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Evaluative Conditioning and the Development of Attitudes in Early Childhood

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Many attitudes are acquired in early childhood. However, due to a lack of experimental research, little is known about the processes of how they are acquired. Two experiments were therefore conducted with 153 German kindergarten children aged 3–6 years that provide first evidence for childhood attitude formation in terms of evaluative conditioning. Specifically, it was found that children preferred novel stimuli previously paired with liked stimuli over novel stimuli previously paired with disliked stimuli. This effect occurred independently of age, generalized toward similar novel stimuli, and did not depend on children's recollection of how stimuli were paired. The findings are discussed in terms of the processes underlying childhood attitude formation, and implications for related research areas are highlighted.

Early affections often run the deepest. Indeed, adults regularly identify childhood as a source of their likes and dislikes, and similarly, psychologists argue that young children, in seeking to understand and predict their world (cf. Gelman, Coley, & Gottfried, 1994; Perner, Mauer, & Hildenbrand, 2011), could acquire attitudes as these provide structure and help to guide behavior (e.g., Ferguson & Bargh, 2004; Katz, 1960). For example, it has been argued that during childhood, attitudes such as prejudice (Allport, 1954; Devine, 1989; Rudman, 2004), dietary preferences (Birch & Fisher, 1998; Kelder, Perry, Klepp, & Lytle, 1994), or product evaluations (Connell, Brucks, & Nielsen, 2014) are first acquired. However, aside from previous research demonstrating that many such attitudes emerge between 3 and 6 years of age (e.g., Bahn, 1986; Raabe & Beelmann, 2011), and that their emergence is situated in children's social interactions (e.g., Degner & Dalege, 2013; Houldcroft, Haycraft, & Farrow, 2014; MacMillan, Tarrant, Abraham, & Morris, 2014; Pagla & Brennan, 2014; Tsai & Kaufman, 2014), little is known about the processes of *how* they are acquired. In the research reported here, we seek to advance this line of research by showing, for the first time, that attitude formation in 3- to 6-year-old children can be explained in terms of evaluative conditioning (EC).

EC refers to changes in liking that are due to the pairing of stimuli (De Houwer, 2007) and describes how individuals use ecological regularities to inform their attitudes. In a prototypical procedure used to demonstrate EC, neutral conditioned stimuli (CS) such as objects, faces, or brand names are repeatedly shown with liked or disliked unconditioned stimuli (US) such as affective pictures, words, or scents. Notwithstanding earlier controversy, it is a well-established finding that adult participants evaluate CS paired with liked US more favorably after conditioning as compared to CS paired with disliked US (see the meta-analysis of Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010).

Based on the findings that young children and even infants readily learn about ecological regularities (e.g., Blass, Ganchrow, & Steiner, 1984; Gopnik, Sobel, Schulz, & Glymour, 2001), we hypothesized that young children could also use the pairings of neutral and affective stimuli in attitude formation, and would therefore demonstrate EC. Thus far, however, this hypothesis has not been tested, and even in older children, EC has rarely been demonstrated (specifically, only Field, 2006a, who used child-adequate materials, demonstrated EC among 7- to 11-year-old children; for an overview of unsuccessful demonstrations, see Hofmann et al., 2010). This lack of investigations is surprising, not only because of the presumed relevance of

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childhood for attitude formation, but because early childhood development could be informative for identifying the processes underlying attitude formation (e.g., the extent to which EC requires propositional reasoning, which improves during development, e.g., Markovits, 2014, is a topic of intense discussion, see Hofmann et al., 2010). Therefore, we conducted two experiments in which we tested for the occurrence of EC among 3- to 6-year-old children.

Experiment 1

In Experiment 1, we tested for EC among 3- to 6-year-old children using the child-adequate materials previously developed by Field (2006a). Specifically, children were presented with unknown cartoon characters (CS) that were paired with pictures of liked or disliked animals (US). We predicted that CS paired with liked US would be preferred to CS paired with disliked US.

Method

Participants and Design

Based on EC observed in adults (Hofmann et al., 2010), we targeted a minimum of $N = 42$ participants ($\beta = \alpha = .05$ for $d = 0.52$, one-sample t test). The data were collected during April 2013, in a private kindergarten located in Halle (Saale), Germany, a city of 227,670 habitants with about 6.9% migrants (Bayerisches Landesamt für Statistik, 2011). All analyses were conducted after stopping to collect data at the end of a 2-week period. In total, 44 children (24 female, 20 male; $M_{\text{age}} = 5.07$ years, age range = 37–79 months) participated voluntarily with their parents' or legal guardians' informed written consent (see Table 1 for the number of participating children per age group). They were randomly assigned to the conditions of a 2 (US valence: liked vs. disliked) × 2 (counterbalancing of CS–US assignment) design with US valence manipulated within and counterbalancing manipulated between participants. In return for their participation, the children received a puzzle.

