Commentary

The logical status of applied geographical reasoning

DRAGOS SIMANDAN

*Geography Department, Brock University, 500 Glenridge Avenue, St Catharines, Ontario,
Canada L2S 3A1*
E-mail: simandan@brocku.ca

This commentary is an invitation addressed to policy-oriented human and physical geographers to consider, from a strictly logical point of view, the way that reasoning works in applied geographical thought. The promise hidden in this somewhat unfashionable return to logic is twofold. First, by traversing the distance between our discipline and formal logic we may harvest the reward of a *more rigorous* understanding of the daily work that we do as policy-oriented geographers than that provided by the earlier scholarship on geography as practice (Dewsbury and Naylor 2002; Lorimer 2003). Second, the arid land of logic offers a novel entry point into answering the formidably difficult question of whether there is any common ground left between applied human geography and applied physical geography (Gatrell and Jensen 2009; Massey 1999; Richards 2003; Bracken and Oughton 2006; Couper 2007; Matthews and Herbert 2004).

To be sure, previous scholarship has questioned the operation of logic and reason in geography from a variety of standpoints. These include physical geography (Inkpen 2004; Gregory KJ *et al*. 2002), positivistic human geography (Bunge 1966; Harvey 1969; Gould 1999), humanistic geography (Buttimer 1993; Adams *et al*. 2001), non-representational theory (Thrift 2008; Anderson and Harrison 2010; Pile 2010), postmodern and poststructuralist geographies (Soja 1989; Doel 1999; Ley 2003), feminist geographies (Rose 1993; Whatmore 2002; Pratt 2004), as well as a neglected work that stands in a class of its own (Olsson 1975). Part of the value of applied geography is assumed to consist in its unique way of thinking about reality, or, in other words, in the existence of a geographical way of reasoning (Johnston and Sidaway 2004; Gregory *et al*. 2002; Aitken and Valentine 2006; Gatrell and Jensen 2009). Taking this assumption as given, there remains the further task of specifying and characteris-

ing the properties of this type of reasoning. Some may start by invoking the set of concepts that guide applied geographers' inferring of knowledge about the world (e.g. distance, space, place, territory, landscape, scale, environment, locale, site). According to this view (Holloway *et al*. 2008) what makes policy-oriented geographical reasoning geographic is the active use of key geographical concepts. The advantage of this position resides in the fact that it brings out in a sufficiently vivid manner what separates applied geography from other related practical disciplines. The disadvantage comes from the fact that, by focusing on substantive semantic issues, this position foregoes the opportunity of characterising applied geographical reasoning in formal terms, *qua* reasoning (Harman 2008). That is, it sidesteps the epistemically useful exercise of trying to clarify the *logical* status of policy-oriented geographical reasoning.

Logic is the formal study of reasoning. Many scholars equate it with deduction, but deduction is only one of the subfields of logic (Kosko 1993; Shapiro 2007). The study of deduction, however, is useful for understanding what applied geographical reasoning is not (Rips 2008). The shortest path to this goal involves, first, the specification of one of the key properties of deductive logic and, second, the explanation of why applied geographical reasoning fails to have this property. A system of reasoning is said to have the property of monotonicity if the addition of new information to the premises of a valid argument cannot modify the conclusions already drawn in that argument. Monotonicity is the hallmark of deduction and explains both its success and its failure (Rips 2008). Its success and appeal come from the certainty guaranteed by a deductive argument: we live in a changing, uncertain world, and being able to point to a system of reasoning that seems to shelter us from this frightening uncertainty seems reassuring. Beliefs set in stone by

deductive inference act as anchors on which one can rely forever. Or so it seems. The failure of deduction comes precisely from this false sense of certainty (Harman 2008). Reasoning must be reasoning about something, and that something is usually some aspect of the material world. Since the material world – by opposition to the abstract world of mathematics (Shapiro 2007) – is a non-stationary, ever-changing environment, it follows that any system of reasoning that would help us navigate reality must at the minimum be able to cope with this perpetual change (Rescher 1996; Abbott 2001). Change in the world should imply change in our beliefs about the world and deduction is not up to this fundamentally adaptive task of belief revision (Rott 2008). It is for this reason that logic has moved beyond deduction to elaborate systems of reasoning that are non-monotonic, that is, that are sensitive to the addition of new information. Nicholas Rescher (2009, 148) offers a banal example of non-monotonic reasoning from everyday life that will help the readers grasp just what non-monotonicity is all about. Suppose that, in trying to answer the question 'What will John do during the trip?' the following four data points become successively available:

1 He loves doing crosswords.
2 He loves reading mysteries even more.
3 He didn't take any books along.
4 One of his fellow passengers lends him a book.

