Three-year-olds' memory for a person met only once at the age of 12 months: Very long-term memory revealed by a late-manifesting novelty preference.

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Abstract

This study examined three-year-olds' verbal and non-verbal memory for a person met only once after a 28 month interval. Children in the Test group (*N*=50) had participated in an earlier experiment at our lab at the age of 12 months where they met one of two possible experimenters. At this past event half of the children were tested by one, the other half by the other experimenter. At the follow-up, run by a naïve experimenter, the children were shown two videos from the original experiment in a visual paired comparison task: One with the specific experimenter testing them at the original visit (the Target) and one of the other experimenter (the Foil), with whom they had no experience. When explicitly asked, the children's responses did not differ from chance. However, eye-tracking data revealed a late-manifesting novelty preference for the "Foil" person indicating memory for the "Target" person met once before.

KEYWORDS: Long-term memory; Infancy; Early Childhood; Eye-tracking; Childhood amnesia, Visual Paired Comparison; Verbal recognition.

1. Introduction

One of the greatest memory enigmas is that if we ask adults about their earliest memories, most people will not be able to report memories for any event that happened before the age of 3-4 years – the phenomenon called *infantile* or *childhood amnesia* (Bauer, 2007; Goswami, 2008; Jack & Hayne, 2010; Pillemer & White, 1989). Intriguingly, we also know beyond doubt that children learn a lot, and at an impressive pace, from birth throughout childhood (e.g. Berk, 2012). This knowledge naturally leads us to questions about children's capacity for long-term memory and their ability to report such memories at a given point in life (e.g. Lie & Newcombe, 1999; Nelson & Fivush, 2004). It is well established, that the ability to remember specific events (or elements hereof) does not function at an adult level in the beginning of life, but also that such memory is developing rapidly from birth throughout childhood (Bauer, 2007; Hayne, 2004).

Although many studies investigating the long-term memories of infants and young children have focused on memory intervals from days to weeks (e.g. Bahrick, Gogate, & Ruiz, 2002; Barr, Dowden, & Hayne, 1996), some studies have found evidence of young children's memory after intervals of months (e.g. Bauer, Wenner, Dropik, & Wewerka, 2000; Bornstein, Arterberry, & Mash, 2004; Morgan & Hayne, 2011) or even years (e.g. Myers, Perris &, Speaker, 1994). In addition to the retention interval, the methods used, the specific age group, and the material to be remembered vary greatly in such studies. Thus, it can be very difficult to directly compare the results from these diverse approaches. However, in a review of infant memory development, Hayne (2004) identified four principles that seem to be valid *across* different methodological approaches: (1) That *older infants encode information faster*; (2) that *older infants remember longer*; (3) that *older infants exploit a wider range of retrieval cues*; and (4) that *forgotten memories can be retrieved through the presentation of a reminder*. Even though it is possible in this way to deduce generally valid principles from the wealth of empirical studies on children's event

memory it may be argued that some studies are more easily related to the childhood amnesia than others. For instance, some studies are targeting children's long-term memory for *specific* or *unique* real world episodes. When considering childhood amnesia, memories for unique episodes experienced in infancy are of special interest since these are the ones that for the most part do not make it into the later childhood and adulthood, after the offset of childhood amnesia (Bauer, 2007). For instance, Myers, Clifton, and Clarkson (1987) reported that "almost threes" retained memory for action sequences experienced between 6 and 40 weeks of age, a very long retention interval for this age-group indeed. However, since these action sequences were experienced on 15-19 different occasions, the relation to one-off experiences becomes unclear. In a similar study, Perris, Myers, and Clifton (1990) reported that 2½-year-olds who had on one occasion reached for a sounding object in the dark at the age of 6½ months as a part of a study on auditory localization, would reach more for such an object when brought in a similar condition compared to a control group. The children thus exhibited long-term performance-memory after a single experience only, a result more easily related to memory for specific events.

Another important issue related to memory early in life is the ability to report these memories verbally or non-verbally. The inability to verbally report preverbal experiences has been one of the most prominent factors in the suggested explanations for childhood amnesia (Bauer, 2007; Hayne & Jack, 2011). In a seminal study, Simcock and Hayne (2002) found that children (29, 33, or 39 months of age) were able to remember and produce event-relevant actions related to a distinct event after a delay of 6 or 12 months, but they were unable to translate their preverbal memory of this event into language in spite of having acquired the necessary vocabulary. In contrast, Morris and Baker-Ward (2007) found that two-year-olds in some cases *were* able to use newly acquired words to describe preverbal memories when provided with sufficient contextual support during the verbal memory assessment in the form of physical reminders of the original event (see also, Bauer et al., 2004). It is evident from this ongoing dispute that the question of translating preverbal memories into language later in development is far

from settled. Yet, it is at the heart of theory-building on childhood amnesia to understand *when* and *how* in development verbal report of early experiences is possible.