Materials and Procedure

The children were tested individually in front of a laptop computer in a quiet room by a female experimenter who had been participating in the kindergarten's everyday activities 1 week prior to conducting the study. The experimenter sat next to the child but could not see the computer screen. The study was described as a game consisting of shouting "Da!" (engl. *there*) whenever a "monster" appeared on the screen. Specifically, children were shown printouts of the CS, that is, the two cartoon monsters "Andimon" and "Helemon" (Field, 2006a); told that they would observe these monsters and other animals strolling through a forest; and asked to shout whenever a monster appeared. On each trial of the task, the children saw an animation of rustling bushes for a random variable interval between 1.8 and 6 s, after which one of two cartoon monsters appeared between the bushes for 3 s. For children in the first counterbalancing condition, a puppy was displayed next to Andimon, and a spider was displayed next to Helemon. For children in the second counterbalancing condition, this CS–US assignment was reversed. Each trial was started manually when the child was attending to the screen. There were 20 trials presented in random order, consisting of 10 trials per CS–US pair.

Dependent variables. After the conditioning procedure, children evaluated the CS in two newly developed tasks. In both tasks, children were asked to compare the CS and to indicate their relative preference in order to keep the tasks understandable for the youngest participating children. In a *forced-choice preference task*, the children were asked to evaluate the CS (shown as cardboard cutouts) by choosing either Andimon or Helemon to participate with them in nine different activities (e.g., attending the child's birthday party, reading a story). In a further *graded preference task*, the children distributed 10 pink, heart-shaped cardboard cutouts across Andimon and Helemon such that a monster should receive more hearts to the extent that it was liked more than the other. Scores for these tasks (i.e., the relative frequency of choices for and the number of hearts given to a particular CS, see Table 1) were transformed linearly into EC scores so that 1 indicated maximum preference for the CS paired with the positive US, −1 maximum preference for the CS paired with the negative US, and 0 indifference.

Additional measures consisted of a *US evaluation task*, in which the children distributed 10 hearts over the two US, and a standard *recollection task*, in which children were asked to indicate which monster had been shown with which animal (both US and another set of puppy and spider images were available as responses). Although the first task served as a manipulation check of US valence, a

Table 1
Preference Tasks Unstandardized Means, EC Scores, and Effect Sizes in Experiments 1 and 2

Age group *N* (f, m)	*n* (f, m)	Preference tasks unstandardized means (*SD*)			EC scores (*SD*)	Cohen's *d*, 95% CI [LL, UL]
		Experiment 1				
		FCPT	GPT			
3 years 10 (7, 1)	8 (6, 2)	.59 (.19)	5.75 (2.86)		.164 (.381)	0.430 [−0.311, 1.143]
4 years 9 (3, 6)	8 (3, 5)	.65 (.19)	6.88 (2.10)		.340 (.310)	1.096 [0.181, 1.966]
5 years 9 (5, 4)	6 (4, 2)	.61 (.15)	5.17 (0.98)		.128 (.240)	0.532 [−0.351, 1.373]
6 years 16 (9, 7)	14 (9, 5)	.55 (.26)	5.71 (2.78)		.119 (.534)	0.223 [−0.312, 0.749]
Overall 44 (24, 20)	36 (22, 14)	.59 (.21)	5.89 (2.42)		.180 (.413)	0.435 [0.090, 0.774]
		Experiment 2				
		FCPTs	GPT	RST diff.		
3 years 23 (13, 10)	19 (11, 8)	.52 (.25)	5.05 (1.41)	.13 (.69)	.042 (.238)	0.175 [−0.281, 0.626]
4 years 32 (16, 16)	27 (13, 14)	.54 (.27)	5.33 (1.53)	.10 (.82)	.068 (.290)	0.233 [−0.152, 0.613]
5 years 33 (20, 13)	30 (17, 13)	.58 (.31)	5.16 (1.49)	.02 (.67)	.066 (.342)	0.193 [−0.170, 0.552]
6 years 21 (11, 10)	19 (10. 9)	.56 (.37)	5.79 (1.81)	.14 (.68)	.117 (.369)	0.317 [−0.148, 0.774]
Overall 109 (60, 49)	95 (51, 44)	.55 (.30)	5.31 (1.55)	.09 (.71)	.072 (.311)	0.230 [0.026, 0.434]

