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On the porosity of subject and object in ‘mindfulness’ scientific study: challenges to ‘scientific’ construction, operationalization and measurement of mindfulness

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Mindfulness, derived from Buddhist psychology and philosophy, has gained broad popularity in the last decades, due importantly to scientific interest and findings. Yet Buddhist mindfulness developed in Asian pre-scientific culture and religion, and is predicated upon long-term cultivation of introspective awareness of lived experience, not highly accessible to empirical study. Further complicating the ‘science’ of mindfulness, mindfulness’s very definition is multifaceted, resistant to dismantling and requires substantial amounts of personal practice to gain expertise. Most scientists investigating mindfulness have not achieved a high level of this expertise. Here I address how mindfulness is currently being invented as a scientific fact or object of inquiry. The intrinsic porosity of subjective and objective factors influencing the investigation of mindfulness is highlighted: the evolving body of ‘scientific’ experts, instruments used to measure mindfulness, the alliances of funders and other supporters of mindfulness research, and the public representation of the related findings.

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The definition, operationalization and measurement of mindfulness in modern science are highly enmeshed in a web of complex historical, social, economic, political and technological factors. Fundamental and accepted scientific criteria are often cast aside in the process [1], [2,3]. This is exemplified by the massive proliferation of self-report mindfulness questionnaires in mindfulness research [4,5], despite the fact that they have been shown to have obvious and significant problems with validity and/or reliability in many studies (see later discussion). How otherwise to explain that basic and obvious

empirical evidence be so thoroughly discounted or ignored in the scientific invention of mindfulness? Because the evidence, by itself, seems unable to influence a major research focus on mindfulness, it seems insufficient to dwell on and recapitulate already established empirical facts merely about, say, measurement issues of mindfulness. Another more contextual analysis is plainly necessary.

Mindfulness programs and mindfulness as a multifaceted phenomenon have swept from ancient Asian shores into ‘Western’ healthcare, psychology, education, commerce and science. Notwithstanding, the very meaning of the word ‘mindfulness’ has remained elusive and open to interpretation, morphing into different dimensions in various contexts and settings [5,6,7]. Sometimes mindfulness is seen as a path to psychological wellbeing, to a new spirituality, to improved cognitive and brain functioning, to educating the young, to self-optimization, to enhanced longevity and physical health, to cultivating ethical values, to improving social relationships, to greater ecological awareness. You name it, and mindfulness can be defined, operationalized, and offered as a fresh, new promise for better living.

At the very same moment, we have entered a *Zeitgeist* in which central societal forces are increasingly at odds with the meaning and the value of science in our lives, and this exists both within and outside the scientific enterprise. There are those who believe science is THE primary approach, *prima facie*, to the understanding and sustaining of the universe and life forms and environment on earth (e.g. [8]). Others discount the importance of much science, pointing to the ever-changing landscape of scientific evidence, human cognitive biases, limitations, fallibilities and subjectivity that inherently reside in scientific inquiry [1,3,9,10]. Still others within the scientific community operate at or over the very boundaries of acceptable scientific methodology, with broad-scale behaviors occurring, such as p-hacking, selective and biased reporting of the literature, and violations of basic tenets of hypothesis testing and validity checks [3,9].

This tension has grown recently stronger as politics has entered the debate about what ‘fake news’ is and how widespread it exists. When we consider mindfulness within this background of current discourse—mindfulness with its huge and rapid popularity, with its origins in Eastern prescientific cultures as an approach to derive

'truths' about personal lived experience, a phenomenon so infused with very individual and subjective processes and far away from what we think of as hard physical facts—it may be particularly challenging to put mindfulness under the microscope of scientific investigation—using tools largely borrowed from the natural sciences—regarding how we might study, measure and define it.

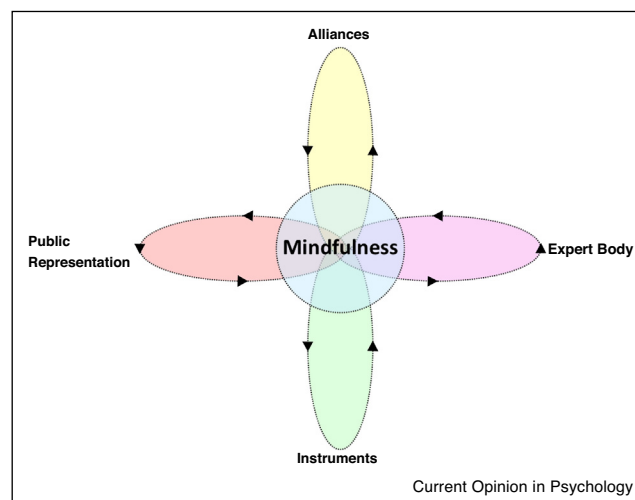
So what happens as mindfulness enters the central purview of science? What are the current forces in society and science that are forming our understanding of mindfulness as an object of science? How sound is the current scientific investigation of mindfulness, in general? Given the vagueness regarding definition of mindfulness, which characterizations seem to be gaining ground in science? What is the tension between the science of mindfulness and the practice of mindfulness?

