Response to comments on "Differential sensitivity to human communication in dogs, wolves and human infants"* [1]

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Abstract

Both comments raise important methodological issues and propose alternative accounts to our finding of the A-not-B error in dogs. Not denying that attentional processes and local enhancement are involved in such object search tasks, here we provide new evidence and argue for that dogs' behavior is affected by a combination of factors, including specific susceptibility to human communicative signals.

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[1]

Fiset claims that our results[1] contradict Gagnon and Dore[2] who reported that dogs do not commit A-not-B search error if they face a human who provides ostensive-referential signals. He suggests that dogs' perseverative search bias in our study[1] arises from the use of an "atypical" and mistakenly designed testing procedure and not from the dogs' specific susceptibility to human communicative signals. According to Fiset our procedure deviates from the "typical" test because (I) the experimenter is "sham baiting" location A during the B trials, (II) the experimenter provides communicative signals for the subject during the hiding and (III) the roller-coaster trajectory of the target object distracts the dogs making the object search task attentionally more demanding in the social communicative context as compared to the non-social hiding condition. Fiset also claims that dogs show a higher tendency to commit context-specific A-not-B error in comparison to wolves because the later possess better skills of attention.

First, we do not share Fiset's opinion that the experimental condition in Gagnon and Dore[2,3] studies constituted a social context similar to the social-communicative condition of our study[1]. In these earlier studies the target object was not manipulated directly by the human but instead it was remotely moved by a 1.25 m transparent nylon thread. Moreover the experimenter avoided as far as possible to provide any communicative cues to the dog, attracted the dog's attention in a non-communicative manner (by moving the target object in the dog's immediate visual field) and we did not find any indication of using eye contact or verbal command in the written procedure. In contrast, they reported that care was taken that the dog looked at the object and ignored the human during the procedure. Thus the method reported by Gagnon and Dore was not truly social and was explicitly non-communicative therefore the procedure unsuitable to test the effect of human ostensive communicative signals on the search behavior of dogs. Although Gagnon and Dore's studies rather mimicked the non-communicative trials of our study, this is a matter of interpretation at this stage and due to the significant procedural differences there is no reason for making any direct comparison of the dogs' performance.

Second, we agree with Fiset that tracking the object can be attentionally more demanding in the communicative and non-communicative social conditions than in the non-social trials. To see whether this point would account for the increased search errors in the B trials we

observed twelve naïve dogs in a less demanding version of social condition. The procedure was identical to that of the SocCom condition[1] except that during the B trials after the experimenter had picked up the object (and attracted the dog's attention by communicative signals) she did not bend her upper body behind screen A with the toy in hand but walked to screen B while keeping the toy object on the same level in her hand. That is, the object did not shuttle between the shoulder height of the experimenter and the ground level at location A and was constantly visible until she placed it behind screen B. In contrast to Fiset's prediction, we could not find significant improvement in dogs' performance compared to our original results in the fully communicative task (correct choices: 27.7% vs. 22.2%; $t_{22} = 0.467$, $P = 0.645$; groups were matched for age, gender and breed category).

Third, we believe that Fiset's discussion of wolf-dog differences needs some complementary notes. To this date there is no supporting evidence for wolves' higher attentional span (as compared to dogs) and the reference cited by Fiset[4] as a support for the relatively "*short and variable attentional span for social cues"* in dogs is not relevant in this context. That study tested subjects' willingness to "eavesdrop" in a non-communicative context and not the amount of time a dog is able to concentrate on a communicating human without becoming distracted.

Fourth, we strongly disagree with the notion that wolves would outperform dogs in pointing tasks. In those studies in which subjects were tested with an attentionally highly demanding signal (momentary distal pointing), in contrast to dogs, wolves could utilize this cue only after extensive formal training[5,6] or at least after extensive experience with humans[7]. We argue that wolves are not merely *"less prone to interference from social cues"* than dogs but the dogs' higher susceptibility to human social signals is the key factor in wolf-dog differences[8].

Finally, the finding that dogs showed similarly high performance in the A trials of both social and non-social conditions (92-98%) seems to confute Fiset's hypothesis claiming that the experimenter's movements (walking behind position-B after hiding the object at location A) worsened the performance of dogs in social conditions as compared to the non-social context. So we do not see any reason to accept that the 'short attentional span'

explains dogs' performance in these versions of the task better than the theory that we advanced in our paper.

Although Marshall-Pescini and her colleagues in their comment agree with the general notion that ostensive communicative cues have a strong influence on dogs' behavior, they challenge our proposal and claim that in our particular experiment[1] the dogs' A-not-B error stem from the "unbalanced" cuing procedure of the social communicative hiding context and does not indicate unique susceptibility to human communication. That is, whilst in the B trials of the NonCom context the experimenter used sound stimuli (by squeezing the toy) both before the toy is hidden behind A and B screens subjects were not provided communicative signals adjacent to the B barrier in the SocCom condition.