Note. Preference tasks unstandardized means and EC scores indicate the preference for the CS paired with the liked US over the CS paired with the disliked US for Experiment 1 (the expected values for indifference are 0.50, 5, and 0 for FCPT, GPT, and EC scores, respectively). For Experiment 2, preference tasks unstandardized means and EC scores indicate the overall preference for liked-paired CS and similar stimuli (the expected values for indifference are 0.50, 5, 0, and 0 for FCPTs, GPT, RST Diff., and EC scores, respectively). Cohen's *d* values and CIs for EC scores are based on one-sample *t* tests using Wuensch's (2012) edits of Smithson's (n.d.) SPSS scripts. *N* = number of participating children per age group; *n* = number of children included in the analyses per age group; f = female; m = male; LL = lower level; UL = upper level; FCPT = forced-choice preference task; FCPTs = simplified forced-choice preference task; GPT = graded preference task; RST diff. = rating-scale task difference scores.

recollection task was employed to measure the relation between CS evaluations and children's conscious knowledge of the CS–US pairings, which is typically used to infer EC's reliance on propositional reasoning (e.g., Halbeisen, Blask, Weil, & Walther, 2014). The experiment concluded by assessing additional demographic data (native language, favorite color, eyesight).

Results

Confirming the manipulation of US valence, the US evaluation task revealed that the puppy received more than half of all hearts ($M = 6.41$, $SD = 2.16$ vs. 5), $t(43) = 4.32$, $p < .001$, $d = 0.65$, 95% CI [0.32, 0.97]. However, seven children preferred the spider over the puppy, and eight children indicated indifference. We treated the children showing inverse preferences as though they had been assigned to the opposing counterbalancing condition and excluded the data of the children showing indifference, leaving 36 children's data for analysis.

To test for the occurrence of EC, the EC scores were submitted to a linear mixed-effects (LME) modeling as implemented in R 3.0.3 (R Development Core Team, 2012) package lme4 1.1.5 (Bates, Maechler, & Bolker, 2012). We first defined a baseline regression model for which the fixed effect, that is, the intercept, would capture an overall difference of EC scores from 0, and for which random effects, that is, by-evaluation task and by-participant variation of the intercept, would control for the EC scores belonging to different evaluation tasks and different participants, respectively. In support of our hypothesis, this model revealed clear evidence of EC: Across all age groups, the intercept differed significantly from zero, $B = .18$, $SE = .07$, $t = 2.61$, $p = .009$, showing an overall preference for the CS paired with the liked US over the CS paired with the disliked US (for means and effect sizes, see Table 1; p values are based on Wald chi-square tests as implemented in R package car 2.0.25; Fox & Weisberg, 2011).

Subsequently, we tested with likelihood ratio tests for moderations of EC by examining whether the inclusion of further fixed or random effects into the baseline model would lead to improvements in model fit (cf. Baayen, Davidson, & Bates, 2008). However, we did not find evidence of moderation: Neither random effects of counterbalancing nor fixed effects of age (in months) improved the model's fit, $\chi^2(1) = 2.39$, $p = .122$ and $\chi^2(1) = 0.45$, $p = .505$, respectively. We also tested for the influence of recollecting the CS–US pairings on EC. Overall, children showed above-chance level recollection for the CS–US pairings ($M = 0.67$, $SD = 0.48$ vs. 0.0625), $t(35) = 7.58$, $p < .001$, $d = 1.26$, 95% CI [0.81, 1.69], and a regression analysis also revealed that recollection improved with increasing age (in months, grand mean centered), $b = .016$, $SE = .005$, $t(34) = 2.91$, $p = .006$, $d = 0.49$, 95% CI [0.13, 0.83]. However, including recollection or an interaction of recollection with age within the baseline EC model yielded no improvements in model fit, all χ^2s < 1.86, all ps $> .59$. These findings suggest that across all age groups, EC occurred independent of whether or not children were able to recall which CS and US had been paired.

Discussion

Our findings provide first evidence for EC in 3- to 6-year-old children, which occurred independently of age and recollection of the CS–US pairings. However, to substantiate the tentative conclusion that attitude formation in young children can be explained in terms of EC, we conducted a second experiment.

Experiment 2

The goals of Experiment 2 were twofold. First, given their novelty, we wanted to replicate our findings. Second, we extended our scope toward attitude generalization, as EC's ability to explain childhood attitude formation toward social groups, or types of foods and products, critically depends on showing that the effects are not restricted to the specific CS (cf. Hütter, Kutzner, & Fiedler, 2014). We therefore conducted a replication with a different set of stimuli that would allow us to test for EC's generalization toward similar novel stimuli.