To facilitate this discussion, modification of a conceptual model of Bruno Latour [10] will be used. Latour has been interested in how natural phenomena become established scientific entities or facts. Rather than assuming that empirical evidence or facts are simply revealed over time by perspicacious applications of 'objective' methodologies, he convincingly shows that humans contribute to the creation and construction of scientific facts via the intermingling of at least four interlinked circulating influences (Figure 1): 1) development of a unique body of experts who determine evidential criteria and entry into established platforms of scientific communication and

exchange (e.g. specialized societies, journals, scientific meetings, scientific review processes, and criteria for what constitutes evidence in a particular domain); 2) approaches to operationalization and measurement (e.g. how the object of study is defined and what measurement instruments are used); 3) alliances of sponsors of scientific investigation of the phenomenon, including funding institutes, supporting staff from the administrative to the custodial (e.g. governments, business interests or the military); 4) public representation and responses regarding the investigated phenomenon (e.g. what the public understand about the object of scientific interest, also their expectations, hopes, fears and reactions). This model of fixing and setting scientific fact and evidence lays bare the porosity of 'objective' and 'subjective' in the search for scientific knowledge. For example, it is human beings, within a particular biographical, historical and cultural context (i.e. with their own subjectivities) who consensually set criteria for empirical evidence, choose the parameters to be studied, and decide whether or not to support investigation. This is essential to remember, even with respect to the natural sciences, but perhaps especially so in the less material pursuits of contemplative disciplines or vast other domains of the social and behavioral sciences that primarily deal with covert, private and personal processes of lived experience (e.g. the study of grief, anxiety, depression or positive psychology).

Regarding 'mindfulness' as an object of scientific study, let us briefly first examine one of the above-mentioned

Figure 1



Categories of circulating and interdependent influences upon the scientific investigation and characterization of mindfulness as scientific object or fact (based on a model of Latour [10]). Members of the body of experts decide what constitutes scientific evidence, whether individual scientists are qualified to carry out research and publish research in a particular area, as well as who can join the formal and informal societies of experts. Instruments are those tools used to measure the phenomenon of focus. Alliances include all those who serve to support the investigation of mindfulness, for example funding institutions, developers of measurement instruments, but also the custodial and canteen personnel who make it possible for scientists to do their research. Lastly the public representation comprises all the information that reaches the public about mindfulness and its potential extent of effects upon different areas of life, whether accurate or inaccurate. Public representation also includes the public's responses to this new information.

influence—the experts, or gatekeepers of mindfulness in science. Who comprises the community of scientific mindfulness experts (societies, journals): Neuroscientists studying MBI's? Philosophers? Medical or psychotherapy researchers? Academicians with or without substantial prior experience with the practice or study of mindfulness and Buddhist psychology? Who has the upper hand to decide on what is valid evidence? What is the extent of expertise residing in this community of experts regarding the phenomena of interest (an expert in nuclear fission would be expected to have a long and specialized training in physics; is that analogously so with 'mindfulness experts')? Given the scientific mindfulness literature has exploded over the last ten years, where have all these mindfulness experts come from? What particular operationalizations and measurements of mindfulness do these 'experts' employ? To what extent do experts from different approaches to operationalization and measurement cooperate or compete? These are questions that must be carefully considered when examining and evaluating the empirical mindfulness literature.