In their study, therefore, they reversed the situation; the cuing procedure was balanced in the SocCom condition (communicative signals at both A and B locations) and unbalanced in the NonCom (sound stimuli only at the empty A location). Dogs' better performance in the balanced (modified SocCom) as compared to the unbalanced (modNonCom) cuing context led them to the conclusion that local enhancement can account for A-not-B errors and question that the context specific changes in the dogs' tendency to commit A-not-B error would have any relevance to their sophisticated understanding of human communication.

While we agree that our findings open the door for alternative explanations and the underlying cognitive processes of the A-not-B error in dogs call for further studies, we are not convinced that Marshall-Pescini et al. could provide convincing evidence for local enhancement as an alternative to our hypothesis.

First, in our view Marshall-Pescini et al.'s modified SocCom condition is not fully suitable to make distinction between these accounts. Namely the local enhancement account as well as our hypothesis predicts that applying verbal attention-attracting signals at location B during the B trials will eliminate the perseverative search error as these cues not only enhance the saliency of B barrier but can be interpreted by the dogs as a novel imperative order that overrides the former instruction ("Go to the A barrier!") and urge the dog to redirect their approach to the B barrier.

Second, we agree that their "unbalanced" version of the Non Communicative condition (mod NonCom) is a more suitable control for studying the biasing effect of the ostensive-communicative signals in our original "unbalanced" SocCom condition than the "balanced" NonCom procedure we used[1]. Unfortunately, however, Marshall-Pescini and her colleagues failed to replicate the SocCom and NonCom conditions of our original study, thus their conclusions are limited to the comparison of a balanced (modSocCom) and an unbalanced (modNonCom) condition thus having a similar technical problem like in our original study. Therefore we have only indirect evidence that balanced social cuing in the modSocCom condition eliminates the robust A-not-B error of SocCom condition whereas there is no similar difference between the balanced NonCom condition and the unbalanced modNonCom conditions. This provides some evidence that the unbalancedness of the cuing between A and B location is not sufficient for triggering perseverative search at the A barrier. Instead, the factor what matters is the communicative nature of the signals provided by the human.

Third we do not agree with the notion that the "unbalanced nature" of the social communicative hiding context is a methodological failure. In contrast, like in our infant study[9], it was an important design feature of our procedure. Regarding Topal et al[9] Marshall-Pescini et al. mistakenly claim that *"procedures followed with human infants, did not differentially enhance the two locations"* in the SocCom condition. In fact, the experimenter employed strong ostensive-communicative signals adjacent to A location during the A trials and she also used social cues in the B trials to attract infants' attention at the starting position (adjacent to A location) but she recalled the infants' attention using non-social noise effects adjacent to B location. This procedure was specifically designed to test the prediction that perseverative search bias can be triggered by differential communicative cuing of the two hiding locations in infants and the error is not simply a matter of attention. Admittedly, in our dog study the cuing procedure in the SocCom condition was more unbalanced because the experimenter did not recall the dogs' attention using any conspicuous noise.

We, therefore, conducted an experiment in which naïve dogs participated in one of the two novel versions of SocCom condition of Topál et al.[1].

In the $SocCom^{A}$-$Sound^{B}$ condition cuing procedure corresponded to that of the infant study[9]; strong communicative cues adjacent to A barrier ($SocCom^{A}$) in both A and B trials and conspicuous non-social sound signals before hiding the object behind B barrier in the B trials ($Sound^{B}$). That is in the B trials, before hiding the toy at B, the experimenter recalled the dog's attention by squeezing the toy (with her back turned toward the dog).
In the $Sound^{A}$-$Sound^{B}$ condition dogs participated in the very same procedure as in the $SocCom^{A}$-$Sound^{B}$ except for that during the B trials experimenter used the same non-social cuing at location A and B. Results show that in contrast to the non-social sound stimuli by which the experimenter recalled the dogs' attention before hiding the toy behind screen B and thus made the B location salient, dogs performed below the success rate expected by random search ($SocCom^{A}$-$Sound^{B}$, correct choices: 29.3%, $t_{15} = -2.248$, $P = 0.04$). If, however, after social-communicative A trials the experimenter enhanced both A and B locations equally, dogs selected randomly ($Sound^{A}$-$Sound^{B}$, correct choices: 50%, $t_{15} = 0.0$, $P = 1.0$) (see Fig.1). This finding provides further support for the notion that social and non-social cues are not equally effective in inducing A-not-B error in dogs.
Therefore we persist in our view that what matters is not the mere amount, but the informational selectivity of attention. That is, dogs might have extracted different kinds of information to be learnt from the communicative versus non-communicative demonstrations and this is modulated by social cognitive processes. Nevertheless, we agree with both Fiset and Marshall-Pescini et al. that attentional processes are involved in such object search tasks and local enhancement learning may also influence performance.