In the present study we sought to investigate young children's long-term memory for a one-off and highly controlled episode experienced in infancy. We wanted to include both verbal and non-verbal measures of the children's memory to be informed about the role of language in the remembering or forgetting of such an event. More specifically, we tested children's memory for a unique event experienced 28 months (range 24-32) earlier at the age of 12 months. All participating children had taken part in an experimental study on object cognition in our lab (see detailed description in Kingo & Krøjgaard, 2012), and their parents had allowed us to contact them again for additional studies. During the original lab visit the children were presented with various novel and custom made test objects and interacted with an engaging experimenter for approximately 45 minutes in what we found to be a unique and highly salient event (see also section 2. Method and Procedure). For several reasons this provided an excellent opportunity to test these children's memory for their previous lab visit: (1) We knew the exact date of each visit and the exact age of the infants when they visited; (2) we had good control over what the infants experienced during their first visit, since every step of the experimental procedure was carefully planned and kept constant between infants; (3) furthermore, we had a unique video recording of the experiment-event for each participant. Finally (4), the test could take place in exactly the same lab/location as where the original experiment was conducted. In short, it would be possible to employ massive cuing related to the original unique experience. As an additional feature, some of the infants were originally tested by a Scandinavian-Caucasian male experimenter (Person A), while others were originally tested by a Mixed Scandinavian-African male experimenter (Person B). This fact provided a good opportunity for conducting a contrasted recognition test.

We hypothesized that reintroducing the children in the test group to the original lab room, some of the original props, and a video recording (specific to each child) of the original experimenter and actions would strongly cue the memory of the prior lab visit if such a memory trace was available after this very long retention interval (Newcombe, Lloyd, & Ratliff, 2007; Perris et al., 1990). Given the age of our participants, the encoding conditions, and the length of the retention interval, there was no simple way to predict whether such a memory trace would reveal itself as a novelty or a familiarity preference (see Hayne, 2004; Houston-Price & Nakai, 2004; and Cohen, 2004 for discussions). The typical preference-pattern for visual recognition memory has been suggested to follow four phases such that short retention intervals (Phase 1, associated with strong memory traces) produce novelty preferences, intermediate retention intervals produce null preferences (Phase 2), long retention intervals (Phase 3)associated with weak memory traces) produce familiarity preferences and very long retention intervals (Phase 4, associated with inaccessible memory traces) produces null preferences again (Bahrick & Pickens, 1995). In their particular study Bahrick and Pickens suggested that Phase 1 was found after 1 min, Phase 2 after 1 day to 2 weeks, Phase 3 after 1 to 3 months, and Phase 4 after even longer retention intervals. They also stated, however, that these phases were not discrete. The duration of each phase may differ depending of several factors such as subject's age, the level of encoding etc. In any case, following this suggested retention pattern, we should expect to find a familiarity preference (if any) given that our retention interval was more than two years which must be considered to be long or very long. On the other hand, other factors besides retention interval have been known to affect the retrievability of memory traces in visual recognition studies. Bahrick, Hernandez-Reif, and Pickens (1997), for instance, found that retrieval cues could shift visual preference towards novelty to resemble more recent memories. Hayne (2004) in her review of infant memory development concluded that infants exploit a wider range of retrieval cues with age, and Newcombe et al. (2007) have recently argued that event memory is facilitated if one succeeds providing a match of distinctive features

between the original to-be-remembered event and the context for retrieval. Encoding time of the to-be-remembered target material has also been found to be an important factor in infants' memory abilities. Several visual preference studies have found that longer familiarization or encoding time results in higher novelty preferences (e.g. Richmond, Sowerby, Colombo, & Hayne, 2004; Rose, Gottfried, Melloy-Carminar, & Bridger, 1982); and Barr et al. (1996), in a deferred imitation study, reported that longer encoding time of the relevant material facilitated infants' memory for this material over longer delays. So given the amount of available retrieval cues in our study and the test-age (36-44 months) of the participating children, we expected that even a weak memory trace would have the chance to present itself and that it might even emerge as a novelty preference. Furthermore, infants were exposed to the original experimenter for approximately 45 minutes during their first lab visit, which is a long exposure-time to the target material in comparison with most other experimental memory studies with infants (e.g. max 60 seconds in Barr et al. [1996] or max 160 seconds in Bahrick et al. [2002]); we expected this to be a strengthening factor for the memory trace.

2. Method and Procedure

2.1 Original event

In the original event (the study reported in Kingo & Krøjgaard, 2012) the 12 month old infants visited our lab with one or both parents. The infants spent some time in the room to get accustomed to the surroundings while their parent(s) filled our consent forms and received additional information on the study. For the critical part of the study, infants were seated in a high chair by a table while the experimenter sat on the other side. The experimenter would reach into a box and pull out different objects that he would show to the infant, shake a couple of times and then return to the box. The infant was encouraged to reach into the box to retrieve an object. Sometimes they would find an object, and sometimes there would be no object. During this time, the scene was video recorded. There were six

such trials in addition to a warm-up phase. Note that although this was indeed the critical part of the original study the total event of the visit in the lab room lasted approximately 45 minutes.

