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Editorial

Working with wicked problems in socio-ecological systems: Awareness, acceptance, and adaptation

As documented by C. West Churchman in a 1967 editorial for *Management Science*, the Berkeley design science professor Horst Rittel had identified a distinctive "class of social system problems which are ill-formulated, where the [available] information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing... [such that] proposed 'solutions' often turn out to be worse than the symptoms" (Churchman, 1967, p. B-141). Rittel called these "wicked problems," and foresaw that acknowledging their intractability and ubiquity would prompt a change in the ambitions and approaches of those charged to study and solve them.

This year marks the 40th anniversary of the publication of "*Dilemmas in a general theory of planning*" (1973), a seminal paper in which Rittel and fellow planning professor Melvin Webber formally presented the thesis that numerous problems in planning, management, and policy-making are by nature wicked, and stand in sharp contrast to the problems of engineering and sciences. They identified 10 properties typical of wicked problems, each of which can be seen as a consequence or a specific instance of at least one of the following five characteristics.

Indeterminacy in problem formulation—the precise formulation of a wicked problem as a problem with unique and determinate satisfaction conditions is virtually impossible because the values and interests of concerned and affected parties are diverse, often in conflict with one another, and change over time and across generations.

Non-definitiveness in problem solution—a rigorous and ultimate solution to a wicked problem with definitive results is unattainable because neither the problem nor the repercussions of its solution are determinate. The latter is best described by Rittel and Webber as "The full consequences [of a solution] cannot be appraised until the waves of repercussions have completely run out, and we have no way of tracing the waves through all the affected lives ahead of time or within a limited time span" (Rittel & Webber, 1973, p. 163).

Non-solubility—wicked problems can never be solved because of the first two characteristics. Unlike "tame problems" that are determinate with clear goal(s) and a definite set of well-defined rules (like those in mathematics, engineering, and chess), and are thus ultimately *soluble* (eliminable), wicked problems may be suppressed or even overcome, but cannot be eliminated. In different and often more wicked forms, they will recur. Therefore, "[a]t best they are only re-solved—over and over again" (Rittel & Webber, 1973, p.160).

Irreversible consequentiality—every implemented solution to a wicked problem is consequential, often triggering ripple effects throughout the entire socio-ecological system that are neither reversible, nor stoppable. Large scale ecological projects (e.g., greenways, parks, reservoirs, natural reserves, wild life habitats, and riparian buffers), public works projects (e.g., freeways, airports, dams, and subways), and implemented environmental policies (e.g., the Clean Air Act in the United States, and the Chinese national policy of cross-region water resources transfer—"Nan Shui Bei Diao") all "leave[s] 'traces' that cannot be undone" (Rittel & Webber, 1973, p.163).

Individual uniqueness—despite likely similarities among wicked problems, there always is one or more distinguishing property of overriding importance that makes an individual problem and its solution(s) essentially *one-of-a-kind*. There are therefore no classes of wicked problems, nor immediately transferable solutions.

Because of these characteristics, Rittel and Webber argued that wicked problems are innately resistant to any tame formulations of scientific analysis and linear protocols for professional practice, defying the conventional approaches and skill sets of planning, management, and policy-making. The inadequacy lies in the intellectual roots of these traditional approaches and skill sets. One common strategy underlying the scientific analysis and professional practice to "tame" wicked problems has been that of *divide and conquer* which "consists of 'carving off' a piece of the [wicked] problem and finding a rational and feasible solution to this piece" (Churchman, 1967, p. B-141). Such a partial solution, if ever attainable, not only leaves behind the rest of the wicked problem unanalyzed, but its implementation will also change the dynamics of the socio-ecological system in which the original problem resides, often precipitating a mutated wicked problem. As such, the best the academic and professional exercises employing these linear approaches and partial skill sets can accomplish is to implement the suggestions of partial analyses and to deceive people that the problem is solved, while "the beast [the wicked problem, that is] is still as wicked as ever" (Churchman, 1967, p. B-142).

Collectively, as the literature shows, Rittel, Webber, and Churchman had presented a persuasive case that calls for scholars, practitioners, stakeholders, and the general public to attend to the daunting social reality of wicked problems. Churchman in particular had also charged both the academic and professional communities with the moral responsibilities to raise a general

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awareness about wicked problems, commit to an honest acceptance of their intractability, and create innovative adaptation strategies and approaches to live with them (Churchman, 1967).