Turning to the topic of measurement of mindfulness (instruments), at least 5 types of measurements have been used to assess the presence and extent of mindfulness—self-report questionnaires, (neuro-)physiological approaches (particularly brain scan parameters), qualitative methods based upon interviews, and observational and experimental measures. By far, the most prevalent current procedure assesses self-report of characteristics assumed to be associated with mindfulness, whether operationalized as self-assessed inattentiveness to daily experience [11], ability verbally to describe experience [12] or other qualities. These questionnaires ask respondents to determine the extent to which they believe themselves characterized by certain behaviors, attitudes or values that the questionnaire developers have attributed to be 'mindful'. There are numerous grounds that these self-report scales neither make sense nor are valid. 1) There is good reason to believe that respondents are not able accurately to evaluate themselves in this regard: the well known and replicated Dunning-Kruger cognitive bias shows that people are prone greatly to exaggerate their own abilities or knowledge [13]. 2) Self-reports and behavior often do not correspond, particularly about prosocial qualities [14,15,16]. 3) Inequivalence of semantic interpretations of questionnaire items (e.g. between respondents with versus without meditation experience) have led to absurd results in which binge-drinking students and heroine addicts score much more 'mindfully' than healthy controls or long-term mindfulness meditators [4,17,18,19,20]. 4) Actual mindfulness training programs or prior mindfulness meditation experience does not consistently reveal higher scores on these scales, for example [11,21–28]. 5) Even when scores do differ between MBI participants and controls, the effect sizes are typically modest [29,30,31*] (with often about 90%

overlap between mindful-trained and naïve individuals). 6) Important subscales of questionnaires have sometimes been shown, even by the scale developers themselves, to lack validity [32–36]. 7) What is actually operationalized and measured in the various questionnaires (and therefore the very meaning of mindfulness) can be very different from scale to scale, and popular scales frequently do not correlate highly with one-another [12,17,27]. Thus, for example, the MAAS measures perceptions of being inattentive; another includes a similar dimension as one of its five facets, but includes another, ability to verbally express oneself, that is found in no other questionnaire. 8) Expert mindfulness practitioners do not agree with less mindfully experienced developers of mindfulness scales regarding the definitions and scope of the questionnaire measures [25,37,38]. Together, these established critiques should prove sufficient, on Popperian scientific grounds [2], to dismiss the self-report literature, but self-report remains a leading contender in mindfulness research [4,5*].

Other approaches have begun to characterize mindfulness in more biological terms, often related to measurement of brain function and structure, for example that mindfulness practice results in specific forms of cortical and subcortical activity, alters brain circuitry and causes brain growth in particular regions [21]. Given the methodological limitation of the relevant studies [39], our very incipient understanding of the central nervous system, and the inherent problems of quantifying lived experience by means of physiological correlates [40], physiological characterizations of mindfulness processes are interesting but neither specific nor sufficient for assessing mindfulness. They remain preliminary insights.

Very differently, interviews of mindfulness practitioners or participants in mindfulness-based programs are employed qualitatively to estimate how lived experience is characterized by respondents as a consequence of cultivation of mindfulness [41,42]. Observational and experimental approaches may explore the degree to which participants attend to visual stimuli or cognitive stimuli, show acts of kindness, display emotional reactivity or exhibit different types of cognitive biases [43–46]. They reflect individual qualities that may be integral or related to mindfulness but are not necessarily specific to mindfulness.

Thus, the non-specificity of mindfulness measures, together with gestalt-like, multi-dimensionality of mindfulness definitions, which resist attempts at dismantling, present large challenges to measurement of 'mindfulness', as opposed to quantifying its constituent elements. Additionally, without consensus about precise descriptions of those constituent elements of mindfulness among researchers, measurement of mindfulness remains a quandary. Perhaps, we should be satisfied at least for

