Thus, while the results cited by M&S may show that reasoning is not well adapted for individual intellectual inquiry (which, as M&S rightly stress, we find very hard), they do not show that it is not adapted to other roles in individual cognition, broadly construed. Of course, as M&S note, motivated reasoning and reason-based choice often have unwelcome consequences (especially, perhaps, in modern technological societies), but, if anything, this tends to support the present suggestion, since the more functions these biases have, the more gains there are to offset the costs.

Reasoning as deliberative in function but dialogic in structure and origin

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Abstract: Mercier and Sperber (M&S) claim that the main function of reasoning is to generate support for conclusions derived unconsciously. An alternative account holds that reasoning has a deliberative function even though it is an internalized analogue of public discourse. We sketch this alternative and compare it with M&S's in the light of the empirical phenomena they discuss.

Mercier and Sperber (M&S) argue that the function of reasoning is *argumentative*: "It is to devise and evaluate arguments intended to persuade" (see their abstract). This contrasts with a more familiar *deliberative* view of reasoning, which holds that the function of reasoning is to draw new conclusions and form new beliefs. Reasoning within that more familiar view is then seen as a special kind of *inference*, perhaps one with a distinctive relationship to consciousness and the rational faculties of the whole agent. Such views also tend to be individualistic; they hold that the psychology of reasoning has no special relation to social life.

M&S do allow that sometimes reasoning leads to new conclusions on practical and theoretical matters being drawn by the reasoner, conclusions that can be put to use in guiding action. But this is an incidental by-product of reasoning's main function, where "function" is understood in evolutionary terms.

There is also a third option, however, one drawing on the views of the Russian psychologist Lev Vygotsky (1986). On this view, reasoning is deliberative in function but dialogic in structure (Yegnashankaran 2010). Reasoning is an internalized analogue of interpersonal discourse. Interpersonal discourse itself might be typically a complicated mix of attempts to persuade, attempts to think things through and form new conclusions, and other activities, but what results in our psychology is a tool whose function is primarily deliberative. We do not think that this view is clearly superior to M&S's, but we do think it is an important option to have on the table when considering the evolution of reasoning and the opposition between deliberative and argumentative views.

Once we have the contrast between M&S's view and the Vygotskian version of the deliberative view in mind, the message of the empirical evidence is less clear. M&S say that, on their view, "reasoning should produce its best results when used in argumentative contexts, most notably in group discussions" (sect. 1.2, para. 11). This, they say, is what we actually find. But if the aim of reasoning is to help in persuasion, one would think that a context of dialogue would promote more and more agile deployment of justifications for whatever each agent antecedently believes, not a willingness to respond to others' arguments by changing one's mind. M&S see people as poor individual reasoners but "skilled arguers," where skilled arguers "are not after the truth but after arguments supporting

their views" (see their abstract). But that picture is at tension with the fact that people interacting in groups are, as M&S accept, quite *good* at finding the truth by exchanging ideas, and not merely at buttressing their own positions. And on the M&S view as we understand it, any similarity between changes of mind induced by the social exchange of ideas and changes of mind induced by private reflection is incidental.

On the other side, some forms of confirmation bias do fit better with M&S's view. On a Vygotskian deliberative view, an agent has no good reason to prefer a search for confirmation of a hypothesis they are inclined to believe, to a search for disconfirmation of the hypothesis. On M&S's view, this tendency does make sense.

Finally, we suggest that M&S may underestimate the adaptive value of the directions agents may be in led by conscious reasoning. For example, they discuss an experiment where individuals are asked to choose between a small heart-shaped chocolate and a larger chocolate shaped like a roach. Most individuals chose the roach-shaped one, because making the other choice would be harder to rationally justify. M&S say that "in the light of the results from the psychology of disgust ..., we can tell that their choice was certainly the wrong one" (sect. 5.3.4, para. 2). But if an analogue of this chocolate choice was faced in an evolutionary setting, a reasoner would win out.