2.2 Participants

For the current study we contacted the parents of all 128 children who had participated in the original study by mail. Of these 77 responded positively and were willing to come back for additional testing. However, of the 77 children who came back to our lab, most of them (N=52, 22 females) had been tested by Person B and only about a third (N=25, 17 females) by Person A resulting in highly skewed cells. To counter the fact that the Person A and Person B groups differed in number and gender distribution, we removed the latest tested children from the study until we had two groups matched on number and gender (Person A group: N=25, 17 females and Person B group: N=25, 17 females). So the final participants in the test group were 50 (34 females, all Scandinavian-Caucasian with a few exceptions) 40-month-olds (M_{age}= 40 months, range 36.0-44.0). In addition, we recruited and tested 36 children for our control group (M_{age}= 39 months, range 38.6-39.3, 21 females). Participants in the control group were recruited in the Aarhus area via registers from the National Board of Health in Denmark.

2.3 Apparatus, Stimuli, and Procedure

2.3.1 Test group.

Each of the children in the test group was brought into the exact same lab room he or she had experienced once before (at the age of 12 months). At this second session, they were tested by a female experimenter whom they had never seen before. First, the children participated in a warm-up task involving some of the props and all of the prop-related actions from the original study. One purpose of this was to maximally cue the children's memory of the original event (see also the Detailed Methods

and Materials in the supporting information available on-line). Subsequently, the children were seated in an eye-tracker booth. Here they watched two simultaneous 45-sec video sequences displaying recordings from the original study (video only, since the simultaneous presentation of two audio tracks might have caused unnecessary confusion). The 45-sec interval was chosen because it naturally resulted in a meaningful sequence of two test-trials from the original study (see Supplementary movie 1 available on-line). One of the simultaneous videos (the Target) was a recording of the original male experimenter (Person A or B) performing a test procedure made during that *particular* child's first visit to the lab. The other video (the Foil) was of the other (and previously unseen) male experimenter performing the exact same procedure at the same location. Only two different Foil movies were used, one of each experimenter. These were chosen to ensure that the experimenters were equally engaging in the movies (with regard to smiling, eye-contact etc.). In addition, the Foil movies were chosen such that there were no obviously salient features (e.g. a red t-shirt, unusual movements etc.) that would attract the children's attention to a larger degree than what was the case for the Target movies. The children were *not* visible in any of the videos, only occasionally would a child's hands be briefly visible. In contrast, the face and upper torso of the experimenter were clearly visible at all times. This stimulus preparation resulted in 50 different movie-pairs consisting of a simultaneous presentation of a child-specific (unique) Target movie and a fixed Foil movie. Location (left – right) of the Target and Foil movies and of the videos of Person A and B was counterbalanced across participants and importantly, the female experimenter was naïve as to which movie was the Target movie for each specific child. The children's visual behavior during the presentation was registered by the eye-tracker (Tobii X120) and by the end of the procedure, the children were verbally asked for recognition of any of the two displayed experimenters (see also the Detailed Methods and Materials in the supporting information available on-line).

2.3.2 Control group.

An additional group of children was tested in the eye-tracker booth to control for the possibility that the stimulus material in some way produced an artificial looking bias towards the Target or the Foil movies. More specifically, the purpose of including this group was only to address the concern that the specific pairings of Target and Foil movies may artificially and by chance create systematic differences in the children's looking behavior. The children in the Control group had never experienced any of the original experimenters and had no experience with the event presented in the videos. The stimulus for the control group was 36 movie-pairs randomly picked from the specific movie-pairs presented to the Test group. These movies kept their coding as "Target" or "Foil" to enable the same analysis as for the Test group, but for the Control group this coding was only an expression of the relation between the two videos when they were shown to a child in the Test group. Like in the Test group, half of the children in the Control group saw a movie-pair where Person A had been the Target and half of them saw a movie-pair where Person B had been the Target.

3. Results

3.1 The Verbal Recognition Test

Binomial test of the answers to the verbal recognition question showed that the children did not answer better than chance. Only 38 of the 50 children in the test group provided an answer at all, and of these only 18 (47%) answered correctly (binomial test against 0.5 test prop.), $p > .8$. The children were thus unable to verbally express any recognition of the original experimenter.

3.2 The Eye-tracking Data

For the eye-tracking data the children's looking-times for the two simultaneous videos of the Target and the Foil experimenter were measured and, as it is typically done in Visual Paired Comparison (VPC) -studies, the proportional looking-time to the Foil movie was computed (looking-time to the Foil movie

divided by the total looking-time to both the Foil and Target movies). For the Test group, a preliminary analysis of variance with Total looking-time and Foil-proportion as dependent measures, Test-age (corresponding to retention interval since all participants were 12 months of age at encoding) as a covariate, and Gender as a factor revealed no significant main effects or interactions (all *p*s > .1). In addition, a preliminary t-test revealed no difference in the overall looking-times to person A (*M* = 17.63 sec *SD* = 5.03 sec) and B (*M* = 18.05 sec *SD* = 5.10 sec): $t(49) = .35$, $p > .7$. The Foil-proportion was then compared to a hypothetical population mean of .5 (no preference) in a one-sample t-test: *M* =.57, *SD* = .10, $t(49) = 4.85$, $p < .0001$, $r = .57$. The children clearly looked more to the Foil movie than expected by chance, thus indicating a novelty preference for the previously unseen person (see Figure 1).