Although social hiding context represents more complex and attentionally more demanding situation, we conceive attention and local enhancement not as an alternative to social cognition but as processes by means of which social cognitive phenomena, like susceptibility to communicative signals, are implemented. Dogs' behavior in the A-not-B error task probably driven by a combination of factors, including sensitivity toward human ostensive signals.

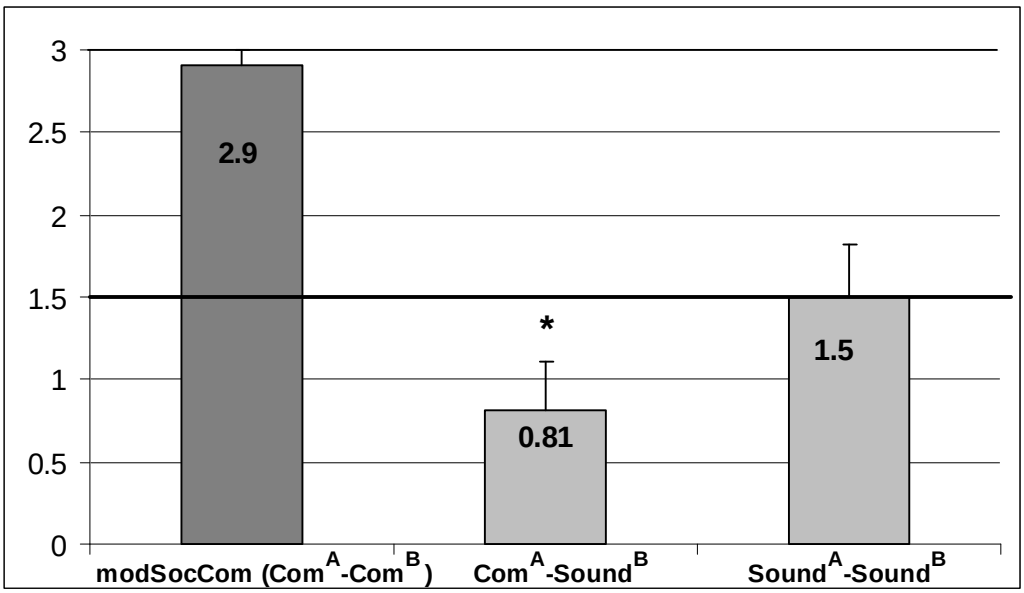

***Figure** 1. Scores of correct responses (mean + SE) in the B-trials in the modified versions of the social communicative condition. After the experimenter had repeatedly hidden the toy using ostensive communicative signals in the A-trials, she enhanced both barriers($^{A, B}$) in the B trials by using either the same communicative (Com) or non-social sound signals (Sound). Different cuing pattern leads to significantly different search response providing evidence for the differential role of ostensive and non-ostensive signals in inducing A-not-B error. Dogs selected the baited B location in the balanced communicative cuing (Com^A-Com^B) condition (data from Marshal-Pescini et al. comment) whereas they showed random search in the balanced non-social cuing context (Sound^A-Sound^B, n = 16) and significant search bias toward the empty A location if the experimenter enhanced the A location communicatively and then recalled the dogs' attention by squeezing the toy prior to hiding in B location (Com^A-Sound^B, n = 16). *: P < 0.05*

References

1. J. Topál, G. Gergely, Á. Erdőhegyi, G. Csibra, Á. Miklósi, *Science* **325,** 1269 (2009).

2. S. Gagnon, F. Y. Dore, *.J Comp. Psychol.* **108**, 220 (1994).

3. S. Gagnon, F. Y. Dore, *J. Comp. Psychol.* **106**, 58 (1992).

4. F. Range, L. Horn, T. Bugnyar, G. K. Gajdon, L. Huber, *Anim. Cogn.* **12,** 181 (2009).

5. Á. Miklósi, E. Kubinyi, J. Topál, M. Gácsi, Zs. Virányi, V. Csányi, *Curr. Biol.* **13,** 763 (2003).
6. Zs. Virányi, M. Gácsi, E. Kubinyi, J. Topál, B. Belényi, D. Ujfalussy, Á. Miklósi, *Anim. Cogn.* **11,** 373 (2008).
7. M. Gácsi, B. Győri, Zs. Virányi, E. Kubinyi, F. Range, B.Belényi, Á. Miklósi, *Plos One* **4,** e6584 (2009).
8. M. Gácsi, B. Győri, Á. Miklósi, Zs. Virányi, E. Kubinyi, J. Topál, V. Csányi, *Dev. Psychobiol.* **47,** 111 (2005).
9. J. Topál, G. Gergely, Á. Miklósi, Á. Erdőhegyi, G. Csibra, *Science* **321,** 1831 (2008).
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