if E1 had provided explicit encouragement (e.g. “Can you hand me the bowl?”), the act of helping would have been indistinguishable from the act of complying with a request to share an object, which children can do reliably from around 12 months (Hay & Murray, 1982; Rheingold, Hay, & West, 1976). Third, by letting E2 offer encouragement during the training phase for children in the experimental group we could keep E1’s signals of need (reaching, looking, vocalizing) constant across conditions and phases. This way, differences between the experimental and control conditions could not be due to E1 having expressed a more dire need in the experimental condition.

Three children completed only 8 of the 9 test trials. Since these children had fewer opportunities to help during the test phase, their data were included in analyses of the training phase helping, but not in the analyses of the test phase helping.

Coding

Children’s behavior was coded from video recordings using Mangold Interact. Coders assessed (1) whether the child helped (by handing the object to E1 while E1 was reaching); (2) the latency of the child’s helping (if the child helped); (3) how long the child looked at E1, the dropped object, or something else (by coding what the child was looking at while E1 was reaching and summing the looking durations for each of the three coded looking locations). Twenty percent of the data were coded for reliability (helping: Cohen’s $\kappa = .98$; helping latency: Pearson’s $r = .99$; looking durations: $r = .92$).

Data Analysis

The number of trials on which children helped was analyzed using Poisson regression, which is a common technique for analyzing count data (Dobson & Barnett, 2008; Fox, 2008). Preliminary analyses revealed no significant effects of task order (block A vs. block B) or testing site. The final models included: child age group (younger vs. older), condition (experimental vs. control), child gender, and age-by-condition interaction as predictors (see Appendix). Hypotheses were tested using likelihood ratio tests for model fit and z-tests for individual regression coefficients (Fox, 2008). As an index of effect size, we report increase in Cragg and Uhler's *pseudo-*R^2 (Δ*pseudo-*R^2) associated with adding the relevant variable to the regression model (Long & Freese, 2005).

Using the median age (14.8 months) as the cut-off ensured that similar sample size, and thus similar power for detecting a significant effect of the experimental manipulation, in the younger and older groups. Although prior research has not indicated precisely when most children begin to help reliably in simple out-of-reach helping task without scaffolding, it suggests that this shift would indeed happen around the middle of the first half of the second year. Still, to check whether the data were more consistent with a radically different cut-off, we fitted alternative Poisson regression models (see Method) predicting the total number of trials on which infants helped (across training and test phases). These models used all possible cut-offs between 13 and 18 months in 0.1 month increments. The best-fitting models (with the lowest model deviance [Fox, 2008]) had cut-offs around 15 months (minimum model deviance: 419.90). Models with cut-offs around 15 months not only fit better than models with later or earlier cut-offs (model deviance: 425.79 - 442.60) but also fit appreciably better than a model with age as a continuous linear predictor (model deviance: 438.07). Separate analyses of training and test trials yielded similar results. Thus, examinations of alternative regression models supported our a priori choice of the median age as a cut-off dividing children into a younger and an older group.

For analyses of helping latencies and looking times, we used mixed Analysis of Variance. Preliminary analyses revealed no effect of child gender and block type. The models reported below included condition (experimental; control) and age group (younger; older) as between-subjects factors and phase (training; test) as a within-subject factor.

Results

Age and Vocabulary Comparisons of Experimental and Control Groups

The random assignment to control and experimental conditions created groups that appeared developmentally similar prior to the experimental manipulation: There were no significant differences between experimental and control groups for age (younger: $t[32] = 0.40$, $p = .70$, older: $t[33] = 0.71$, $p = .48$), CDI receptive vocabulary (younger: Wilcoxon rank-sum test: $W = 80.5$, $p = .86$, older: $W = 101.5$, $p = .89$) or CDI productive vocabulary (younger: $W = 75$, $p = .64$, older: $W = 85$, $p = .57$).