The total looking-time for the Control group (*M* = 35.33 sec, *SD* 8.54 sec) did not differ from that of the Test group (*M* = 35.67 sec, *SD* = 5.14 sec) $t(84) = .23$, $p > .8$. For the Control group, a preliminary analysis of variance with Total looking-time and Foil-proportion as dependent measures, Test-age as a covariate, and Gender as a factor revealed no significant main effects or interactions (all *p*s > .1). A preliminary t-test for differences in the looking-times to person A and B was also run for the Control group. Interestingly, children in the Control group looked more to the video of Person B (the mixed Scandinavian-African, *M* = 20.17, sec *SD* = 6.46 sec) than to Person A (the Scandinavian-Caucasian, *M* = 15.16 sec, *SD* = 6.35 sec), $t(35) = 3.15$, $p < .005$ (see the Person A and B looking-times for Test and Control groups in Figure 2). Note that this difference was *not* found in the Test group (see also the Discussion). But more importantly, the Foil-proportion was again compared to a hypothetical population mean of .5 (no preference) in a one-sample t-test: *M* = .53, *SD* = .16, $t(35) = .98$, $p > .33$, $r = .16$. The proportional looking-times did not differ from chance, and we thus concluded that the video material did not produce an artificial looking-bias to the Target or the Foil video. Consequently, the preference for the Foil video found in the Test group – but not in the Control group – could only be attributed to the

fact that the children from the Test group had actually experienced one of the experimenters once when they were 12 months of age.

Finally, a time-dependent analysis was run on the eye-tracking data for the Test group to see if the novelty-preference was stable over time. Other VPC studies have found that a novelty-preference typically does not manifest early during the test-phase. Initially, the pattern often is that of a familiarity- or a null-preference, while the novelty-preference does not manifest until later in the test-phase. This has been found with adults (Manns, Stark, & Squire, 2000; Snyder, Blank, & Marsolek, 2008), and with infants (Richmond & Nelson, 2009), and has been predicted by computational modeling (Sirois & Mareschal, 2004). However, the retention intervals in these studies were much shorter so the findings would not necessarily replicate to the present study. We split the 45 seconds of test-time into three 15-sec time-segments. A repeated measures ANOVA with Foil-proportion as the dependent measure and Time (3) as a factor revealed that the Foil-proportion did change over time: F (2, 45) = 7.73, $p < 0.005$, η_p^2 = .26. Contrasts of Time 1-3 revealed that the Foil-proportion was significantly higher at Time-segment 2 than at Time-segment 1 (F (1, 46) = 7.58, $p < .01$) whereas the levels at Time-segment 2 and 3 did not differ (F (1, 46) = .84, $p > .3$) (see Figure 3). Similarly, comparing the mean Foil-proportion to chance level (.5) at Time 1, 2, and 3 revealed that the proportion did not differ from chance at Time 1 (t(49) = .57, $p > .5$) while it did differ from chance at Time 2 (t(46) = 4.50, $p < .001$) and Time 3 t(49) = 5.31, $p < .001$). An binomial test of "First fixation" (i.e. which video the children fixated first at the very beginning of the test) did not reveal any differences between the Target and the Foil videos, $p = .89$. Similarly, second-by-second analyses of the Foil-proportion during the first 10 seconds of the test did not reveal any deviations from chance level (all ps > .3. See Figure 4). Thus, there was no evidence of an early transient familiarity- (or novelty)-preference.

4. Discussion

The present study tested three-year-olds memory for a person met only once at the age of 12 months. Whereas the children did not fare better than chance when asked verbally, the visual attention of the children in the test group did indeed seem to be affected by their original test-experience. These children showed a clear novelty-preference for the previously unseen person, indicating recognition memory for the original experimenter. As mentioned in the introduction it is rare to find evidence of memory for a one-off experience with three-year-olds after a retention interval of more than two years and with no reinstatement. Our hypothesis was that massive cuing and contextual support would enable the retention and activation of such a memory trace. Certainly, several of the factors known to facilitate such memory were helping the children in this study: There were multiple cues to the original experience (the room, props, actions, etc.); the children watched a unique 45 sec long recording from their original visit (cue specificity); the original experience was unique compared to daily life; the contrast between the Target and the Foil person was high (different race); the encoding time was very long compared to other studies; and the stimulus material was dynamic which has been shown to facilitate recognition better than static stimuli (Goldstein, Chance, Hoisington, & Buescher; 1987). Note that even though the racial differences between person A and B may have facilitated recognition by providing a sharp contrast, there were no differences in the overall looking-times to person A and B in the Test group. In contrast, such a difference was found in the Control group with a preference for the mixed African-Scandinavian person (B). This finding in the Control group is not surprising *per se*, and is most likely explained by the increased attention to other-race faces also found in other studies (e.g. Al-Janabi, MacLeod, & Rhodes, 2012). However, the fact that this other-race attentional bias was not found in the Test group suggests that the novelty-preference driven by the specific memory trace had a stronger influence on the visual attention than any "default" other-race attentional bias in this study.