The past 40 years have witnessed a sustained and positive response to these calls for awareness, acceptance, and adaptation: the seeds of Rittel–Webber–Churchman's seminal ideas have been spread over on soils of diverse subject areas, germinated and grown. Today, using "wicked problems" as a key word, one can readily find hundreds of articles in areas concerning public administration, urban planning and design, policy analysis, health care and education, ecology, forest management, business administration, applied economics, environmental ethics, and engineering design, to list just a few. With substantive research and scholarship, there has clearly been a steadily rising awareness of wicked problems and an increasingly broad—yet often reluctant—acceptance of their intractability among scholars, practitioners, stakeholders, and the general public.

It is now widely recognized in the literature, for example, that in a socio-ecological system, *wickedness*, the ubiquity of wicked problems, is the norm, and present in almost every pressing issue area that matters to the human society today, such as global climate change, sustainability, stem cell research and usage, resource management, terrorism, and urbanization. As the socio-ecological system evolves, so do the wickedness and the issue areas where it appears. This does seem to lead to the speculation that there might be a conservation law (a term borrowed from physics) of wickedness in the socio-ecological system which states that wickedness (not necessarily individual wicked problems) co-evolves with the socio-ecological system—the beast will not extinguish but only change its appearance from one to another as the jungle succeeds. It is also noteworthy that the tone in which people describe their relationship with wicked problems has become progressively softer, from "tame," "deal with," "handle," "tackle," to even "work with" (Australian Public Service Commission, 2007, p. 11, 17, 35), "live with" (Norton, 2012, p. 460), and "embracing" (Raisio, 2010), reflecting a greater degree of acceptance of wicked problems as a sustained social reality that human society has to live with.

Another important yet still evolving consensus in the literature is germane to the social nature of working with wicked problems and adaptation strategies. Because wicked problems are in essence "expressions of diverse and conflicting values and interests" (Norton, 2012, p. 450), the process of working with them is fundamentally *social*, and should not be scientized in the conventional sense (Conklin & Weil, 2007). Instead of the partial and linear strategy of divide and conquer that aims at searching for definitive solutions, it requires a holistic and process oriented approach that is by nature *adaptive*, *participatory*, and *transdisciplinary* (APT for short). By examining a wicked problem as a whole through a panoramic social lens rather than a scientific microscope, and working with it through an open and heuristic process of collective learning, exploration, and experimentation, the APT approach promises to be efficacious in fostering collaborative behavior, reducing conflicts, building trust among all stakeholders and communities involved, and ultimately producing better and more satisfying results. With more empirical research and applications, a more developed APT approach, along with innovative methods and skill sets, will be a competent alternative to the traditional solution seeking approaches.

One intuitive metaphorical instrument of useful functionalities for the enterprise of working with wicked problems is a new and "wicked" version of the parable *Blind men and an elephant*. The fable has been effectively employed to demonstrate human cognitive limitations, substantiate the need for collective and participatory learning, celebrate diversity in opinions and perspectives, and champion transdisciplinarity. But the assumption that the object blind men touch—the problem they investigate—is as gentle and docile as an elephant becomes void in socio-ecological systems where wickedness is the norm, and the "beast[s]" (the wicked problems, that is) (Churchman, 1967, p. B-141) are "aggressive", "malignant", "vicious" (Rittel & Webber, 1973, p. 160), and untamable. In place of the elephant, a hippopotamus makes the fable more fitting. As gigantic and powerful as an elephant, a hippopotamus is known for being aggressive, untamable, and dangerous—each year in Africa, hippopotami reportedly hurt more people than any other animals (Frame & Frame, 1974; Straight Dope, 2000)—resembling many characteristics that Rittel, Webber, and Churchman described for "the beast." Therefore, a "wicked version" of the parable could be that of *Blind men and a hippopotamus* which, while retaining all the important and useful functionalities of the "tame version" aforesaid, serves as a more delicate instrument to facilitate various activities of working with wicked problems, especially those germane to the development and applications of the APT approach.

Table 1
Articles on wicked problems by continents.

Continent	Articles	Percentage
Africa	3	0.9
Asia	24	7.2
Europe	113	34.0
North America	135	40.7
Oceania	54	16.3
South America	3	0.9
Total	332	100

In spite of its many achievements, however, working with wicked problems is still an evolving and, to a large extent, emerging enterprise in a stage of enlightenment. Much of its research and scholarship, as substantive as it may seem, remains largely a repetitive description of the social reality of wickedness, rather than well-grounded theoretical explorations or empirical investigations. The focus has been placed upon raising awareness, preaching for acceptance, and advocating creative adaptation strategies and innovative approaches. But little has been reported on exactly *how* these ideas and proposed approaches, such as the aforementioned APT approach and its managerial version of "better knowledge, better consultation, and better use of third-party partners" (Head, 2008, p. 114), can be materialized on theoretical and/or empirical grounds. Aside from substance, the peer reviewed scholarly publications on wicked problems remain modest in quantity—our recent survey found a total of 332 cited papers on the Scopus database in the Elsevier Editorial System, and 162 on Web of Science. They are also geographically scattered, presenting a huge disparity across the world.

