

## Supplementary Materials

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### **Experiments 1-3: Effects of Preceding and Upcoming Response on Leader RT**

Following peer review, we conducted additional analyses to test the consistency of our main finding related to action-effect anticipation, i.e., that leader's action initiation was affected by the type of the expected follower's response only after compatible trials, but not after incompatible trials (as captured by the two-way interaction between Upcoming Response and Preceding Response). As described below, these analyses attested the consistency of our finding, both across experiments and across different actions produced by the leader.

First, we tested whether a reliable two-way interaction between Upcoming Response and Preceding Response was present across all experiments that involved the manipulation of the follower's response compatibility. Thus, we ran an omnibus 2X2X3 mixed-design ANOVA on data from Experiments 1-3, with factors Upcoming Response, Preceding Response, and Experiment (*Experiment: 1 vs. 2 vs. 3*). The analysis confirmed the main effects of Upcoming Response and Preceding Response, and their interaction. Further, it showed that these effects were qualified by a three-way interaction involving the factor Experiment (see results in Table S3 and means in Table S1).

We followed this up with a 2X2X2 mixed ANOVA on data from Experiments 2-3 and found no effects of Experiment (i.e., *Experiment: experiment 2 vs. experiment 3*; Table S4). These analyses, together with the post-hoc comparisons reported in the main text, suggest that the interaction was indeed present across all three experiments. They also showed that, although the effect size associated with this finding was greater in Experiment 1 (involving human followers) than in Experiments 2-3 (involving virtual followers), it was similar across the two experiments using virtual followers.

Second, we investigated whether the interaction was present across different keypresses produced by the leader (*Press Type: short vs. long*). To test this, we carried out a 2X2X3X2

mixed ANOVA with Upcoming Response, Preceding Response, Experiment, and Press Type as factors. We found no evidence that the interaction between Upcoming Response and Preceding Response was modulated by Press Type (i.e., no three- or four-way interactions involving Press Type; Table S5). The stability of the interaction across keypresses was further confirmed by two 2X2X3 mixed ANOVA's, one conducted for trials where the leader produced a short keypress and another for long keypress trials: In both cases, the interaction was reliable (see results in Tables S6 and S7, and means in Table S2).

**Table S1.** Experiments 1-3: Average leaders' response times (RT) with 95% CIs, presented by Preceding Response and Upcoming Response.

	Experiment 1		Experiment 2		Experiment 3	
	comp.	incomp.	comp.	incomp.	comp.	incomp.
preceding comp.	466 [ $\pm 4$ ]	493 [ $\pm 5$ ]	459 [ $\pm 5$ ]	468 [ $\pm 5$ ]	456 [ $\pm 5$ ]	467 [ $\pm 5$ ]
preceding incomp.	489 [ $\pm 5$ ]	483 [ $\pm 5$ ]	469 [ $\pm 5$ ]	470 [ $\pm 5$ ]	470 [ $\pm 5$ ]	461 [ $\pm 5$ ]

**Table S2.** Experiments 1-3: Average leaders' response times (RT) with 95% CIs, presented by Preceding Response and Upcoming Response, and by leaders' Press Type.

		Experiment 1		Experiment 2		Experiment 3	
		comp.	incomp.	comp.	incomp.	comp.	incomp.
short	preceding comp.	458 [ $\pm 6$ ]	490 [ $\pm 7$ ]	439 [ $\pm 7$ ]	453 [ $\pm 7$ ]	441 [ $\pm 7$ ]	454 [ $\pm 7$ ]
	preceding incomp.	484 [ $\pm 6$ ]	480 [ $\pm 6$ ]	449 [ $\pm 7$ ]	457 [ $\pm 8$ ]	457 [ $\pm 7$ ]	450 [ $\pm 7$ ]
long	preceding comp.	474 [ $\pm 6$ ]	497 [ $\pm 7$ ]	478 [ $\pm 7$ ]	484 [ $\pm 7$ ]	470 [ $\pm 7$ ]	481 [ $\pm 7$ ]
	preceding incomp.	494 [ $\pm 7$ ]	486 [ $\pm 6$ ]	491 [ $\pm 7$ ]	483 [ $\pm 7$ ]	482 [ $\pm 7$ ]	472 [ $\pm 7$ ]

**Table S3.** Experiments 1-3: Results from the 2 (*Upcoming Response: compatible/incompatible*) X 2 (*Preceding Response: compatible/incompatible*) X 3 (*Experiment: 1/2/3*) mixed-design ANOVA on data from Experiments 1-3.

