

**Supplementary Material for: Infants' representation of asymmetric social influence**

**Experimental data set**

**Table S1.** Means and CI of the raw data in seconds

	First Author		Primary Coder	
	Neutral	Incongruent	Neutral	Incongruent
<b>12 m.o.</b>	8.208 [4.913; 11.502]	11.021 [6.006; 16.036]	8.259 [4.985; 11.532]	10.977 [5.945; 16.009]
<b>15 m.o.</b>	6.876 [4.411; 9.340]	10.431 [7.022; 13.839]	6.947 [4.483; 9.411]	10.436 [7.030; 13.842]
<b>18 m.o.</b>	7.070 [5.007; 9.134]	12.1 [8.008; 16.191]	7.155 [5.100; 9.209]	12.638 [8.078; 17.198]
<b>All</b>	7.385 [5.957; 8.812]	11.184 [8.923; 13.445]	7.453 [6.032; 8.875]	11.350 [8.995; 13.705]

**Table S2.** Means and CI of the base-10 log-transformed data

	First Author		Primary Coder	
	Neutral	Incongruent	Neutral	Incongruent
<b>12 m.o.</b>	0.785 [0.590; 0.980]	0.912 [0.725; 1.098]	0.794 [0.606; 0.982]	0.907 [0.719; 1.095]
<b>15 m.o.</b>	0.751 [0.597; 0.905]	0.941 [0.794; 1.089]	0.757 [0.604; 0.909]	0.942 [0.795; 1.089]
<b>18 m.o.</b>	0.781 [0.641; 0.922]	0.992 [0.832; 1.153]	0.789 [0.651; 0.927]	1.002 [0.836; 1.169]
<b>All</b>	0.772 [0.684; 0.860]	0.948 [0.860; 1.037]	0.780 [0.694; 0.866]	0.950 [0.860; 1.041]

**Table S3.** Raw data of all the participants (in seconds)

Group Age	First Author		Primary Coder	
	Neutral	Incongruent	Neutral	Incongruent
<b>12 m.o.</b>	1.480	9.580	1.621	9.586
	10.830	10.030	10.830	10.070
	2.480	7.820	2.480	7.820
	13.580	8.240	13.410	8.240

	9.580	14.690	9.620	14.680
	9.030	9.240	9.030	9.240
	4.060	4.550	4.103	4.550
	2.930	1.970	2.930	1.970
	1.580	4.240	1.930	3.620
	5.550	5.930	5.552	5.930
	11.930	18.000	11.930	18.000
	9.000	9.550	9.480	9.414
	6.890	5.060	6.820	5.069
	2.790	2.240	2.790	2.240
	24.620	32.620	24.620	32.620
	15.000	32.590	15.000	32.590
	6.760	27.000	6.930	27.000
	8.380	5.240	8.410	5.240
	14.900	19.830	15.070	19.830
	1.620	2.070	1.690	2.070
	4.590	7.140	4.720	7.140
	2.100	3.720	2.100	3.720
	19.210	13.760	19.210	13.760
	8.240	14.760	8.210	14.720
<b>15 m.o.</b>	4.970	6.480	5.340	6.380
	5.830	8.720	5.830	8.690
	4.000	7.340	4.000	7.590
	5.620	7.310	5.720	7.310
	5.000	7.760	5.030	7.760
	9.140	14.970	9.140	14.970
	7.380	9.210	7.480	9.210
	2.280	11.590	2.280	11.590
	11.440	14.000	11.552	14.000
<b>18 m.o.</b>	14.380	16.720	14.440	16.724
	14.340	23.310	14.480	23.410
	3.000	8.680	3.000	8.580

	5.200	17.410	5.310	17.370
	7.820	8.240	7.820	8.370
	3.310	3.310	4.060	3.310
	3.750	4.860	3.750	4.860
	1.510	7.440	1.510	7.340
	5.580	11.370	5.620	11.414
	6.340	8.510	6.448	8.510
	9.100	3.060	8.960	3.100
	7.510	4.240	7.580	4.310
	4.860	20.730	4.860	29.200
	9.790	29.310	9.890	29.310
	5.200	12.410	5.200	12.410

### **Exploring the effect of the exclusion criteria**

In order to be included in the main analyses, the infants had to be looking at the screen at the beginning of the test phase, when the centrally located agent (the imitator or the target) started to move towards the agents located at the bottom of the screen; that is: just after the agent paused 0.5 s and just before the agent followed the path of any of the other agents. We set this exclusion criterion a priori because we considered it crucial that infants witnessed the agent (the imitator or the target) choosing who to follow from the beginning. Many participants looked away from the screen during the 0.5 s pause, consequently, they did not look at the screen at the beginning of the test phase and, thus, were excluded from the main analyses. The number of infants excluded for this reason in each of the three ages groups were similar (Table S5).