Helping Behavior

To test whether older infants were more competent helpers than younger infants, we analyzed age effects on helping frequency in the control condition only. As expected, older infants were significantly more helpful ($M_{helping} = 6.29$) than younger infants ($M_{helping} = 3.29$), Poisson regression: $b_{\text{older}} = 0.64$, $z = 3.89$, $p < .001$, when pooling across all 18 trials. The age group difference was not statistically significant for the training phase data alone, $b_{older} = 0.24$, $z = 1.06$, $p = .29$, but was significant for the test phase data, $b_{\text{older}} = 1.08$, $z = 4.29$, $p < .001$. (Two outliers [Tukey, 1977] were detected in the training phase data and one in the test phase data among younger infants in the control condition. After removing these observations, the older age group was significantly more helpful than the younger age group both for the training phase, b_{older} = 0.78, z = 2.79, p = .005, and the test phase, b_{older} = 1.36, z = 4.71, p < .001.)

Table 1 shows a summary of the Poisson regression models for the analyses of helping behavior in training and test trials.

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As predicted, encouragement and praise increased helping frequencies in the younger age group but not the older age group in both the training phase and the test phase (Figure 1).

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For the training phase (N = 69), there was a significant interaction between Condition and Age Group, Poisson regression: $D(1)$ = 6.71, p = .010, $\Delta pseudo\text{-}R^2$ = .07. (The interaction remained significant after removing the two outliers: $D[2]$ = 15.99, p < .001.) To investigate the sources of this interaction, separate models were fitted to each age group. In the younger age group, the mean helping frequency in the experimental condition ($M_{helping}$ = 4.59) was higher than in the control condition ($M_{helping}$ = 2.06), b = 0.80, z = 3.94, p < .001, 95% CI [0.40, 1.20], $\Delta pseudo\text{-}R^2$ = .33. In the older age group, the mean helping frequency did not differ significantly between the experimental ($M_{helping}$ = 2.83) and control conditions ($M_{helping}$ = 2.65), b = 0.06, z = 0.31, p = .76, 95% CI [-0.34, 0.46], $\Delta pseudo\text{-}R^2$ = .003. (Wilcoxon rank-sum tests yielded identical conclusions: younger infants: W = 86.5, p = .04, older infants: W = 147.5, p = .86.)

The Condition by Age Group interaction was also significant for the test phase (N = 66), D(1) = 6.62, p = .010, Δ*pseudo*-R^2 = .07. (The interaction remained significant after removing the outlier: D[2] = 16.48, p < .001.) This two-way interaction reflected the fact that in the younger group, the mean helping frequency in the experimental condition ($M_{helping}$ = 2.64) was again higher than in the control condition ($M_{helping}$ = 1.24), b = 0.78, z = 2.84, p = .005, 95% CI [0.24, 1.31], Δ*pseudo*-R^2 = .24. In the older group, the mean helping frequency did not differ between the experimental ($M_{helping}$ = 3.44) and control condition ($M_{helping}$ = 3.65), b = -0.06, z = -0.33, p = .74, 95% CI [-0.29, 0.41], Δ*pseudo*-R^2 = .003. (Wilcoxon rank-sum tests yielded identical conclusions: younger infants: W = 70, p = .04, older infants: W = 155, p = .96.)

Among younger infants, 76 percent in the experimental condition helped at least once in both training and test phases. In the control condition, only 29 percent of younger infants helped at least once, Fisher's exact test: p = .01. There was no such significant difference among the older infants, p = .51. (Experimental: 56%, control: 41%).

Gender and Order Effects on Helping Frequencies

In the training phase, there was a significant gender effect: Males ($M_{helping}$ = 2.63) helped significantly less than females ($M_{helping}$ = 3.52), b_{male} = -0.31, z = -2.20, p = .028, 95% CI [0.04, 0.58], Δ*pseudo*-R^2 = .05. In the test phase, there was no significant gender effect, b_{male} = -0.16, -1.04, p = .30, 95% CI [-0.13, 0.45], Δ*pseudo*-R^2 = .05 (Males: $M_{helping}$ = 2.51, Females: $M_{helping}$ = 3.07). The gender difference was not predicted, but, as noted in the Discussion, it is consistent with past findings of higher rates of some prosocial behaviors in girls at older ages (Eisenberg, Spinrad, & Knafo-Noam, 2015).