	<i>df</i>	<i>F</i>	<i>p</i>	$\eta_G^2$
Experiment	2, 96	0.66	.520	.01
Upcoming Response	1, 96	21.03	< .001	< .01
Preceding Response	1, 96	11.60	< .001	< .01
Experiment * Upcoming Response	2, 96	5.14	.007	< .01
Experiment * Preceding Response	2, 96	0.62	.540	< .01
Upcoming Response * Preceding Response	1, 96	47.20	< .001	< .01
Experiment * Upcoming Response * Preceding Response	2, 96	9.27	< .001	< .01

**Table S4** Experiments 2 and 3: Results from the 2 (*Upcoming Response: compatible/incompatible*) X 2 (*Preceding Response: compatible/incompatible*) X 2 (*Experiment: 2/3*) mixed-design ANOVA on data from Experiments 2-3.

	<i>df</i>	<i>F</i>	<i>p</i>	$\eta_G^2$
Experiment	1, 61	0.01	.908	< .01
Upcoming Response	1, 61	10.10	.002	< .01
Preceding Response	1, 61	5.01	.029	< .01
Experiment * Upcoming Response	1, 61	1.84	.179	< .01
Experiment * Preceding Response	1, 61	0.44	.508	< .01
Upcoming Response * Preceding Response	1, 61	10.04	.002	< .01
Experiment * Upcoming Response * Preceding Response	1, 61	0.68	.412	< .01

**Table S5.** Experiments 1-3: Results from the 2 (*Upcoming Response: compatible/incompatible*) X 2 (*Preceding Response: compatible/incompatible*) X 3 (*Experiment: 1/2/3*) X 2 (*Press Type: short/long*) mixed-design ANOVA on data from Experiments 1-3.

	<i>df</i>	<i>F</i>	<i>p</i>	$\eta_G^2$
Experiment	2, 96	0.65	.526	.01
Upcoming Response	1, 96	20.65	< .001	< .01
Preceding Response	1, 96	12.25	< .001	< .01
Press Type	1, 96	46.98	< .001	.02
Experiment * Upcoming Response	2, 96	4.61	.012	< .01
Experiment * Preceding Response	2, 96	0.66	.519	< .01
Experiment * Press Type	2, 96	3.68	.029	< .01
Upcoming Response * Preceding Response	1, 96	51.47	< .001	< .01
Upcoming Response * Press Type	1, 96	4.57	.035	< .01
Preceding Response * Press Type	1, 96	1.08	.300	< .01
Experiment * Upcoming Response * Preceding Response	2, 96	9.55	< .001	< .01
Experiment * Upcoming Response * Press Type	2, 96	2.11	.127	< .01
Experiment * Preceding Response * Press Type	2, 96	0.25	.780	< .01
Upcoming Response * Preceding Response * Press Type	1, 96	0.11	.742	< .01
Experiment * Upcoming Response * Preceding Response * Press Type	2, 96	0.37	.694	< .01

**Table S6.** Experiments 1-3: Results from the 2 (*Upcoming Response: compatible/incompatible*) X 2 (*Preceding Response: compatible/incompatible*) X 3 (*Experiment: 1/2/3*) mixed-design ANOVA on data from Experiments 1-3, only short keypress trials.

	<i>df</i>	<i>F</i>	<i>p</i>	$\eta_G^2$
Experiment	2, 96	1.29	.278	.02
Upcoming Response	1, 96	22.39	< .001	< .01
Preceding Response	1, 96	11.51	.001	< .01
Experiment * Upcoming Response	2, 96	3.46	.035	< .01
Experiment * Preceding Response	2, 96	0.77	.466	< .01
Upcoming Response * Preceding Response	1, 96	31.41	< .001	< .01
Experiment * Upcoming Response * Preceding Response	2, 96	6.67	.002	< .01

**Table S7.** Experiments 1-3: Results from the 2 (*Upcoming Response: compatible/incompatible*) X 2 (*Preceding Response: compatible/incompatible*) X 3 (*Experiment: 1/2/3*) mixed-design ANOVA on data from Experiments 1-3, only long keypress trials.