Finding a visual novelty-preference, and not a familiarity-preference, after a long retention interval is somewhat unusual (e.g. Bahrick, Gogate, & Ruiz, 2002; Bahrick & Pickens, 1995; Courage &

Howe, 1998, 2001) although not entirely unprecedented (see Bornstein et al., 2004). Familiarity-preference findings after long retention intervals are typically explained by suggesting that strong memory traces produce novelty-preferences whereas weaker memory-traces produce familiarity-preferences (Bahrick & Pickens, 1995; Courage & Howe, 1998). However, we believe that the facilitating factors mentioned above also provide a theoretical explanation for the fact that we found a novelty preference after such a long retention interval since, in addition to strengthening the memory trace, these factors are also thought to move the visual preference in the direction of novelty (Bahrick et al., 1997; Richmond et al., 2004; Rose et al., 1982).

The memory trace manifesting as a novelty preference in the eye-tracking data was contrasted by a null-finding when giving a verbal recognition question to the same material. It is not uncommon to find that the non-verbal memory outperforms the verbal memory and this has been found in children several times before (e.g. Lie & Newcombe, 1999; Newcombe & Fox, 1994; Simcock & Hayne, 2002, 2003). In contrast to Morris and Baker-Ward (2007), we did not find that strong contextual support enabled explicit verbal report of memory for the preverbal experience. However, whether or not the memory found by a novelty-preference should be called implicit or explicit in general is controversial and has been discussed much recently (e.g. Hayne, 2004; Manns et al., 2000; Snyder et al., 2008). This discussion also has implications for the terms we should use to accurately describe processes behind memory findings from novelty-preference studies (recognizing, remembering, recollection of familiarity etc.). In spite of the diverging opinions in the field, it has important theoretical implications for the present study whether the VCP is a measure of explicit memory or not. If it is (e.g. Manns et al., 2000), then what we have found is evidence that three-year olds can have explicit memory for something experienced only once when there were 12 months old, but also that such explicit memory is difficult to retrieve and report verbally at this age. This would place language and verbalization as very central components both in understanding the current pattern of results and in addressing childhood amnesia

as a phenomenon. If, on the other hand, VPC measures implicit memory (e.g. Snyder et al., 2008) then the interpretation of the current pattern of results will most likely be that we are tapping two different memory systems (an implicit and an explicit) with our non-verbal and verbal measures, and that only the implicit memory system is able to retain the relevant memory trace in the current study. Based on the current data, we cannot make any firm conclusions on the nature of the memory measured by VPC. However, it is interesting that the novelty-preference in the present study manifested quite late in the test-phase (after more than 15 seconds) and without any early transient preferences. Richmond, Colombo, and Hayne (2007), for instance, found that adults showed increasing latency during a forced-choice recognition task (explicit recognition) as the retention interval was increased. Similar findings were reported by Chance and Goldstein (1987). It seems that the novelty-preference in the current study in similar ways is slow to manifest after a long retention interval. In this way, our data behaves in a similar manner to the studies on explicit recognition memory mentioned above and our findings are thus more compatible with an "explicit" interpretation of the VPC measure. Additional studies are required to test this hypothesis, but it is evident from the time-analysis of the present data (see Fig. 2) that we would not have found evidence of a memory trace if we had stopped looking after the first 5 or 10 seconds as is often the case in VPC studies. Based on the present findings we argue that by cutting the test-phases as short as 5-10 seconds (or even shorter) researchers may risk losing important information - especially in memory studies with long retention intervals and/or dynamic test-material.

4.1 Conclusions

In the present study, three year old children showed clear non-verbal recognition memory for persons experienced at the age of 12 months. Note that these results cannot be explained by noise in the stimulus material (as evidenced by the results from the control group) or by experimenter bias (because she was naïve with regard to who tested each infant at the original visit). By all standards, this is

memory over a very long retention interval for children of this age, especially since the to-be-remembered event was a *single* (unique) event without any reinstatement or reminders during retention (Perris et al., 1990; Rovee-Collier & Cuevas, 2009). The present study has implications for our understanding of early childhood memory and the phenomena that are related to memory development such as the balance of implicit and explicit memory, the ability to verbalize memory, and childhood amnesia. The finding that three-year-olds have *any* kind of memory for a single event experienced more than two years earlier calls for increased attention to the question of *why* such seemingly resistant memory-traces are so difficult to verbally report later in life and to conditions that will allow the memory traces to become explicitly available. The results obtained in the present study indicate that the use of massive and highly specific as well as dynamic cuing may be a very promising, yet hitherto underexplored, path in our attempts to specify and demystify what is remembered and what is forgotten from early childhood. Finally, we suggest that extending the test-phase in the VPC paradigm will increase the chances for capturing information that is relevant for children's long-term memory of dynamic events.