**Table S5.** Number of infants who were excluded because they were not looking at the screen when looking time started to be measured.

Group Age	First test outcome	Second Test Outcome	Both test outcomes	Total
12 m.o.	7	5	0	12

15 m.o.	6	6	2	14
18 m.o.	2	8	1	11

We assume that the elevated rejection rate was a consequence of the strict exclusion criteria were used. Thus, we conducted complementary analyses to check whether our results depended on our exclusion criteria. For the exploratory analysis, we included those infants who looked away at the beginning of the test phase (during the crucial choice event) but looked back at the screen before the look-away time criterion to stop the test movie (1.5 s) elapsed ( $n = 14$ , see Table S6). Because the test trials stopped after a 1.5s elapsed from the moment a participant started to look away, we could not include in our novel analysis the infants who looked away at the beginning of the test phase, and, on top of this, did not look back at the screen before our criterion to stop the test movie elapsed ( $n = 23$ ). Thus, due to our procedure, these participants did not see the test outcome at all and they cannot contribute any interpretable looking time data.

**Table S6.** Raw data in seconds and base-10 log-transformed data of the infants who looked away when the centrally located agent (the imitator or the target) started to move towards the agents located at the bottom of the screen, and looked back at the screen before the look-away time criterion to stop the test movie (1.5 s) elapsed. Coding was made by the primary coder.

Group Age	Raw data in seconds		Base-10 log-transformed data	
	Neutral	Incongruent	Neutral	Incongruent
12 m.o.	4.793	8.172	0.681	0.912
	8.2069	11.069	0.914	1.044
	2.965	11.862	0.472	1.074
	0.137	12.206	-0.863	1.087
15 m.o.	1.621	2.069	0.210	0.316
	0.517	14.621	-0.287	1.165
	0.137	19.758	-0.863	1.296
	3.655	7.276	0.563	0.862

	3.966	7.483	0.598	0.874
<b>18 m.o.</b>	9.137	14.127	0.961	1.150
	5.034	2.172	0.702	0.337
	5.827	6.034	0.765	0.781
	8.379	15.241	0.923	1.183
	2.655	4.137	0.424	0.617

After adding the base-10 log-transformed data of these infants to the original data set, we performed a mixed model ANOVA of total looking time at the screen with Age (12- 15- or 18-month-olds) and order of the test events (Neutral outcome first vs Incongruent outcome first) as between-participants factors and Congruency (Incongruent vs. Neutral outcome) as a within-participants factor. The ANOVA yielded only a main effect of Congruency ( $F(1, 56) = 18.411, p < .001, \eta^2_p = .247$ ). Separate analyses of each age group revealed that, in all age groups, infants looked significantly longer at the Incongruent test events than at the Neutral test events (12-month-olds:  $t(19) = 2.207, p = .040, d = 0.72$ ; 15-month-olds:  $t(20) = 2.953, p = .008, d = 0.93$ ; 18-month-olds:  $t(20) = 2.563, p = .019, d = 0.81$ ).

The results obtained after loosening our exclusion criteria are aligned with the planned analyses reported in the main text. In addition to confirming the results observed for the 15- and 18-month-olds, these new analyses yielded a significant effect of congruency on 12-month-olds' looking times as well. In short, these analyses confirm the robustness of our main results. Note also that even the participants who looked away during the crucial test event (when the centrally located agent started to move towards the non-target agent) seem to show the expected pattern of results (Table S6). It is plausible that these participants inferred the crucial test event retrospectively, upon seeing that the initially centrally located agent had relocated next to the non-target.

### **Exploring the eye-tracker data during the familiarization**

During each of the two familiarization phases, infants viewed four times the target and the non-target agents perform intransitive actions. We used the eye-tracker data to explore infants' preferences for such agents (for two of the 12 m.o. participants, no eye-tracker data could be collected). During the familiarization phase, we measured the total looking time to the different agents while the target and the non-target performed their actions. We then divided the looking time to each particular agent by the looking time to the whole screen over the same period. We computed this ratio for each repetition of the actions in each of the two familiarization movies and converted it in percentages.