	<i>df</i>	<i>F</i>	<i>p</i>	$\eta_G^2$
Experiment	2, 96	0.23	.797	.02
Upcoming Response	1, 96	5.01	.027	< .01
Preceding Response	1, 96	4.01	.048	< .01
Experiment * Upcoming Response	2, 96	3.76	.027	< .01
Experiment * Preceding Response	2, 96	0.22	.799	< .01
Upcoming Response * Preceding Response	1, 96	30.38	< .001	< .01
Experiment * Upcoming Response * Preceding Response	2, 96	4.99	< .001	< .01

### Experiments 1 and 4: Effect of Preceding Follower RT

To investigate whether leaders adapted to their partner's response speed on the preceding trial, we carried out LME models (computed in R v.3.0.3, lme4 package v.1.1-5; Bates, Maechler, Bolker, & Walker, 2019; *p*-values were approximated with lmerTest package v.3.1.0; Kuznetsova, Brockhoff, & Christensen, 2017). For Experiment 1, we ran the following model:

```
lmer (Leader RT ~ 1 + Preceding Follower RT * Upcoming Response * Preceding
Response + (1 + Preceding Follower RT * Upcoming Response * Preceding Response ||
Participant), data = dat)
```

And for Experiment 4, we carried out the model:

```
lmer (Leader RT ~ 1 + Preceding Follower RT + (1 + Preceding Follower RT || Participant),
data = dat)
```

See Table S8 and S9 below for full results of these models, and Figure S1 for an illustration of the association between Preceding Follower RT and Leader RT. See the main text for a specification of the data subset used in each model.

**Table S8.** Experiment 1: LME model (fixed structure results).

	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	485.07	12.14	39.96	< .001
Preceding Follower RT	7.83	1.60	4.88	< .001
Upcoming Response	-12.45	3.43	-3.62	< .001
Preceding Response	-5.17	2.43	-2.13	.041
Preceding Follower RT* Upcoming Response	-3.97	2.39	-1.66	.104
Preceding Follower RT* Preceding Response	1.40	2.01	0.69	.495
Upcoming Response* Preceding Response	-36.14	5.10	-7.08	< .001
Preceding Follower RT* Upcoming Response* Preceding Response	-7.32	4.32	-1.69	.098

**Table S9.** Experiment 4: LME model as per main text (fixed structure results).

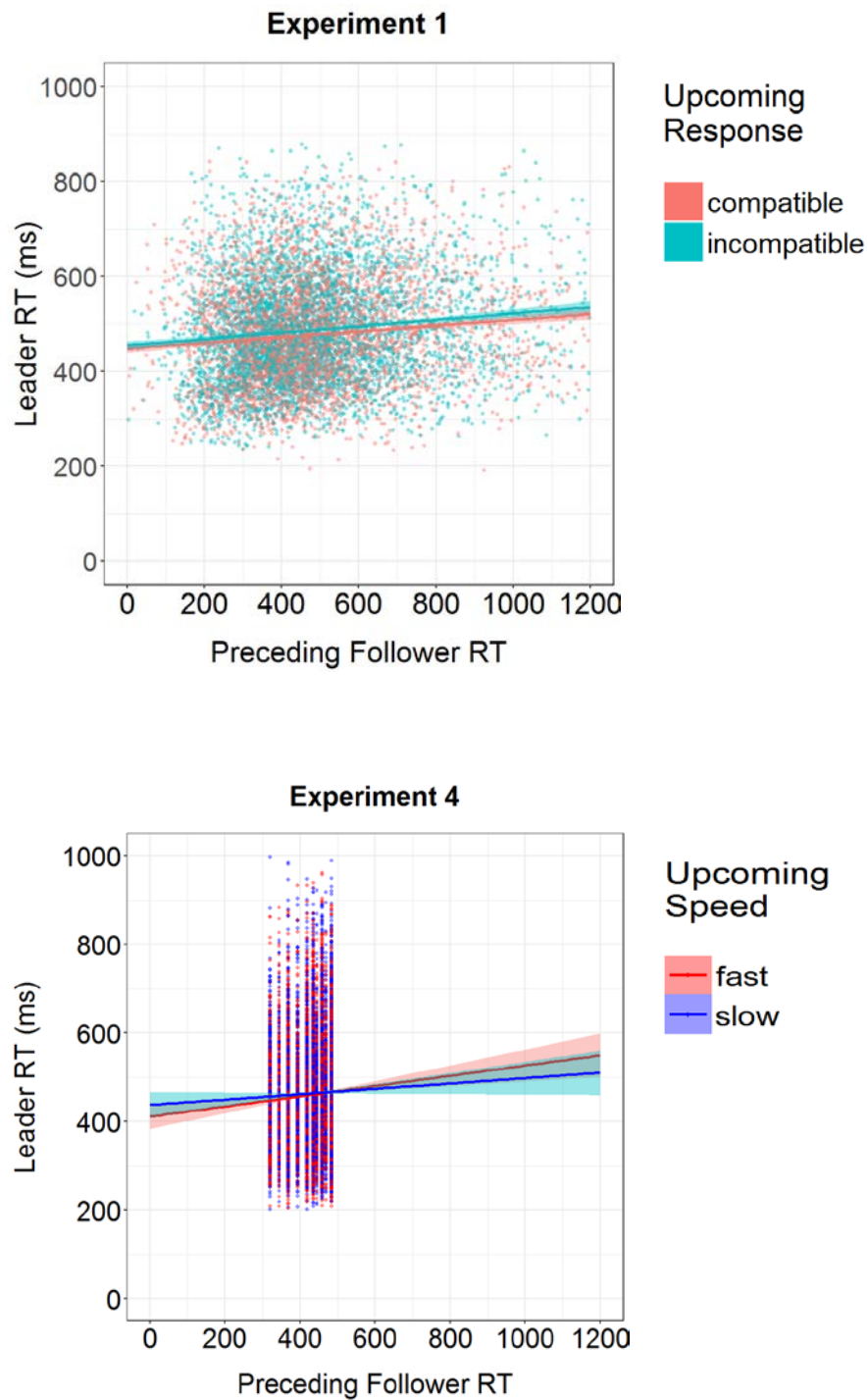
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	456.55	14.31	31.91	< .001
Preceding Follower RT	3.76	1.70	2.21	.035