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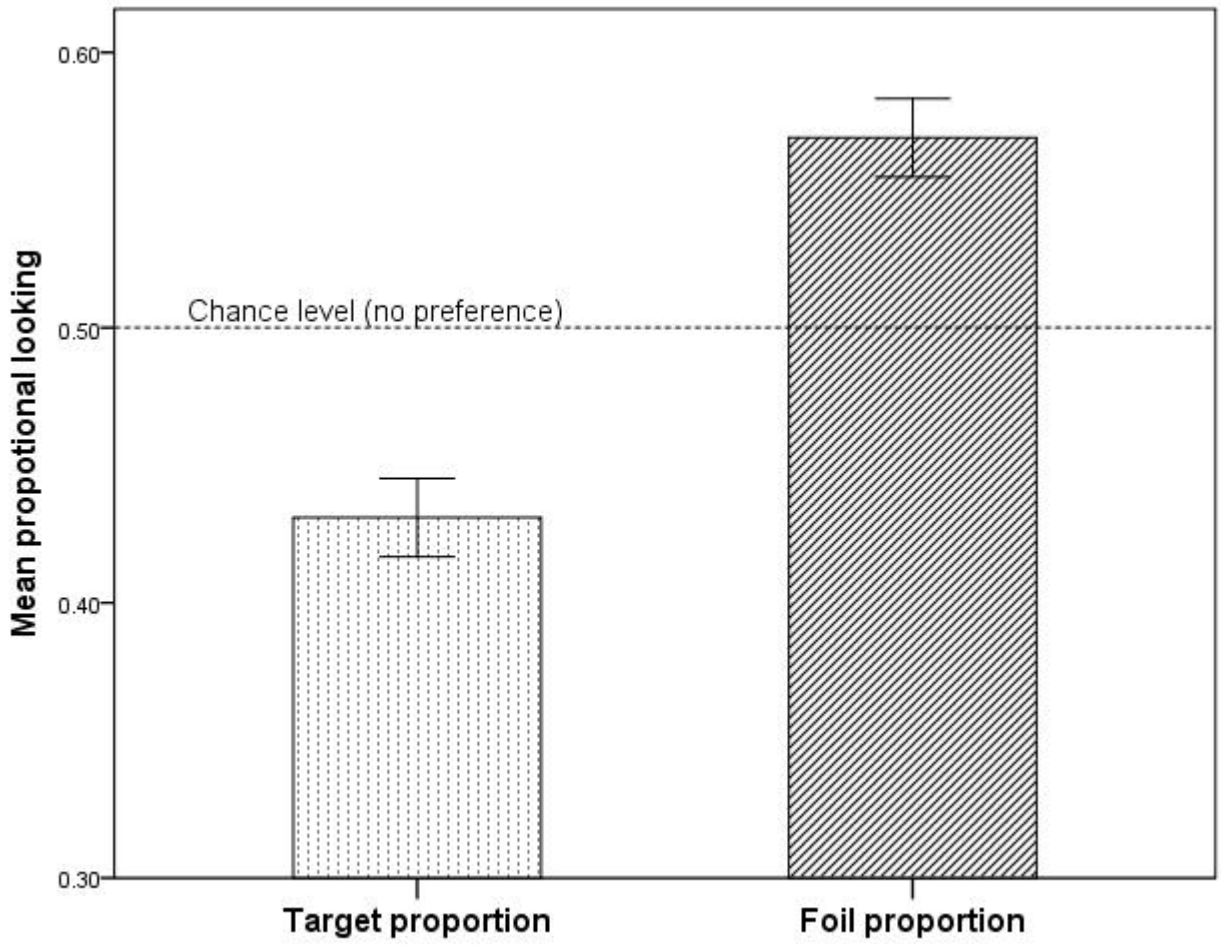

Fig. 1: Levels of proportional looking to the Target and the Foil movies (full 45 seconds) as compared to the chance level. Error bars +/- 1 SE.