Inspection of the average helping frequencies suggested changes in helping rates from the training to test phases (Figure 1). Although such changes were not predicted, we conducted nonparametric Wilcoxon rank-sum tests to compare the changes in helping frequency from the training to test phase. (Poisson regression is not appropriate for the analysis of repeated measurements.) There were no significant differences between experimental and control groups in the change in helping frequency from training to test phases among younger (Wilcoxon rank-sum test: $W = 179.5$, $p = .22$) or older ($W = 160$, $p = .83$) infants. However, pooling across experimental groups, there was a significant difference between older and younger infants in their change in helping rates from training to test phases, $W = 855.5$, $p = .001$. Younger infants helped significantly more during the training phase than during the test phase ($M_{training} = 3.32$, $M_{test} = 2.06$), Wilcoxon signed-rank test: $V = 181.5$. Older infants' helping frequencies did not differ significantly between the training to test phases ($M_{training} = 2.74$, $M_{test} = 3.54$), $V = 181.5$, $p = .07$. For the sake of completeness, we have included trial-by-trial averages by age group and condition in Figure 2, which are consistent with the mean trends analyzed here: Younger infants' helping propensity decreased over the course of the 18 trials, whereas older infants were, if anything, slightly more likely to help on later than on earlier trials.

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Latency to Help

Table 2 lists the average helping latencies by phase, condition, and age group. A mixed analysis of variance with condition and age group as between-subjects factors and phase as a within-subjects factor revealed a significant two-way interaction between condition and phase, $F(1, 30) = 6.65$, $p = .015$. This non-hypothesized interaction was due to a near-significant increase in average helping latency from the training phase to the test phase for infants in the control condition, $M_{change} = 4.30$, paired-samples $t(11) = 2.20$, $p = .05$, but not in the experimental condition, $M_{change} = -1.28$ sec, $t(20) = 0.90$, $p = .38$. There were no other significant two-way or three-way interactions, *p*s > .09. Although older infants helped somewhat more quickly than younger infants ($M_{older} = 21.9$ sec, vs. $M_{younger} = 18.4$ sec), there was no significant main effect of age group, $F(1, 30) = 1.71$, $p = .20$.

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Looking Behavior

Table 3 shows summary statistics for infant looking toward E1 or the dropped object while E1 was reaching. A mixed analysis of variance with condition and age group as between-subjects factors and phase as a within-subjects factor revealed no significant main effects, two-way interactions, or three-way interactions, *p*s > .13.

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A main reason for analyzing infant looking was to investigate whether younger infants in the control condition failed to help because they never saw E1 reaching for the object. In that case, the difference in helping frequencies between experimental and control conditions among younger infants could simply be due to E2 drawing children's attention to E1. To investigate this possibility, we analyzed the looking behavior for younger infants who did not help during the training phase ("non-helpers," $N = 9$ in control condition, $N = 4$ in experimental condition).

Even on the first trial, non-helpers paid substantial attention to the helping situation. On average, non-helpers in the control condition looked at E1 or the object for 24.6 sec during the first trial, whereas non-helpers in the experimental condition looked at E1 or the object for 32.0 sec, not a significant difference, $t(11) = 0.87$, $p = .40$. Across all training trials, non-helpers in the control condition looked at E1 or the object for an average of 17.4 sec (vs. 24.2 sec in experimental condition, $t[11] = 1.30$, $p = .22$). Thus, there was no indication that younger children in the control condition failed to help because they did not notice E1 or the dropped object.

What Affected Younger Infants' Helping: Encouragement, Praise, or Both?