To test the robustness of our adaptation finding from Experiment 4, we ran an additional LME model on full dataset (i.e., including trials where leaders interacted with either the fast or the constant follower, in all parts of the experimental session). We found that the positive correlation between Leader RT and Preceding Follower RT was once again present. However, the associated statistical effect was now smaller and marginally significant (see Tables S9 and S10), a change that could be attributed to the inclusion of trials where response speed varied to a very limited degree (i.e., trials from Part 1 where both followers responded with the same speed).

**Table S10.** Experiment 4: LME model conducted on full data (fixed structure results).

	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Intercept	462.34	14.19	32.58	< .001
Preceding Follower RT	3.61	1.85	1.95	.060





**Figure S1.** Experiments 1 and 4: The relation between Leader RT and Preceding Follower RT shown by Upcoming Response in Experiment 1, and by Upcoming Speed in Experiment 4.

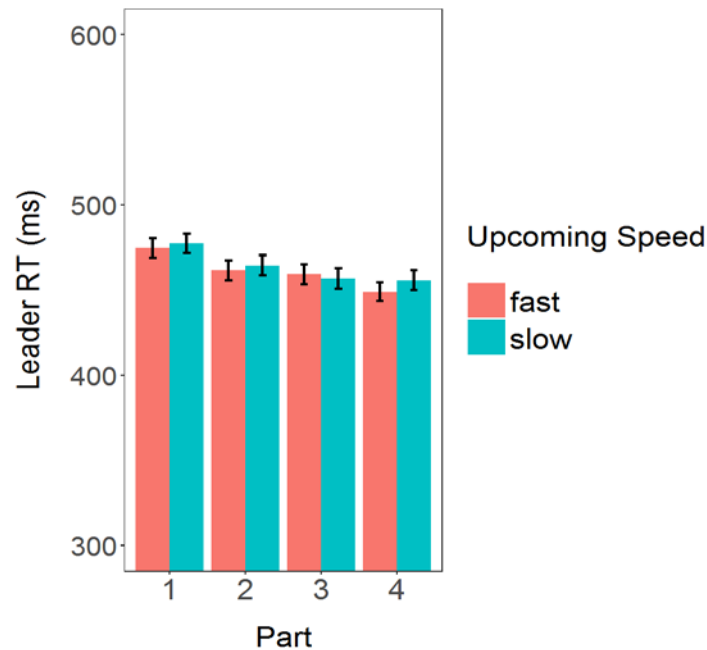
### Experiment 4: Follow-up Comparisons

As per our pre-registration, we tested whether leaders' action execution was affected by whether leaders expected a fast or a slow response (Upcoming Speed: "fast" vs "slow") in any of the four parts of the experimental session (recall that in Part 1 both followers responded with identical speed, but from Part 2 onwards the one follower initiated their response with a greater speed than the other). Across all parts, the effect of Upcoming Speed was not reliable (Part 1:  $t(31) = -0.63, p = .265, d_z = 0.11$ ; Part 2:  $t(31) = -0.41, p = .343, d_z = 0.07$ , Part 3:  $t(31) = 0.36, p = .641, d_z = 0.06$ , Part 4:  $t(31) = -1.89, p = .034, d_z = 0.33$ ; note that none of these p-values meets the conventional threshold for statistical reliability if Bonferroni correction for multiple comparisons is applied; see Leader RT means in Table S11).