The literature survey conducted on the Scopus database reveals that the same level of awareness about wicked problems has not been reportedly found in other continents than Europe, North America, and Oceania (Table 1). Moreover, the institutions with which corresponding authors of the wicked problems papers are affiliated spread over 32 countries, but reside almost exclusively in the developed countries where English is a native language, mainly in the United States (114 out of 332 papers, 34%), the United Kingdom (59 papers, 17.8%), Australia (45 papers, 13.6%), and Canada (21 papers, 6.4%). Why is there such a geographical disparity? Could it be a result of language barrier? A survey on my native language Chinese literature found no scholarly discussions on the subject nor citations of Rittel–Webber–Churchman's works. Could it also be a reflection of the difference in developmental stages between developed and developing countries? Or does it simply suggest that in many parts of the world, people work with wicked problems without knowing it, and thus do not even bother writing it up?

So, in celebrating the 40th anniversary of the seminal paper, we see a steadily growing but still modest enterprise springing from Rittel–Webber–Churchman's intellectual heritage. Its underlying

"AAA" strategy, highlighting the three distinct yet interrelated key steps of *awareness*, *acceptance*, and *adaptation* in the process, provides a rich and enlightening framework that helps "muddling through" (Lindblom, 1959) the jungle of wicked problems. An awareness of wicked problems and acceptance of their intractability, for example, have already been, and will continue to be, enabling people to conscientiously give up the unrealistic hope for scientific solutions to tame the untamable so that they shift focus to the public process of working with wicked problems, and through action-based research, search for new and innovative solutions (Australian Public Service Commission, 2007; Batie, 2008; Conklin & Weil, 2007; Raisio, 2010).

Moreover, by accepting the fact that working with wicked problems is essentially a social process resembling that in *Blind men and a hippopotamus*, people enter "a rich world of process studies" (Norton, 2012, p.461), and become privileged to inquire into questions of epistemological, methodological, and ethical significance. Where does the wickedness in the socio-ecological systems come from? Why are some problems indeterminate and, therefore, wicked, but others not? What supports from the scientific communities does an APT approach require when applied to an AAA process of working with wicked problems? What are the incapacities and limitations inherent in the sciences that prevent their associated communities from effectively meeting these requirements, if at all? What would be the most productive way for scholars and practitioners to honestly communicate with the stakeholders, policy makers, and the general public about this daunting social reality and the inadequacies of sciences to support their adventure of working with it? Exploring these and other questions within the context of working with substantive real world problems that the human society faces today, such as those germane to global climate change adaptation and mitigation, urban and regional sustainability, urbanization, globalization, terrorism, and poverty, will help garner greater insights into these wicked problems and create more innovative ways to work with them.

As to the future for the enterprise of working with wicked problems, we acknowledge the fact that there are many hands on the same hippopotamus and see a critical need for building a "blind men community" of collective learning and exploration. Many people have been, and may well continue to be, working with wicked problems without knowing it or without calling it as such. There are ample examples for the latter case. Peter Hall's 1980 book *Great planning disasters* contains some classic examples of the characteristics of wicked problems without naming them so (Batty, 2012). Arrow's impossibility theorem (1951), Simon's bounded rationality (1955), Lindblom's science of muddling through (1959), Lee's requiem for large scale models (1973), Checkland's soft systems methodology (1985), and more recently, sustainability science, transdisciplinarity, adaptive management, street science (Corburn, 2005), scenario analysis, complex adaptive systems, big problems, dancing with systems (Meadows, 2005), and participatory planning are among theoretical and/or practical frameworks developed under the implicit assumption that the problems they deal with are wicked. An acknowledgment of these relevant works leads to the conviction that the future for the enterprise of working with wicked problems *should be* in the hands of a broader international and transdisciplinary community of many "blind men", including those who may not (yet) know what they touch or simply call it differently. An active and mindful engagement of all the blind men in this community of collective learning and exploration will not only contribute to a shared and better understanding of the hippopotamus, but also benefit the continuing growth and maturity of the enterprise of working with wicked problems. In the building of this international and transdisciplinary community, the journal *Landscape and Urban Planning* is willingly an active and committed participant (see the Announcement for a special issue on the topic in this issue).

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