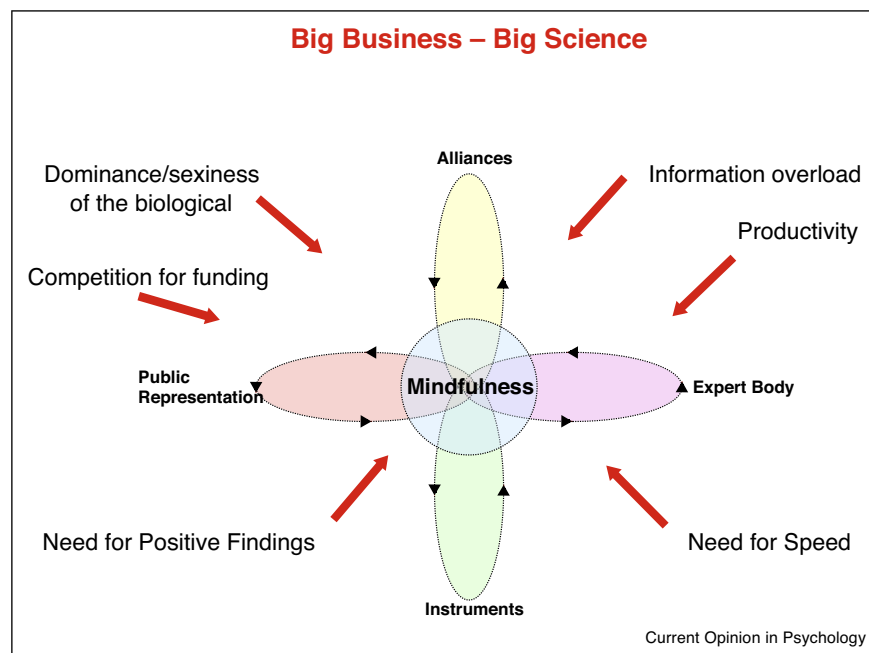
now, with aiming at those constituent elements of primary importance for individual investigations, describing them as what they are (e.g. inattentiveness, emotional reactivity, prosocial behavior, self-attributions, etc.), instead of as 'mindfulness' and leave mindfulness to the complex approach and practices hypothesized to influence those domains.

No empirical purview of any phenomenon would take place without allies willing to support the research and the researchers. Alliances of sponsors have, of course, their own agenda and interests when supporting research. Funders of mental health research will focus upon operationalizations of mindfulness that bear upon psychological characteristics, like emotional regulation or (non-)reactivity [47]. Funders of neuroscience will focus upon parameters of brain function and structure [21]. Military sponsors of mindfulness research may aim at measures of attention and concentration [45,48^{*}]. Institutes, like the NIH and NIMH, which may require researchers to assess the contribution of mechanism-oriented measures to major outcomes seem inclined to self-report indices of mindfulness, both cheap and fast to acquire. Whichever sponsors are most prominent in mindfulness research will sway the definition of mindfulness, what is measured and what research hypotheses are tested. This will inevitably have profound effects upon how we understand the

phenomenon from a 'scientific' perspective. And this understanding may diverge from or converge upon first-person understandings of mindfulness, that is does the lived experience of mindfulness practice coincide with one specific operationalization of mindfulness or another? The predominance of particular scientific definitions and measurements of mindfulness are most likely to be determined, at least at this phase of history, by the allies who supply the greatest amount of resources for investigations. Thus, if the US military is interested in a major way in funding mindfulness research, it is very likely that the general definition and measurement of mindfulness may be greatly influenced in certain directions.

When a phenomenon like mindfulness comes into scientific purview, it also becomes an object of public interest by virtue of its representation in the media and its employment for purposes that public perception may find meaningful. Whatever enters the public domain by scientists' and sponsors' efforts to communicate to the popular press and pundits changes the way people see and relate to the object. Limiting the scope of mindfulness to self-improvement (e.g. reduced anxiety, depression or emotional reactivity) or expanding it to benevolent awareness and action (e.g. toward environment and other animals) will have serious consequences not only for the

Figure 2



Categories of influences upon the scientific study of mindfulness embedded in a broad set of contemporary societal and scientific community determinants and imperatives. In the final analysis, the latter represent current societal pressures upon scientific investigation. A selection of a larger variety of categories of impact upon current scientific practice are indicated by the red arrows [3^{*},9]. These, in turn, are related to still wider political, economic and social forces prevalent, affecting all empirical investigation.

public representation but also for the presuppositions of scientists studying mindfulness, allies supporting its study and what actually gets measured. When exaggerated claims of benefit penetrate numerous areas of general concern (e.g. psychology, neuroscience, education, business and ecological areas) [5*], this may have transient or lasting effects upon how we view and comprehend not only mindfulness but also our lived experience (e.g. whether benevolent action or self-optimization is seen and experienced as a virtue).

It may, therefore, be helpful for scientists to become more intimately aware of the ‘links and knots’ tied amongst the very briefly described four major, circulating factors that drive the scientific discovery and invention of mindfulness (for a vivid example see [49]). These, of course, are woven into a tangible mindfulness fabric by looms built to the particular specifications of our current political and economic dictates of profit, productivity and self-interest (Figure 2); also see [3*]. We scientists are not immune to such motivations, even in the pursuit of mindfulness, somewhat ironically taken by Buddhism to serve an antidote to greed, aversion, and delusion. So let’s see where all this ‘science’ takes us.

Conflict of interest statement

Nothing declared.

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