Highway spotters and traffic controllers: further reflections on complexity

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Norman’s essay on ‘Chaos, complexity and complicatedness’¹ in this issue of Medical Education offers an eloquent description of the reductionist position in medical education. The author’s argument is articulate and provides an impressive set of elaborations and clarifications regarding several scientific concepts that I² and others³,⁴ have invoked in recent discussions on the epistemologies of medical education research. The examples of research cited in the essay¹ are indeed convincing evidence of the areas in which the reductionist model is particularly strong for evolving theory and transferable laws.

However, it is not clear that the line of argument in the essay¹ really addresses the underlying concerns raised by the original papers²–⁴. In fact, in an important sense, the argument is premised on a dichotomy that embodies the very issue those papers were trying to problematise. Early in his essay, Norman asks: ‘Are things in education really too complex and chaotic to yield to meaningful description...?’¹ His question illustrates a dichotomy that appears to take for granted the idea that a description must be simple or it cannot be meaningful. This dichotomy is a recurrent theme throughout the paper: ‘Many physical and biological phenomena are very complicated, but this does not imply that they defy understanding’ and ‘Yet no-one is suggesting we abandon medical research because the human body is just too darn complex to ever be understood.’¹ I believe this construction of the issue misrepresents (again, one might argue, embodies) the point the original papers²–⁴ were trying to address: that is, the issue raised by those papers²–⁴ is not about the possibility that things in education are too complex to yield meaningful description. Rather, it is about the likelihood that there are many places in education where things are too complex for simple descriptions to be particularly meaningful. The challenge put forward in those papers²–⁴, therefore, was not to stop trying for meaningful description because things are too complex, but, rather, to try for more meaningful description by representing the complexity well.

Although Norman¹ advisedly calls for a cautious and judicious use of analogy – and seems to suggest that his own story of traffic patterns on a highway is a silly analogy for education – nonetheless it may be that the traffic example offered is a useful way of illustrating and elaborating on the issue. It is almost certainly true that systematic observation of the traffic flow at a single spot on a highway would lead to a good description of the phenomenon at that particular spot. It is also likely to be true that carefully designed interventions (such as cutting the speed limit by 40%) would show excellent experimenter control over, expand the understanding of and perhaps even improve traffic flow at that particular spot. Moreover, the findings that arise from such studies might very well be meaningfully transferred to other spots on this and other highways because they represent a set of simple universal laws governing traffic flow at a single spot on a highway. However, if one were to try to understand and improve traffic patterns in a city, the value of these findings might require additional consideration.

For example, ‘improving’ flow at that spot by lowering the speed limit of the highway would probably have implications for all other local routes. If traffic speed is slowed on a particular highway by 40%, commuters are likely to begin to avoid this route, thereby potentially overloading other local roads and hurting the overall traffic flow in
Applying the same intervention to all roads in the local area might very well cause more rather than fewer traffic snarls because, if all cars travel more slowly, more cars will be on the road at any given moment. In short, the effort to intervene in a system using simple linear laws that describe isolated phenomena within that system may very well have paradoxical effects on the larger system that could never be anticipated by the laws governing the local phenomenon.

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The traffic disruption described above, however, would probably represent a short-term effect. Over time commuters would continue to adapt and would find new and more efficient routes for themselves or leave at different times of day. Thus, reasonably quickly, the overall system will effectively accommodate the problematic local intervention and, across the city, overall commute times will largely remain as they were prior to the intervention. To use an eerily familiar refrain, commuters will efficiently get where they need to despite us, not because of us. Meanwhile, ironically, the instigator of the intervention will very likely celebrate the local improvement and speculate on its importance in improving the system he is trying to affect, while conjecturing that, because there are so many factors and variables at play in commuting, the positive effect of his intervention on the larger system may not be visible.

It is true that there is danger in pushing analogies too far. And this example, like the larger discussion, is not intended to imply the lack of any value of experimental methods in educational research. It is not even intended to suggest there is no value in reductionism in educational research. Its intent is to point out where there might be limits and blind spots if we hold to the premises of reductionism too tightly and apply them too broadly. In his essay, Norman states: ‘Both complexity and chaos are descriptions of phenomena, not prescriptions of methods.’ I could not agree more and would further suggest that this discussion should be about descriptions of phenomena rather than prescriptions of methods. Norman also suggests: ‘If you want to claim that the unexplained variance is evidence of ‘something else’, it is up to you to figure out what that something else is. To date, exhortations to treat the world of education as complex or chaotic have been bereft of any strategy to explore such complexity.’ Again, I agree that figuring out ‘what that something else is’ is exactly the enterprise. What the traffic analogy above highlights is the possibility that this may require something beyond simple linear descriptions of the isolated parts of a complex interactive system. And while I am not sure I agree that there are no strategies or methods to explore such complexity in our field, it certainly seems unlikely that we will find any if we stand firm on the exclusivity of any one set of strategies and methods.

It would be unfortunate and disappointing if the growing call for representing complexity well were to be broadly interpreted merely as an indictment of a particular research methodology. The papers Norman references do not represent a call to cease the use of experimental methodologies and statistical analyses. Rather, they deliver a call to cease the misuse of such methodologies, a plea to stop linking them inextricably with the reductionist paradigm and an entreaty to avoid presuming that this methodological or epistemological pairing constitutes the exclusive paradigm of good science in our field.

REFERENCES