We performed a mixed model ANOVA on the proportion of looking time to agents with agent type (target vs non-target), familiarization movie (first vs. second) and action number (first, second, third and fourth) as within-participant factors and with Age (12-, 15-, or 18-month-olds) and order of the test events (Neutral outcome first vs Incongruent outcome first) as between-participants factors. The ANOVA yielded a significant interaction between agent type and action number ( $F(3, 30) = 8.221, p < .001, \eta^2_p = .451$ ).

In order to explore this interaction, we collapsed, for each participant, the total looking time for each agent in both movies (see Table S7) and performed a separate t-test for each of the four trial repetitions. In the first and second trial infants looked equal to the two agents (first trial:  $t(45) = 0.595, p = .555, d = 0.01$ ; second trial:  $t(45) = 0.546, p = .588, d = 0.12$ ). However, in the third trial infants looked longer to the non-target ( $t(45) = 3.502, p = .001, d = 0.76$ ; mean target = 23.0%; mean non-target = 43.2%) and, in the fourth trial infants looked longer to the target ( $t(45) = 2.815, p = .007, d = 0.59$ ; mean target = 40.8%; mean non-target = 25.6%).

The results obtained showed that at the beginning of the familiarization, infants looked equally to both agents. Later, infants started to behave differently and paid more attention to one or the other agent depending on the trial repetition, a result which suggests that infants learned to distinguish targets and non-targets during the familiarization. However, the looking preference toward the non-target at the third trial was unexpected for which we have no

explanation. Future studies should investigate whether with more familiarization trials infants would start to look consistently more at the target than at the non-target.

**Table S7.** Mean percentage of total looking time for each agent across trial repetitions of all the participants

	Trial 1		Trial 2		Trial 3		Trial 4	
	Target	Non-Target	Target	Non-Target	Target	Non-Target	Target	Non-Target
12 m.o.	0.000	88.065	58.241	0.000	0.000	83.087	43.056	38.519
	57.321	21.010	20.385	57.459	2.710	60.267	35.862	30.598
	0.000	99.810	97.099	2.901	0.000	99.630	99.259	0.000
	72.479	6.285	14.537	50.463	12.384	49.314	65.348	11.266
	15.580	47.915	0.000	0.000	0.000	50.000	24.609	0.000
	16.118	15.967	3.017	58.069	28.947	25.304	5.062	42.398
	9.545	17.955	50.000	0.000	0.000	0.000	29.018	0.000
	26.164	26.909	50.370	32.500	12.266	43.009	2.251	56.483
	15.536	68.295	45.515	15.392	0.000	82.353	27.188	13.222
	4.240	68.552	31.721	65.129	23.203	68.098	8.597	60.798
	34.205	29.519	30.754	30.886	4.528	22.358	61.647	16.725
	40.556	29.907	44.815	43.333	17.075	75.479	22.391	52.174
	0.000	50.000	1.296	43.611	25.969	0.000	0.000	0.000
	43.223	28.265	44.901	26.256	41.904	40.504	34.745	31.408
15 m.o.	28.889	59.629	17.315	55.833	2.268	87.618	64.374	5.756
	41.014	28.019	35.140	27.504	7.143	52.472	53.765	26.495
	30.233	50.897	28.466	60.813	51.415	29.990	82.727	0.000
	23.737	49.983	66.158	10.181	7.862	70.088	57.130	17.308
	15.896	38.210	41.984	30.905	38.390	38.380	54.594	34.186
	47.240	11.158	33.493	30.548	27.079	33.734	21.111	56.389
	48.794	47.821	54.656	20.941	8.965	24.677	56.757	38.191
	43.786	34.956	11.418	42.285	30.765	26.199	12.894	62.523
	87.616	8.872	47.329	50.256	79.907	13.863	76.574	22.593
	70.887	16.636	51.848	18.299	15.741	41.706	56.866	35.629
	30.604	58.084	26.073	44.036	21.429	65.529	36.685	53.000
	77.368	15.421	17.954	77.182	37.023	47.921	55.360	30.563
	41.555	27.550	35.241	57.353	36.244	39.795	25.929	15.335