Commenting on the 'to and fro' change in our conclusions imposed by this sequence, Rescher notes:

> Such situations are called nonmonotonic because additional knowledge always has the potential of constraining a change of mind – rather than merely providing additional substantiation for a fixed result. We have no assurance that further information produces a closer approximation to the truth.
>
> Rescher (2009, 149)

The central distinction in logic has become that between monotonic (i.e. deduction) and non-monotonic logics (Pollock 2008). The single most important statement that can be made with regard to the logical status of applied (human and physical) geographical reasoning is that it belongs to the class of non-monotonic reasoning[1]. In other words, policy-oriented geographical reasoning is defeasible (i.e. earlier drawn conclusions can be defeated by the addition of new facts, some of which are generated by the very application of our ideas outside academe) and non-demonstrative (i.e. our beliefs about reality cannot be demonstrated once and for ever; we must do with building provisional arguments based on the current weight of the evidence, which itself changes with the times; Pollock 2008). Indeed, unlike mathematics, which is a closed world of formalisms that relies heavily on deduction, demonstration, and proof (Shapiro 2007), applied geography studies and attempts to improve the real, messy world out there. Because that wild, unruly world is always in a process of becoming (Rescher 1996), the conclusions drawn yesterday may have to be abandoned today, and so on, without end in sight. The core virtue of policy-oriented geographical reasoning is not certainty, but adaptability. As the world changes, so do applied geography's entertained beliefs about how to improve it.

The point we are trying to make is that an alternative window into the nature of applied geographical reasoning, besides the one provided by the discipline's key concepts, offers an opening toward the more subtle problematic of the *mechanisms* by which the updating of geographical beliefs[2] operate. We change our minds in applied geography precisely because we do not think deductively. But to say that is not to say much, because negation is always epistemically cheaper than assertion (Lipton 2004). Once understood that applied geographical reasoning is non-monotonic, two types of conceptual work need to be undertaken in order to give substance to this elementary statement. The first is descriptive: astute observation with large enough samples can lead, in time, to a better diagnosis of the patterns of reasoning by which applied geographers reach and abandon their conclusions and their practical advice. The second is normative and prescriptive. Non-monotonic reasoning, just like its monotonic counterpart, can be rigorous or sloppy (Pollock 2008). The rules for valid syllogistic inference have their counterpart in the rules for well formed non-monotonic inference. If the central problematic of deduction is what follows from what, the central problematic of non-monotonic reasoning is what counts as evidence for what. There are several competing ways to answer this problem, ranging from explanationism (Lipton 2004; White 2005), to Bayesianism (Oaksford and Chater 2009), and to error statistics (Mayo 1996; Mayo and Spanos 2006). Each of these approaches is a constellation of epistemic gains and epistemic losses, but this only underscores the necessity of a substantive engagement of policy-oriented geographers in these debates (e.g. Simandan 2011). The aim is not to settle the debate over the best system of non-monotonic reasoning, but to learn from our immersion in the debate how to update our beliefs and strategies for producing applied work in the most epistemically profitable way. Since all the research clusters within applied geography share a concern with the material world and its betterment, they should also share an interest in learning how to improve their non-monotonic reasoning, regardless of whether it is focused on rivers, mountains and wildlife, or on populations, economies, and urban life. Non-monotonic reasoning constitutes a previously unrecognised common ground that policy-oriented human *and* physical geographers can now begin to explore together.

Notes

1 We are not rejecting the use of deduction *by* applied geographers as a form of reasoning (cf. Barnes 2006). Instead, we are saying that deduction cannot be a *geographical* form of reasoning. The difference between the two formulations is subtle, but significant.

2 Geographical beliefs are defined broadly, so as to include beliefs about the real world out there (Geography with a capital G), 'imaginative geographies' (Gregory 1994), as well as beliefs about the relative merits and demerits of competing theories and schools of thought in geography (geography with a lowercase g; e.g. Aitken and Valentine 2006).

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