Method

Participants and Design

Based on the previously observed effect, a minimum of $N = 59$ participants ($\beta = \alpha = .05$, one sample t test) were collected simultaneously during January 2014, in three private kindergartens located in the German cities of Hamburg, Sinzig, and Trier, with 1,693,120 (28.3%), 17,020 (21.9%), and 104,830 (18.9%) habitants (% of migrants in parentheses), respectively (Bayerisches Landesamt für Statistik, 2011). All analyses were conducted after stopping to collect data at the end of a 2-week period. In total, 109 children (60 female, 49 male; $M_{age} = 58.91$ months, age range = 37–79 months) were randomly assigned to the conditions of a 2 (US valence: positive vs. negative) × 4 (counterbalancing of CS–US assignment) design, with US valence manipulated within and counterbalancing manipulated between participants (see Table 1 for the number of participating children per age group). In return for their participation, the children received a sticker.

Procedure and Materials

The procedure and materials of Experiment 2 were largely identical to Experiment 1. However, we decided to exchange the positive US for a picture of ice cream and the negative US for a picture of *Labskaus* (i.e., a mash of corned beef, potatoes, and red beets popular in northern Germany), which in an independently conducted study were shown to be more effective at provoking positive and negative evaluations.

To test for EC and its generalization, Andimon and Helemon were replaced by *fribbles* (Williams, 1998; stimuli retrieved from http://wiki.cnbc.cmu.edu/Novel_Objects). Fribbles "mimic the structures of real-world animals" (Barry, Griffith, De Rossi, & Hermans, 2014, p. 2), in that members of the same "species" share a central body and how different appendages are attached, whereas members of different species may only share a central body. This offers a convenient way of operationalizing degrees of similarity by either remaining within or going across species' boundaries. For our purposes, we selected as CS fribbles belonging to two different species (CS pairs; Fa4_1131, Fc1_2212) and then tested for EC's generalization to fribbles belonging to the same two species (same-species pairs; Fa4_2222, Fc1_3323) and to fribbles belonging to other species that only share the central body with the original CS (different-species pairs; Fa1_1312, Fc3_3121). Because there were two pairs of fribbles from the same two species, either one of which could be used as CS, there were four instead of only two counterbalancing conditions.

Dependent variables. The dependent variables were the same as in Experiment 1, but each child evaluated all three pairs of fribbles, the *forced-choice preference task* was simplified (i.e., children were asked only once and directly which fribble they preferred), and preferences were additionally assessed by a *rating-scale task*. In this task, children were asked to indicate whether a smiling, neutral, or frowning face (coded 3, 2, and 1, respectively) best expressed their liking of an individually presented fribble. The order of evaluation tasks and the order of fribbles within each task were randomized. Similar to Experiment 1, performance in these tasks (i.e., the choices, the number of hearts, and the differences in ratings, see Table 1) was used to calculate standardized EC and generalization scores that indicated the preference for the CS paired with the liked US, and the preferences for fribbles of same- and different-species pairs that were similar to the CS paired with the liked US, respectively.

Before the conclusion of the experiment, children were given the recollection task, which included an additional "don't know" response and completed a sorting task to measure the perceived similarity of fribbles. In the sorting task, children were asked to help the fribbles "find their home" by sorting the printouts of all six fribbles into as many cardboard houses as they saw fit. It was emphasized that fribbles could live alone or in groups and that either way of living was "fine." The experiment concluded by assessing additional demographic data (native language, favorite color, eyesight).

Results

Of the 109 children participating in the experiment, seven were described by the experimenters as either distracted or not complying with participating in the task. These children were excluded from all following analyses.

Manipulation Checks

The US evaluation task revealed a clear preference for ice cream over Labskaus ($M = 8.16$, $SD = 2.30$), $t(101) = 13.85$, $p < .001$, $d = 1.37$, 95% CI [1.09, 1.64]. However, we discarded the data of seven children showing indifference and treated another seven children showing inverse preferences as though they had been assigned to the opposing counterbalancing condition. All subsequent analyses were conducted using the data of the remaining 95 children.

To assess the perceived similarity between fribbles, we counted how often a CS was sorted into the same home as a similar fribble from either the same-species pair ($n = 60$) or the different-species pair ($n = 36$). Consistent with the intended manipulation of similarity, a chi-square test revealed the difference to be significant, $\chi^2(1) = 6.00$, $p = .014$.