	18.343	45.369	11.453	78.958	48.118	0.000	20.506	30.686
	76.235	8.945	39.360	52.919	42.031	48.063	65.501	33.459
	72.445	10.721	0.000	95.269	21.384	63.358	18.981	63.778
18 m.o.	56.398	27.840	40.073	43.977	56.192	34.566	21.171	53.664
	2.516	16.981	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	48.244	32.810	24.482	14.579	8.148	66.787	51.543	0.000
	33.821	45.178	32.407	39.259	51.959	28.308	31.474	7.467
	53.981	23.889	39.757	16.981	20.847	35.352	77.157	2.612
	47.839	34.508	32.716	48.367	20.332	21.067	38.112	34.049
	48.596	34.118	43.426	14.495	13.494	22.736	18.115	9.612
	57.647	26.375	74.628	24.257	72.409	18.794	45.153	47.708
	77.819	6.562	20.595	56.434	62.569	17.098	12.778	12.315
	36.440	46.443	40.074	23.313	11.484	31.779	74.328	9.204
	41.389	46.296	18.946	80.591	12.107	87.431	70.576	10.628
	38.605	48.166	78.692	11.495	0.000	83.952	40.171	29.738
	38.682	35.906	30.352	45.572	21.126	43.151	57.070	33.696
	46.778	44.777	32.183	58.837	26.798	59.061	68.264	10.056
52.391	30.574	35.278	39.352	34.244	55.884	50.686	35.444	

### **Exploring eye-tracker data during the pre-test phase**

We analyzed infants' anticipatory gazes during the pre-test phase to test whether infants anticipate the actions of the imitator on the basis of the target's actions. Just before the test phase started, the centrally located agent (the target or the imitator) slid down along the central vertical axis (1 s) and paused for 0.5 s right before performing its final movement (following the path of the non-target). We measured whether infants anticipated the impending movement of the centrally located agent at this time point by assessing their first fixation (after 250 ms) towards one of two 17.0 cm x 9.6 cm AOIs surrounding the two agents located at the bottom of the screen (see Table S8).



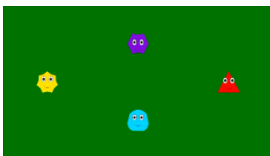
The results showed that infants did not look more at one area than the other in any of the test movies (neutral movie:  $p = .210$ ; incongruent movie:  $p = .720$ , binomial tests). These results provide no evidence for infants' anticipation of the central agent's approach behaviors.

**Table S8.** Number of infants whose first fixation was directed towards one of the agents located at the bottom of the screen (non-target, imitator or target) before the Neutral or the Incongruent Test Event. "Other" refers to infants who did not perform any fixation towards the agents located at the bottom of the screen.

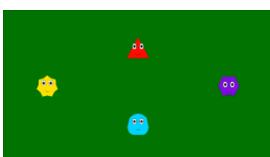
	Neutral Test Event			Incongruent Test Event		
	Non-Target	Imitator	Other	Non-Target	Target	Other
12 m.o.	1	4	9	5	3	6
15 m.o.	4	6	6	7	4	5
18 m.o.	3	5	8	5	7	4

### Experimental stimuli

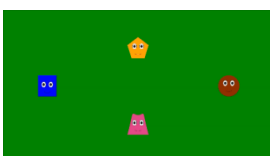
Movie S1. Incongruent Movie (Set 1). Familiarization and incongruent outcome.



Movie S2. Neutral Movie (Set 1). Familiarization and neutral outcome.



Movie S3. Incongruent Movie (Set 2). Familiarization and incongruent outcome.



### Experimental counterbalances

Table S9. Stimuli combinations used for the experimental counterbalances.

List number	First test	Set of agents used in the neutral test	Side of the Non-target during test	Neutral test				Incongruent test			
				Target agent	Main follower (present during test)	Other follower (absent during test)	Non-target	Target agent	Main follower (present during test)	Other follower (absent during test)	Non-target
1	Neutral	set A	Right	Red	Purple	Blue blob	Yellow	Brown	Orange	Pink	Blue square
2	Incongruent	set B	Right	Orange	Brown	Pink	Blue square	Red	Purple	Blue blob	Yellow
3	Neutral	set B	Right	Brown	Orange	Pink	Blue square	Purple	Red	Blue blob	Yellow
4	Incongruent	set A	Right	Purple	Red	Blue blob	Yellow	Orange	Brown	Pink	Blue square
5	Neutral	set A	Left	Purple	Red	Blue blob	Yellow	Orange	Brown	Pink	Blue square
6	Incongruent	set B	Left	Brown	Orange	Pink	Blue square	Purple	Red	Blue blob	Yellow
7	Neutral	set B	Left	Orange	Brown	Pink	Blue square	Red	Purple	Blue blob	Yellow
8	Incongruent	set A	Left	Red	Purple	Blue blob	Yellow	Brown	Orange	Pink	Blue square