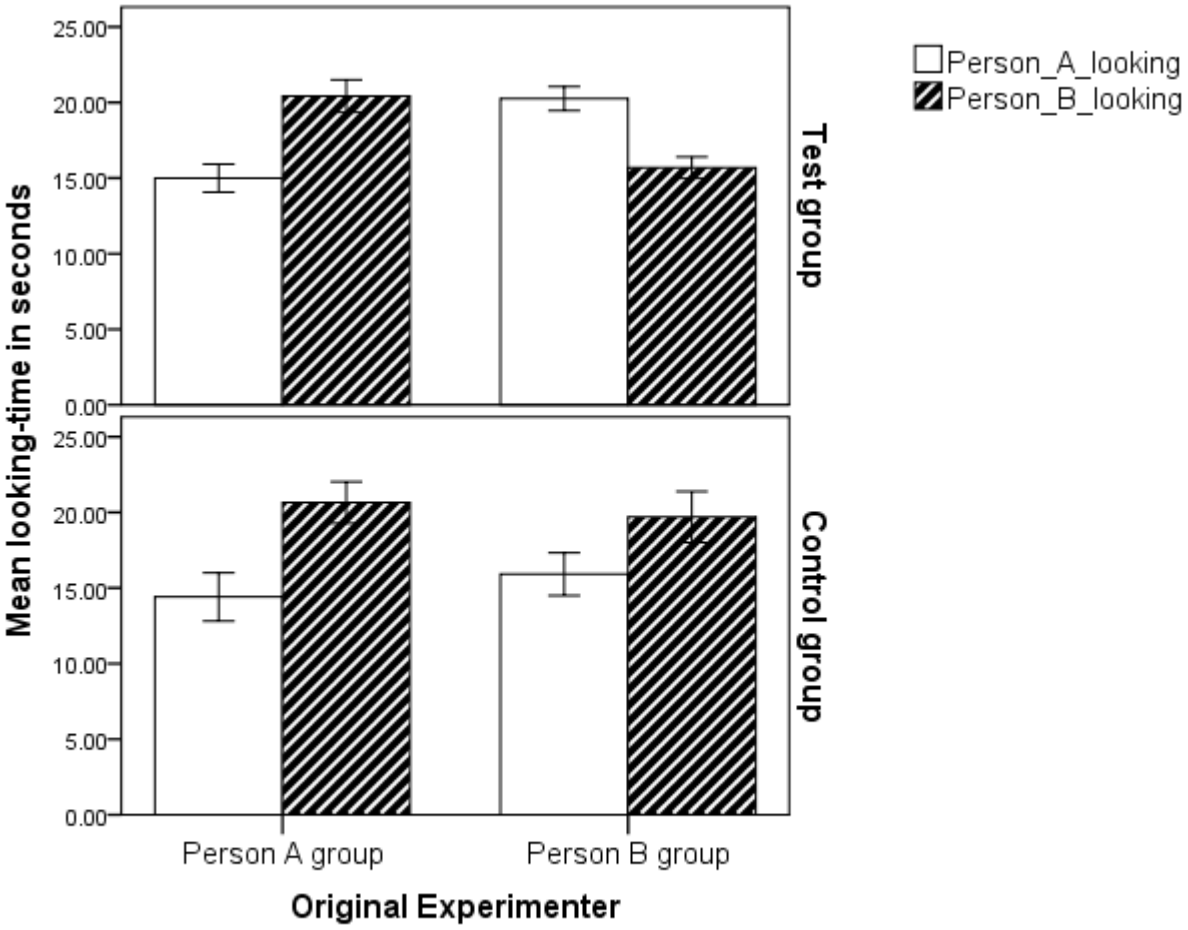

Fig. 2: Mean looking-time to Person A and B split by Original Experimenter and for both the Test and Control groups. Error bars +/- 1 SE. Note that for the Control Group "Original Experimenter" is only an expression of the coding since this group had no experience with the original event.