The present study was designed to test the joint effect of encouragement and praise, not their separate effects, on infant helping (see Introduction). Still, there were some indications that both influenced younger infants' helping. First, if *encouragement* made younger infants more likely to help during the training phase, the experimental group should have begun helping on earlier trials than the control group. Indeed, among younger infants who helped, the experimental group tended to begin helping on earlier trials than the control group ($M_{experimental} = 1.7$, $M_{control} = 2.3$). Next, if *praise* boosted helping tendencies among younger infants, helping propensity during the training phase should have increased more after the first helping act among experimental children (who received praise) than among control children (who received no praise). In line with this hypothesis, the experimental group showed greater increase in helping propensity following their first act of helping (from 59.1% to 68.4% of training trials) than the control group (from 44.4% to 50% of trials). We reiterate, however, that the present study was not designed to detect such effects, and hence lacked the statistical power to render significance tests meaningful.[2]

Discussion

The present experiment investigated whether explicit scaffolding (encouragement and praise) influences infant helping by comparing infants randomly assigned to receive scaffolding to infants assigned to an equivalent no-scaffolding control condition. The main hypothesis, that explicit scaffolding would increase simple helping early in the second year but not later in the second year, was supported.

Infant helping abilities improve dramatically over the second year (Warneken, 2013; Warneken & Tomasello, 2006, 2007). This experimental study shows that social experience, in particular explicit scaffolding, can contribute to very early helping. When helping was encouraged and praised, younger infants' helping rates more than doubled. Younger infants who had received explicit scaffolding also helped more than twice as often as younger infants in the control group during the test trials, when no encouragement or praise was provided to either group. In contrast, explicit scaffolding did not increase older infants' helping. Thus, adult encouragement and praise are not only common, as shown by observational studies (Dahl, 2015; Rheingold, 1982; Waugh et al., 2015), but also effective ways of supporting young infants' helping when this ability is just entering their repertoire. The findings support theoretical perspectives that emphasize socialization in the genesis of human prosociality (Brownell, 2011, in press; Carpendale et al., 2013; Dahl, 2015; Rheingold, 1982).

The present study was designed to investigate *whether*, not *how*, explicit scaffolding increases infant helping. This question was important because several researchers have proposed that early helping is unaffected by encouragement and praise (Martin & Olson, 2015; Warneken & Tomasello, 2009, 2013). The processes by which various forms of scaffolding influence infant helping is a key topic for future research. Some data from the present study suggested particular directions for future study. There were indications that both encouragement and praise were influencing infant helping. Moreover, the data suggested that explicit scaffolding did not merely orient infants' attention. As shown by the looking time data, even control infants who never helped paid substantial attention to the helping situation. Rather, encouragement and praise may have conveyed that the adults value the infants' help and that handing the object back is the right way to help. In addition, given infants' general affiliativeness and desire for social interactions (Brownell, in press; Carpendale, Kettner, & Audet, 2015; Cortes Barragan & Dweck, 2014; Rheingold, 1982; Rheingold, Cook, & Kolowitz, 1987), salient positive signals like praise and encouragement may render helping interactions more enjoyable. Indeed, it is possible that the vocal tones and other non-verbal positive expressions can render helping interactions more enjoyable regardless of the linguistic content of the message (as long as the infant knows what to do) (Fernald, 1993).

Since encouragement and praise tend to co-occur (Dahl, 2015), they may constitute two aspects of a single approach to support of infant helping. There are other forms of scaffolding that do not generally co-occur with explicit encouragement and praise, but vary with child age or between different communities, such as abstract need-oriented scaffolding (e.g. "I could really use your help," Waugh et al., 2015), or assertive scaffolding (such as insistent repetition of requests) versus deliberate scaffolding (for instance questions accompanied by politeness terms such as "please," Köster, Cavalcante, Carvalho, Resende, & Kärtner, 2016). These forms of scaffolding may also influence children's understanding of others' intentions, ability to help others with a particular task, or motivation to interact with or help others. In short, various forms of scaffolding may simultaneously influence multiple aspects of children's helpfulness, including their motivation, understanding, and skills, both in the laboratory and in the child's natural ecology (Carpendale et al., 2015; Dahl, 2015; Hammond & Carpendale, 2015; Paulus, 2014; Sommerville, 2015). Additional research is needed to understand how each form of scaffolding influences the development of helping.