In response to peer review, we carried out post-hoc comparisons also for the main effect of Part (i.e., leaders became faster as the experiment progressed, irrespective of the identity of the follower with whom they interacted). We found that leaders initiated their actions more quickly in the second as compared to the first part of the experimental session ( $t(31) = 2.63, p = .006, d_z = 0.46$ ). However, we found no evidence for any further increase in speed (third vs. second part:  $t(31) = 0.68, p = .250, d_z = 0.12$ ; fourth vs. third part:  $t(31) = 1.14, p = .132, d_z = 0.20$ ). This suggests that most of the speed increase occurred early in the experimental session (see Table S11).

**Table S11.** Experiment 4: Average leaders' response times (RT) with 95% CIs, presented by Upcoming Speed and Part.

Part 1		Part 2		Part 3		Part 4	
"fast"	"slow"	"fast"	"slow"	"fast"	"slow"	"fast"	"slow"
475 [ $\pm 6$ ]	477 [ $\pm 6$ ]	462 [ $\pm 6$ ]	465 [ $\pm 6$ ]	459 [ $\pm 6$ ]	457 [ $\pm 6$ ]	449 [ $\pm 5$ ]	456 [ $\pm 6$ ]



**Figure S2.** Experiments 4: Average leaders' response times (RT), presented by Upcoming Speed and Part. Error bars represent 95% CIs.

### Experiments 1-3: Error Rate Analysis

We asked whether a speed-accuracy trade-off could have confounded the critical result pattern in Experiment 1-3 (i.e., the interaction Upcoming Response\*Preceding Response on leader RT). To test this, we ran 2X2 ANOVA's on leader error rates in each experiment (we used raw data for these analyses; mean error rates in Table S12. In Experiment 1 and Experiment 2, error rates were not reliably affected by Upcoming Response, Preceding Response, or their interaction (*Experiment 1*: Upcoming Response:  $F(1,39) = 3.55, p = .067, \eta_G^2 < .01$ ; Preceding Response:  $F(1,39) = 1.25, p = .270, \eta_G^2 < .01$ ; interaction:  $F(1,39) = 0.70, p = .407, \eta_G^2 < .01$ ; *Experiment 2*: Upcoming Response:  $F(1,31) = 1.35, p = .254, \eta_G^2 < .01$ ; Preceding Response:  $F(1,31) = 0.12, p = .726, \eta_G^2 < .01$ ; interaction:  $F(1,31) < 0.01, p = .985, \eta_G^2 < .01$ ). In Experiment 3, we found a reliable effect of Preceding Response, such as that leaders produced fewer errors after an incompatible than after a compatible follower response (Preceding Response:  $F(1,31) = 9.95, p < .001, \eta_G^2 = .01$ ). Crucially, this effect did not interact with Upcoming Response

(interaction:  $F(1,31) < 0.13$ ,  $p = .716$ ,  $\eta_G^2 < .01$ ). The effect of Upcoming Response was not reliable (Upcoming Response:  $F(1,31) = 0.02$ ,  $p = .885$ ,  $\eta_G^2 < .01$ ).

**Table S12.** Experiments 1-3: Percentages of leaders' erroneous responses with 95% CIs, presented by Preceding Response and Upcoming Response.

	Experiment 1		Experiment 2		Experiment 3	
	comp.	incomp.	comp.	incomp.	comp.	incomp.
preceding comp.	13% [ $\pm 4$ ]	13% [ $\pm 4$ ]	11% [ $\pm 2$ ]	10% [ $\pm 2$ ]	15% [ $\pm 3$ ]	15% [ $\pm 3$ ]
preceding incomp.	13% [ $\pm 4$ ]	12% [ $\pm 4$ ]	11% [ $\pm 3$ ]	10% [ $\pm 2$ ]	13% [ $\pm 3$ ]	14% [ $\pm 3$ ]

### References

- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2019). lme4: Linear mixed-effects models using Eigen and S4. <http://CRAN.R-project.org/package=lme4>
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software*, 82(13), 1–26.