Understanding, evaluating, and producing arguments: Training is necessary for reasoning skills

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Abstract: This commentary suggests that the general population has much less reasoning skill than is claimed by Mercier & Sperber (M&S). In particular, many studies suggest that the skills of understanding, evaluating, and producing arguments are generally poor in the population of people who have not had specific training.

The target article by Mercier & Sperber (M&S) offers several arguments for their Reasoning is Argumentation hypothesis – that the primary function of reasoning in human beings is to evaluate and produce arguments intended to persuade. While I believe that the Reasoning is Argumentation hypothesis is interesting and should be explored, my comments focus on one specific claim M&S make.

To show that the predictions of their hypothesis are borne out, M&S point to multiple psychological studies that purport to demonstrate that people are generally able to reason well. In this context, reasoning well consists in being able to understand, evaluate, and produce arguments. In particular, M&S claim that studies show that (1) people are good at evaluating both subarguments and overall arguments, and (2) people can generally produce good arguments in a debatelike setting.

In fact, the experimental evidence from a variety of studies, including surprisingly many that are cited favorably by M&S, suggests that people do not have these particular skills. One general challenge in extracting broader lessons from experimental data is that the skills of understanding, evaluating, and producing arguments are vaguely defined in the literature in general, and the target article is no exception. There is a crucial distinction between argument content and argument structure that is ignored, and some studies focus solely on argument content, while others focus on argument structure. The extent to which either kind of study supports claims about participants' ability to reason well depends on this distinction in an important way.

The definition of an argument given by M&S is standard: A set of statements, one of which is the conclusion, which is supposed to be epistemically supported by the other statements, called the *premises*. The *content* of an argument refers to the propositions that are expressed by the premises and conclusion, whereas the *structure* of the argument refers to the way the premises work together to support the conclusion. Successfully understanding an argument consists in being able to identify both the content and the structure of the argument: the conclusion, the premises, and the particular way the premises support the conclusion (e.g., whether the premises are linked or convergent). Successfully evaluating an argument consists in being able to assess the content (i.e., determine whether the premises are true) and the structure (i.e., determine whether, assuming that they are true, the premises actually do support the conclusion). Finally, successfully constructing an argument consists in being able to supply true premises and specify how those premises work together to support the conclusion. Although structure and content are both relevant for all three activities, they are relevant in different ways, and so great care is required (but not always taken) in designing experimental tasks that appropriately test them.

Problematic empirical evidence arises for all three: argument understanding, argument evaluation, and argument production. For the first process, there actually seems to be scant research in the area of argument understanding. The little research that does exist in this area is mixed. Some studies (e.g., Ricco 2003, cited by M&S) suggest that for simple arguments, adults can, when prompted, differentiate between linked and convergent arguments. Other studies, however, suggest that, even for simple arguments, untrained college students can identify the conclusion but without prompting are poor at both identifying the premises and how the premises support the conclusion (Harrell 2006; 2008; 2011).

Second, argument evaluation is usually loosely, and only implicitly, defined as being able either to identify reasoning fallacies or to differentiate reasonable arguments from unreasonable ones. The research on argument evaluation seems mixed, at best. In particular, a number of systematic biases have been found. When witnessing an argument from the outside, participants' judgment of the burden of proof depends on who speaks first (Bailenson & Rips 1996, cited by M&S), and participants routinely mistake innocuous repetition for circularity (Rips 2002, cited by M&S). When participating in an argument themselves, participants tend to reason less well than when witnessing an argument (Neuman et al. 2006; Thompson et al. 2005b; both cited by M&S).

Finally, in many of these studies, the perception by the researchers that participants were able to "build complex arguments" (sect. 2.2, para. 3) is vague or ambiguous. Producing an argument is importantly different from, for example, mere fact gathering, but the research focuses almost exclusively on nothing more complex than the listing of reasons to believe. Even for this simple kind of argument production, studies suggest that both low- and high-cognitive-ability participants have difficulty producing evidence for a claim (Sá et al. 2005, cited by M&S).