A related question is why explicit scaffolding did not increase helping among older infants. This finding was consistent with our prediction and with past experimental and observational studies (Dahl, 2015; Eisenberg et al., 1992; Pettygrove et al., 2013; Warneken & Tomasello, 2006, 2007, 2008, 2013). Our prediction was based on the expectation that older infants were more likely to have mastered simple helping tasks, and hence would not require explicit scaffolding in order to help. The data were largely consistent with this expectation: Older infants in the control group helped more than younger infants in the control group when using data from all 18 trials. When analyzing data separately for the two phases, older control infants helped significantly more during the test phase, but not significantly more during the training phase, seemingly because two younger control infants were unusually helpful, (When these two outliers were removed, the age difference was significant also in the training phase). Insofar as older infants in this and past studies tend to help more than younger infants, a likely explanation of this age shift is that older infants, on average, have helped (and been scaffolded) far more at home than younger infants. In one recent study, all mothers of infants above 16 months reported that their infants helped at home, whereas a sizeable minority of parents of infants below 12 months reported that their infants had not helped at home (Dahl, 2015, Study 1). Relatedly, naturalistic observations indicated that infants help increasingly often in everyday life from early in the second year to the middle, suggesting helping rates around 70 helping situations per week already at 14 months (Dahl, 2015, Study 2). With this amount of everyday helping, accompanied by adult support, it is not surprising to observe a major increase in helping skills over the course of the second year.

Yet, our findings do not suggest that the helping propensities of older infants were fully developed. The helping rates among the older infants in the present study (training phase: 30%, test phase: 39%) were within the range of those found by past studies, but somewhat lower those observed in some studies testing older infants or toddlers (Svetlova et al., 2010; Warneken & Tomasello, 2006, 2013). Still, most studies have found that even children who know how to help do not help on every trial. There are several possible explanations for why older infants in the present study did not help on every trial even if they possessed the necessary skills. As argued by Thompson and Newton (2013), helping is a complex behavior for young children that may be influenced by a number of cognitive, motivational, and situational factors: Simply knowing how to help is not enough for infants to help. Infants may have been distracted by E2 or the toys, perhaps finding novel toys more interesting than a behavior with which they are familiar (helping). Alternatively, older infants' greater social understanding and helping skills may have led them to expect that E2 would help E1. Waugh and her colleagues (2015) showed that 18- to 30-month-olds engage in a variety of non-helping behaviors during helping tasks, such as "hypothesis testing," even when they eventually help. Across all ages, individual differences in factors such as sociability, the child's interpretation of the adult's intention, and the child's interest in other activities may also help explain individual differences in helping (Hammond & Carpendale, 2015; Thompson & Newton, 2013; Warneken, 2013). Additional research is needed to understand why infants and older children do not help on every opportunity.

Importantly, these findings do not show that explicit scaffolding never affects children's helping beyond 15 months of age. Infants in the present study encountered a simple helping scenario in which a person was reaching for an object. Older infants' understanding of others' goals, desires, and expectations (Repacholi & Gopnik, 1997; Stipek, Gralinski, & Kopp, 1990; Woodward, 2009) allowed them to grasp this situation and respond appropriately, rendering adult encouragement and praise superfluous. In more complex helping tasks explicit scaffolding also seems to increase helping in older children (Brownell et al., 2013; Dahl, 2015; Garner, 2006; Grusec & Redler, 1980; Hammond & Carpendale, 2015). Thus, future studies should separately manipulate various forms of scaffolding, including but not limited to encouragement and praise, as well as the difficulty of the helping task. We predict that the presence and function of scaffolding with respect to early prosocial behavior will depend on the relations among motivation, skill level, and task difficulty.