EC and Generalization Scores

Showing evidence for EC and its generalization, the LME modeling of the EC and generalization scores (with by-evaluation task, by-participant, and by-city of data collection random variation of the intercept) revealed a significant effect for the intercept, $B = .07$, $SE = .03$, $t = 2.14$, $p = .032$ (for means and effect sizes, see Table 1). Thus, overall, there was a preference for CS paired with the liked US as well as for similar fribbles of same- and different-species pairs. In fact, the EC effect was indistinguishable from its generalization, as the inclusion of dummy-coded fixed effects for the differentiation between CS and same- and different-species pairs did not improve the model fit, $\chi^2(2) = 0.12$, $p = .94$.

Further likelihood ratio tests did also not reveal any moderation of EC or its generalization: Neither random effects of counterbalancing nor fixed effects of age in months improved the model's fit, $\chi^2(1) = 2.79$, $p = .094$ and $\chi^2(1) = 0.33$, $p = .57$, respectively. We also tested for the influence of recollecting the CS–US pairings on EC. Children showed above-chance level recollection for the CS–US pairings ($M = 0.31$, $SD = 0.46$ vs. 0.04), $t(94) = 5.58$, $p < .001$, $d = 0.57$, 95% CI [0.35, 0.78], and a regression analysis revealed that recollection improved with increasing age (in months, grand mean centered), $b = .010$, $SE = .004$, $t(93) = 2.48$, $p = .015$, $d = 0.25$, 95% CI [0.05, 0.46]. However, neither EC nor its generalization were found to depend on recollection or on recollection conditional on children's age, all χ^2s < 10.39, all ps $> .49$.

Discussion

Experiment 2 replicated that EC in 3- to 6-year-old children occurs unrelated to age and recollection of the pairings, even though recollection improved with age. Additionally, we obtained first evidence for the generalization of EC in young children, as fribbles that shared a central body with liked-paired CS were also evaluated more favorable. Interestingly, the strength of this generalization was indistinguishable from the strength of EC and did not depend on the similarity of stimuli as constituted by how fribble's appendages were attached to their bodies. Apparently, for the generalization of EC, similarities of salient stimulus features (i.e., the body) are sufficient.

General Discussion

It is crucial to understand how children acquire attitudes, because childhood attitudes affect children's current as well as their future preferences and behaviors. We hypothesized that young children could use the regularities between neutral and affective stimuli to inform their attitudes, and consistent with that hypothesis, we obtained evidence for EC across two experiments, that is, evidence for attitude formation that is due to the pairing of stimuli. Specifically, we found that 3- to 6-year-old children preferred CS paired with liked US over CS paired with disliked US. This effect occurred swiftly with only 10 learning trials per CS, was obtained reliably with different sets of stimuli and independent of children's age, and generalized toward similar novel stimuli. To the best of our knowledge, these findings represent the first empirical evidence for EC in early childhood (cf. Hofmann et al., 2010).

Although the current set of findings provide first evidence that attitude formation in early childhood can be explained in terms of EC, and that children can use ecological regularities either encountered passively or through active pursuance to inform their attitudes, it is important to note that this interpretation is subject to limitations and that further research is required. For example, the current set of findings suggest that children between 3 and 6 years of age do not differ in their use of the CS–US pairings to inform their attitudes, but it could be possible that we were unable to detect an effect of age given our sample size. Moreover, and although we did obtain evidence for the generalization of EC, we only tested for EC's generalization on the basis of perceptual similarities and did not yet explore the role of knowledge-driven categorization. Given, for example, the prominent role of categorization processes in explaining prejudice formation (e.g., Bigler & Liben, 2007), and children's developmental differences in using category knowledge (e.g., Gelman & Davidson, 2013), it could be worthwhile to explore how category knowledge affects the generalization of EC in different age groups. Moreover, it will be necessary to explore the longevity of young children's EC, and its resistance to extinction and "counterconditioning," not only because these are the functional characteristics investigated in the adult EC literature but because increasing the functional knowledge about EC in early childhood will help to integrate EC with related literatures on the socialization of prejudice (e.g., Degner & Dalege, 2013), the development of phobias (e.g., Field, 2006b), or changing dietary preferences (e.g., Birch & Ventura, 2009; Gripshover & Markmann, 2013).

Finally, increasing the functional knowledge about young children's EC may also help to advance the lasting debate between associative and propositional processes of learning (e.g., De Houwer, Baeyens, & Field, 2005). Although the former imply that the processing of co-occurrences suffices learning, the latter argue that individuals need to engage in propositional reasoning about stimulus relations. Although not conclusive, we found that neither age, which correlates with reasoning ability (e.g., Simms, McCormack, & Beckers, 2012), nor recollection of the pairings, which is a proxy for the formation of propositions, predicted EC. It may therefore be interesting to further explore whether childhood attitude formation conforms to the predictions of associative or propositional models of learning.

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