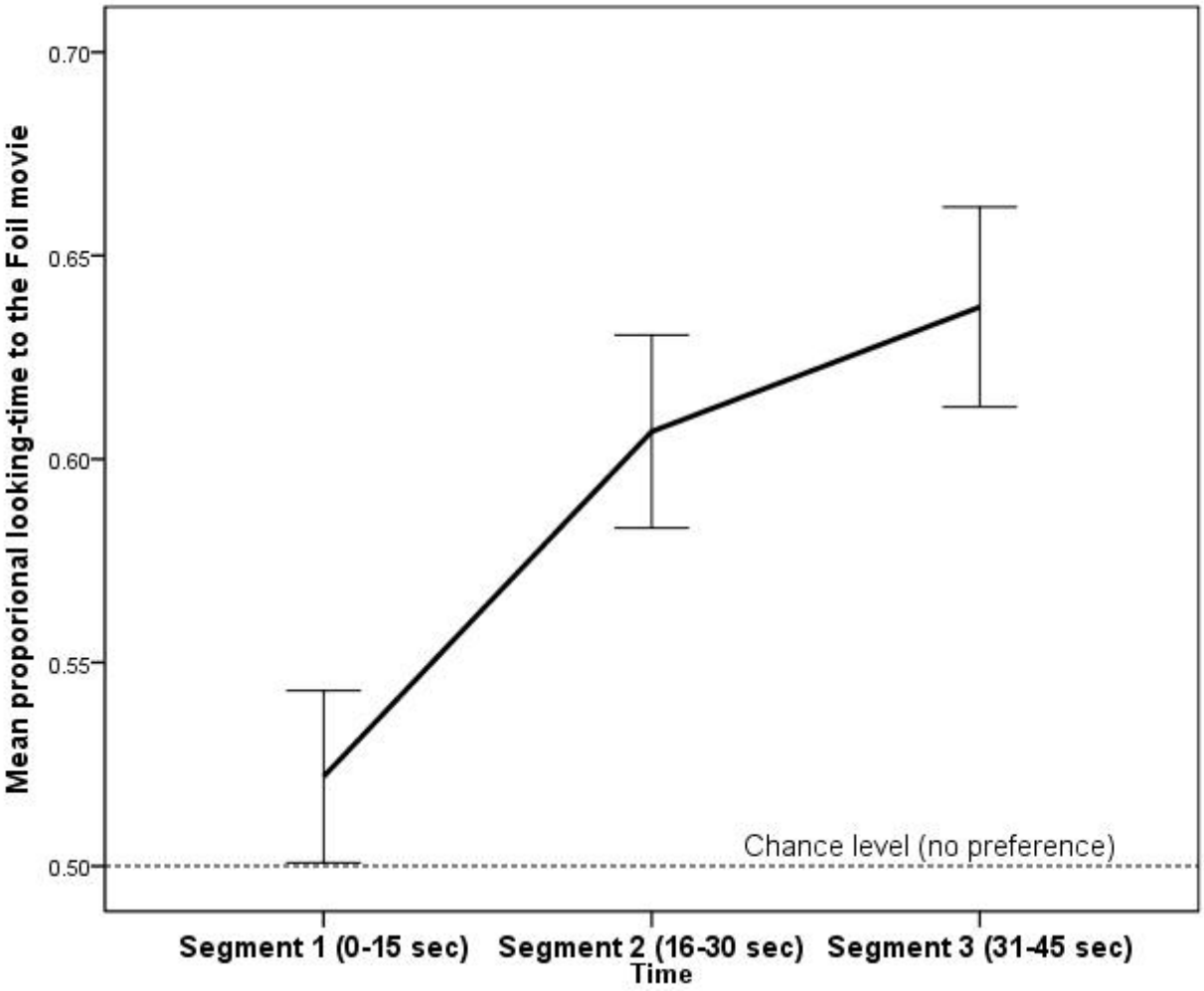

Fig. 3: Proportional looking to the Foil movie during the three 15-sec segments: Time 1 < Time 2 = Time 3. Error bars +/- 1 SE.

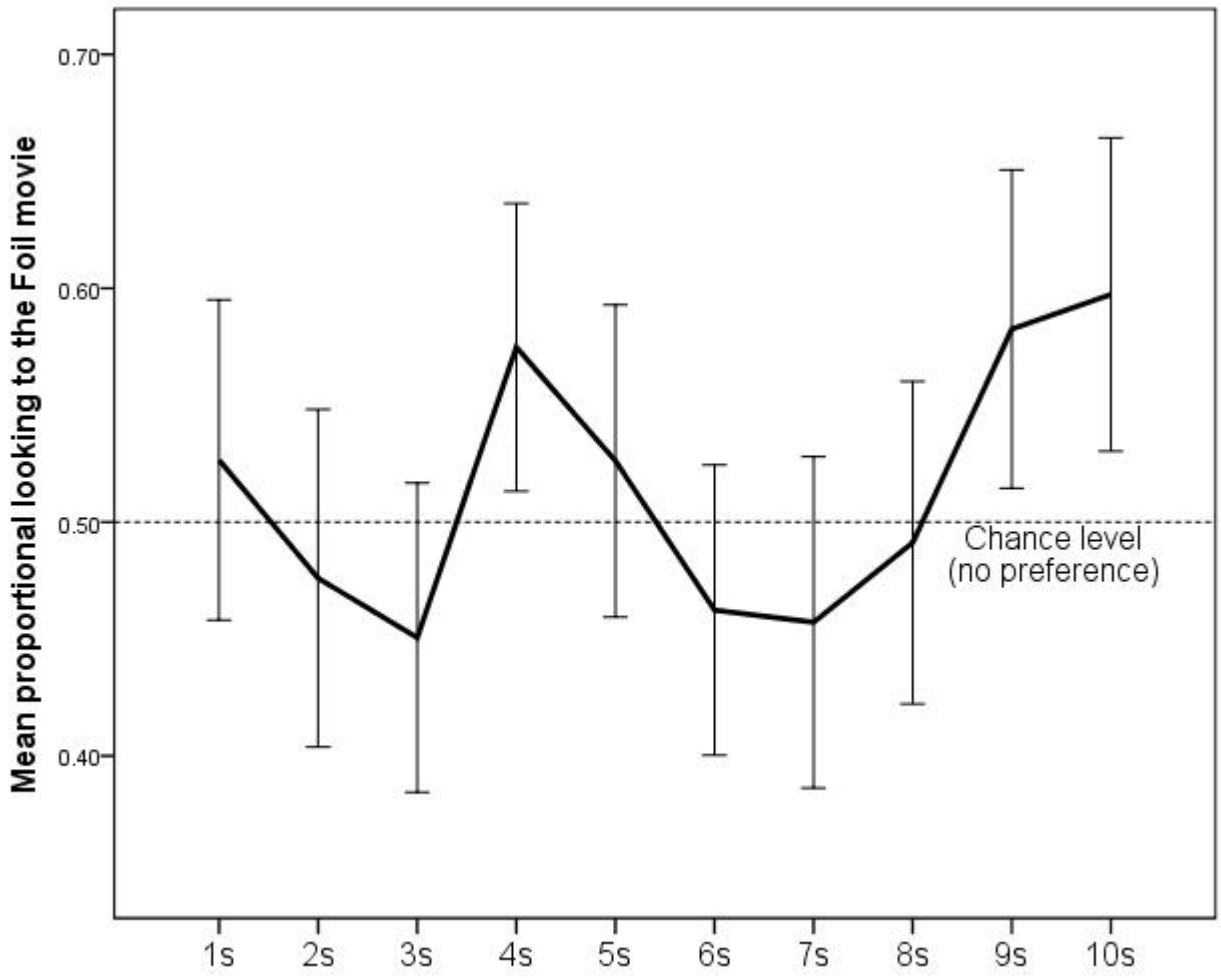

Fig. 4: Proportional looking to the Foil movie during the first 10 seconds. No familiarity- or novelty-preference. Error bars +/- 1 SE.

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