Unexpectedly, younger infants in both conditions helped less during the second half of the trials than during the first half of the trials. The change in helping frequency was similar for younger experimental and control groups, and not observed in older infants, leading us to suspect that the decrease in helping over trials was primarily age-related. To our knowledge, past studies have not reported on the presence or absence of such trends over the course of repeated helping trials. The most obvious explanations are that younger infants became physically or cognitively fatigued by the repeated activity, that they found the tasks repetitive and thus less interesting, or that they became particularly eager to re-engage with the caregiver (who remained unresponsive during the study). However, until this finding has been replicated and, ideally, studied directly we hesitate to make strong claims about the nature and causes of the effect of repeated trials on helping in the younger infants.

Although the decline in helping among younger infants in both groups could be taken to suggest that the effect of scaffolding do not last, helping rates did remain approximately twice as high in the younger experimental group as in the younger control group during the test phase. Given the overall decline of helping among younger infants, we suspect fatigue more than the disappearance of the scaffolding effect. Still, 15 minutes of scaffolding is unlikely to have a lasting impact on the development of infants' helping behavior. In everyday life, scaffolding of helping occurs repeatedly over the course of days and months (Dahl, 2015).

A further limitation of this and most other experiments investigating social influences on infant helping is the lack of a baseline condition (Cortes Barragan & Dweck, 2014; Warneken & Tomasello, 2008, 2013). Without such a baseline assessment, it remains possible that the differences between the younger experimental and control groups were due to pre-existing differences between the samples and not the experimental manipulation. However, two findings argue against this explanation. First, helping rates in the younger control group were similar to those of 14-month-olds in similar tasks in the study by Warneken and Tomasello (2007), even though the studies sampled from different populations. Second, the experimental and control groups in the present study matched in age, productive vocabulary, and receptive vocabulary, further suggesting that the differences in helping between the younger experimental and control groups were due to the experimental manipulation alone. Still, it will be important for future studies to include a baseline condition as well as to expand beyond a single laboratory session. Examining the effects of scaffolding on infant helping over a more extended developmental time, from a pre-intervention baseline, through repeated scaffolding sessions, to multiple post-intervention assessments, would yield novel insights into the role of scaffolding in the early development of helping.

A second unpredicted finding was that that girls helped more than boys during the training phase. Although girls are often reported to show higher levels of prosocial responses than boys, these differences have mainly been found among older children and rarely for instrumental helping (Eisenberg et al., 2015). One possible explanation, suggested by Eisenberg and her colleagues, is that parents expect girls to help more than boys. Alternatively, gender differences could be due to gender differences in related characteristics such as empathy or sociability. However, since the current gender effect was not hypothesized, and since no there was significant gender differences in helping rates during the test phase, this finding should be interpreted with caution.

In conclusion, this study provides the first experimental demonstration of two important principles in the development of helping. Firstly, adults can facilitate young infants' helping behavior: Young infants' helping rates increased both during and after explicit scaffolding. Secondly, the consequences of adult facilitation depend on infants' developmental level in the second year: Explicit scaffolding did not increase helping among older infants on simple out-of-reach helping tasks. The systematic relations among children's skills and motives, adult scaffolding, and situational characteristics constitute a promising area for future research.

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Footnotes

[1]To align with previous published studies (see Dahl, 2015; Warneken & Tomasello, 2008, 2013), we set the target sample size to 18 younger and 18 older infants in each condition. As a further check, we simulated data with 18 participants in each cell with helping rates in the control group between .1 and .4 and helping rates in the experimental group at twice the helping rate as the control group (values informed by prior research). Using a Poisson regression model as in the reported Results, we obtained a power estimate of .88 for detecting a difference between the experimental and control groups.

[2]We thank two anonymous reviewers for suggesting these analyses.

Table 1

Summary of Poisson Regression Models for Training and Test Phase Helping Frequencies