Contrary to the claims by M&S, a wide literature supports the contention that the particular skills of understanding, evaluating, and producing arguments are generally poor in the population of people who have not had specific training and that specific training is what improves these skills. Some studies, for example, show that students perform significantly better on reasoning tasks only when they have learned to identify premises and conclusions (Shaw 1996, cited by M&S) or have learned some standard argumentation norms (Weinstock et al. 2004, cited by M&S). M&S may be correct that some of these negative results arise because the stakes are too low, but many studies that show improvements from specific training occur in high-stakes environments like a college course (Harrell 2011; Twardy 2004; van Gelder 2005; van Gelder et al. 2004). This suggests that difficulty with understanding, evaluating, and producing arguments may be a deeper feature of our cognition.

The argumentative theory of reasoning applies to scientists and philosophers, too

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Abstract: Logical consistency demands that Mercier and Sperber's (M&S's) argumentative theory of reasoning apply to their own reasoning in the target article. Although they hint that their argument applies to professional reasoners such as scientists and philosophers, they do not develop this idea. In this commentary, I discuss the applicability of argumentative theory to science and philosophy, emphasizing the perils of moral reasoning.

Mercier and Sperber (M&S) argue that the primary evolved function of reasoning is persuasive argumentation. If the primary function of any evolved trait – including reasoning ability – is the same for all members of a species, then it follows that professional reasoners (including scientists and philosophers) are primarily in the business of persuasive argumentation. Furthermore, if M&S's dual-process model of reasoning is accurate, professional reasoners initially arrive at their conclusions by intuitive leaps and only later construct logical arguments to convince others of these conclusions. The notion that scientists and philosophers are more concerned with persuading others that something is true than with discovering truth contradicts the image of scientists and philosophers as dispassionate truth-seekers. This response to M&S's target article aims to develop this subversive implication of their argument.

That M&S's argumentative theory applies to their own reasoning is necessary if their theory is to be consistent. To suggest otherwise is to commit what Little (1972) called the *nonreflexive fallacy*. Yet M&S spend virtually the entire article discussing studies of nonscientists and nonphilosophers, with just the briefest mention of how their theory might apply to professional reasoners. One exception is a reference to reviewers of scientific manuscripts who look for flaws in papers to justify rejection when they do not agree with a paper's conclusion. They also remark near the end of their article that even among scientists the ability to control one's own biases is "uncommon" and "almost freakish" (sect. 6, para. 7).

Perhaps the dearth of examples of professional-reasoning-qua-argumentation is due to space limitations. Or, perhaps there is little empirical research on this topic. Or, perhaps other professional reasoners will not find the theory as congenial as M&S suggest in their concluding sentence. After all, it could be somewhat demeaning to see one's professional activity (reasoning) as equivalent to ordinary squabbling over whether my favorite sports team is better than your favorite sports team. Whereas Little (1972) aims to elevate ordinary people to the status of scientists, M&S appear to be challenging the status of scientists and philosophers as elite thinkers. To suggest that "[s]killed arguers, however, are not after the truth but after arguments supporting their views" (see the M&S abstract) is to challenge the idea that scientists and philosophers are motivated in an unbiased way by pure curiosity about what is true.

I believe that we professional reasoners should accept M&S's humbling view of our activities because it is an accurate description of reality. Yes, we are interested in truth, but we relish the thought of convincing others that we have discovered important truths. I must confess that the M&S thesis was immediately congenial to me because it affirms my own long-held beliefs about how professional reasoners such as scientists and moral philosophers go about their work (Johnson et al. 1988). Observations of the actual behavior of scientific researchers indicate that textbook descriptions of science are highly inaccurate. Scientists do not begin with a thorough set of dispassionate observations about