Variable	**Coefficient**	**Estimate**	**Standard err.**	**z-statistic**	***p***
Training Phase					
(Intercept)	b_0	0.59	0.18	3.21	.001
$\text{Gender}_{\text{female}}$	b_1	0.31	0.14	2.20	.028
$\text{Condition}_{\text{experimental}}$	b_2	0.80	0.20	3.94	<.001
$\text{Age Group}_{\text{older}}$	b_3	0.23	0.23	1.03	.301
$\text{Cond.}_{\text{female}}$ x $\text{Age Gr.}_{\text{older}}$	b_4	-0.74	0.29	-2.57	.010
Test Phase					
(Intercept)	b_0	0.14	0.23	0.63	.527
$\text{Gender}_{\text{female}}$	b_1	0.16	0.15	1.04	.297
$\text{Condition}_{\text{experimental}}$	b_2	0.77	0.27	2.81	.005
$\text{Age Group}_{\text{older}}$	b_3	1.07	0.25	4.25	<.001
$\text{Cond.}_{\text{female}}$ x $\text{Age Gr.}_{\text{older}}$	b_4	-0.83	0.33	-2.54	.011

Note. The following Poisson regression models were fitted separately for training and test phases using maximum likelihood estimation:

$$\log(\lambda_i) = b_0 + b_1 * Gender_i + b_2 * Cond_i + b_3 * Age\ Gr_i + b_4 * Cond_i * Age\ Gr_i$$

where $Help_i \sim Pois(\lambda_i)$, and $Help_i$, $Gender_i$, $Cond_i$, and $Age\ Gr_i$ are, respectively, the number of helping trials, and the dummy-coded gender, condition, and age group for participant *i*.

Table 2

Helping Latencies

		Phase	
Age group	**Condition**	**Training**	**Test**
Younger	Control	23.1 (12.2)	23.2 (9.0)
	Experimental	21.3 (5.8)	20.3 (8.0)
Older	Control	17.7 (5.6)	19.1 (6.4)
	Experimental	18.5 (7.8)	18.4 (7.1)

Note. Numbers show mean (and standard deviation) for helping latencies (in seconds) as a function of age group, condition, and phase.

Table 3

Looking at E1 or Object

		Phase	
Age group	**Condition**	**Training**	**Test**
Younger	Control	22.8 (11.8)	21.2 (14.1)
	Experimental	24.1 (13.7)	21.0 (12.8)
Older	Control	19.0 (10.6)	20.1 (6.4)
	Experimental	15.4 (9.7)	16.9 (8.2)

Note. Numbers show mean (and standard deviation) for looking at E1 or the dropped object (in seconds) as a function of age group, condition, and phase.

Figure 1. Number of trials on which infants helped. Heights of bars show mean number of trials on which younger and older infants helped during training (left side) and test (right side) phases in Control (dark gray) and Experimental (light gray) conditions. Error bars show mean helping frequency ± 1 standard error.

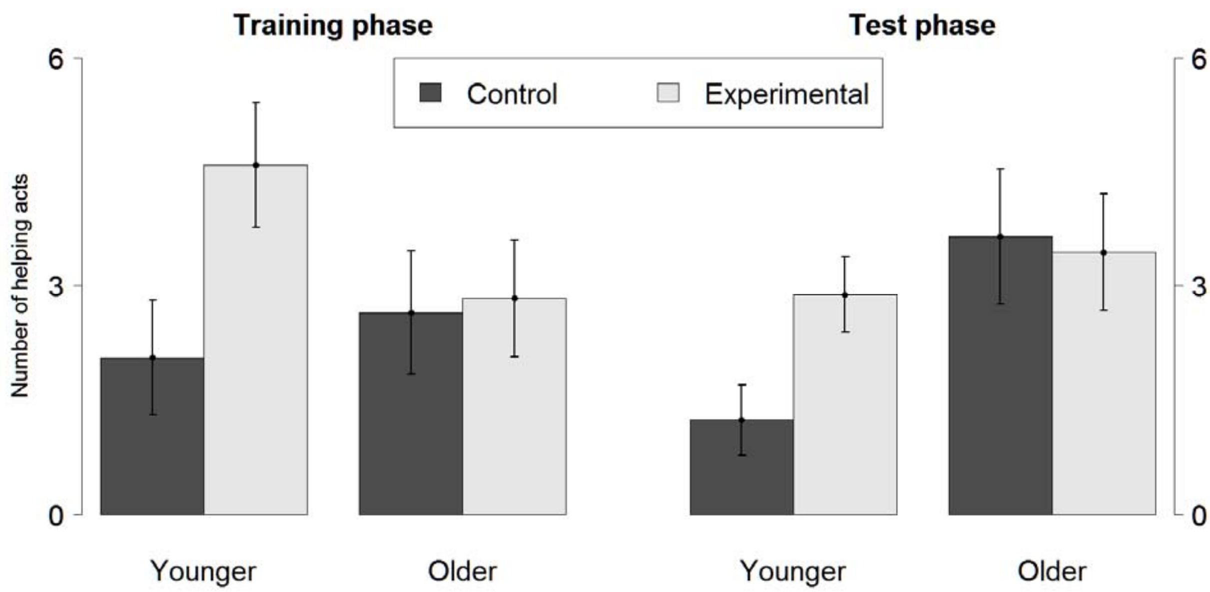
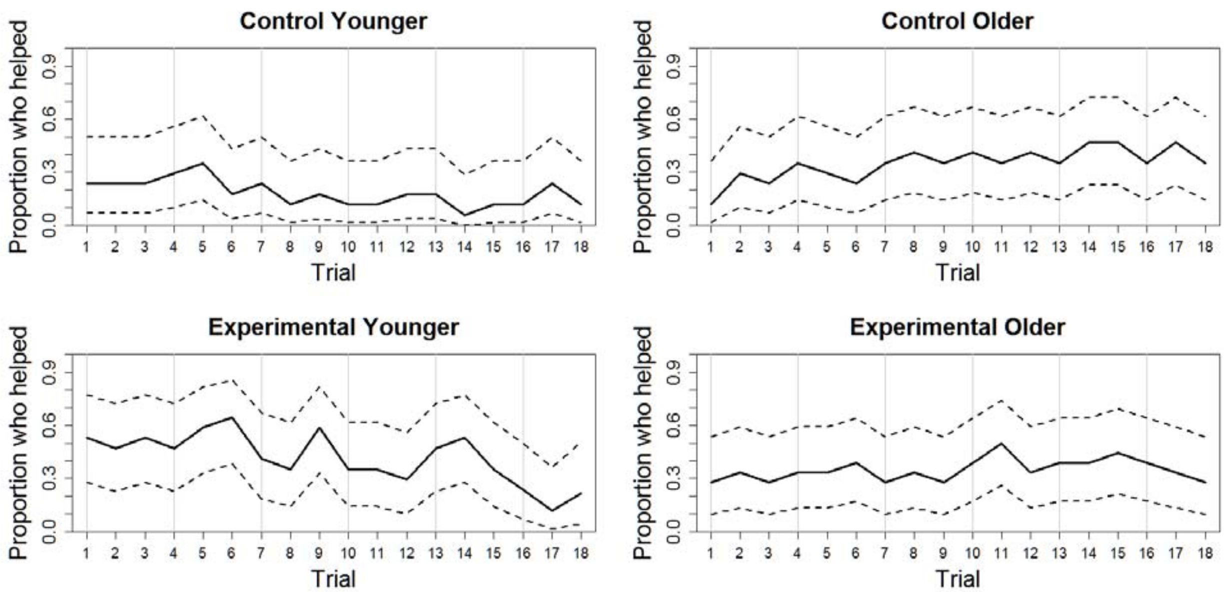


Figure 2. Helping proportion as a function of trial number, age group, and condition. The solid lines show the proportion of trials in which infants helped. The dashed lines indicate the upper and lower boundaries of 95% CIs for the helping proportion (calculated separately for each combination of trial number, age group, and condition). The gray vertical lines indicate the first trials with a new object.



Appendix

In accordance with journal guidelines, we include a table showing correlations between all the predictors (Table A1).

Table A1

Correlation Table for Predictors

	Gender	Condition	Age Group
Gender	-	.02	.07
Condition	.02	-	.01
Age Group	.07	.01	-

Note. The dichotomous predictors were dummy-coded as follows: Gender: female = 0, male = 1; Condition: control = 0, experimental = 1; Age Group: younger = 0, older = 1.