

Editorial: The Four Waves: Then and Now

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ABSTRACT: An editorial on the ongoing debate of the four waves concept and the importance of moving systems thinking as a field toward an empirical standard. Editorials are the views of the author and do not represent the Journal's views.

Introduction

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DR. MIKE C. JACKSON commented recently on a number of my posts on social media (Facebook and LinkedIn). I normally do not debate in the comments in social media, not because I don't believe in the importance of debate, but because I don't think that the structure and culture of social media comment-threads are ideally suited for engaged, dispassionate, scientific debates. I said as much in my response to Dr. Jackson,

[I] rarely have time to engage in long-form debates on social media. I am happy to debate the matter but snikey, short-form, google-researched, social media isn't the place. That's why Gerald, Laura and I took the time to provide a thorough explanation in a published paper, which, as you know, you can respond to by publishing a response paper or I would be happy to arrange a formal public debate in which I'd love to hear the empirical basis for CST as I haven't found one that is commensurate with its longevity.

As I pointed out, there are established venues for debate in the scientific community. Namely, (1) through published response papers in academic journals or other long-form venues that allow for greater depth, and/or (2) through formal debates. I'm happy to engage in either of these with Dr. Jackson. Indeed, writing this short article is an attempt to do just that: to engage in a dispassionate dialogue about the science of systems thinking.

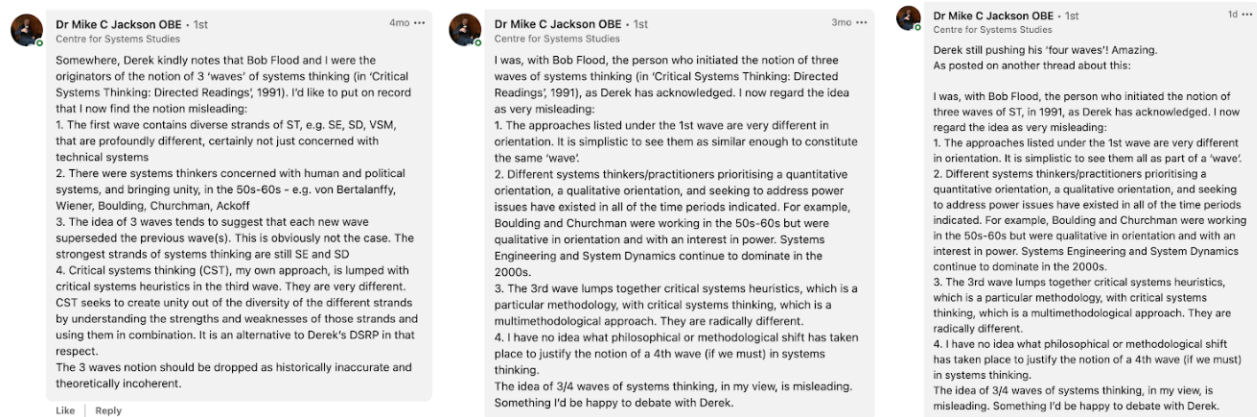
Background

LET ME PROVIDE some background to explain the context of this exchange. Dr. Jackson has taken to commenting on numerous posts with the same [mostly copied and pasted] critique despite the fact



that his critique was answered. In his recurring critique he uses language that might give the reader (unaware of previous posts) the idea that: (1) I have not replied, and/or (2) I have spurned debate. This is not the case. In fact, I was motivated to write this public, formal response to Dr. Jackson in the event that the pattern continues and no formal debate is arranged so that I can quickly post a link to this response and update other readers.

In order to set the stage for my responses further down, here are a few of Dr. Jackson's recent posts [noting the replicative nature].



Dr. Jackson's first post reads:

Dr. Jackson: Somewhere, Derek kindly notes that Bob Flood and I were the originators of the notion of 3 'waves' of systems thinking (in 'Critical Systems Thinking: Directed Readings', 1991). I'd like to put on record that I now find the notion misleading: (1) The first wave contains diverse strands of ST, e.g. SE, SD, VSM, that are profoundly different, certainly not just concerned with technical systems (2) There were systems thinkers concerned with human and political systems, and bringing unity, in the 50s-60s - e.g. von Bertalanffy, Wiener, Boulding, Churchman, Ackoff (3) The idea of 3 waves tends to suggest that each new wave superseded the previous waves). This is obviously not the case. The strongest strands of systems thinking are still SE and SD (4) Critical systems thinking (CST), my own approach, is lumped with critical systems heuristics in the third wave. They are very different. CST seeks to create unity out of the diversity of the different strands by understanding the strengths and weaknesses of those strands and using them in combination. It is an alternative to Derek's DSRP in that respect. The 3 waves notion should be dropped as historically inaccurate and theoretically incoherent.

To which I responded:

Derek Cabrera: Dr. Mike C Jackson OBE The points you make in your

post above have been addressed herein: [link to paper provided]¹

To which Dr. Jackson responded:

Dr. Jackson: Derek Cabrera Obviously, I have read that paper. It doesn't, in my view, answer any of the 4 points I made in my post. If you think it does, perhaps you can explain how.

I was unsure why it would have been "obvious" that Dr. Jackson had read a recently published preprint paper. Then Dr. Jackson posted again the following:

Dr. Jackson writes: Hi Derek, As the initiator (with Bob Flood) of the notion of 'waves' of systems thinking, I think it is reasonable for me to challenge your continued use of an idea that I now regard as simplistic and misleading. Likely, in fact, to hinder progress in systems thinking. Since you do not seem eager to debate the matter, let me ask you one simple question: What do you see the systems approaches you lump together in the '1st Wave' as having in common?. Best, Mike.

To which I again responded:

Derek Cabrera writes: Sorry for the delay in responding Dr Mike C Jackson OBE —I've been busy starting the new semester at Cornell and also rarely have time to engage in long-form debates on social media. I am happy to debate the matter but snipey, short-form, google-researched, social media isn't the place. That's why Gerald [Midgley], Laura [Cabrera] and I took the time to provide a thorough explanation in a published paper, which, as you know, you can respond to by publishing a response paper or I would be happy to arrange a formal public debate in which I'd love to hear the empirical basis for CST as I haven't found one that is commensurate with its longevity [link to paper provided]. To be fair, I'm not committed to the idea of 4 waves (as you say it's not really the thrust of my work and I didn't come up with the idea) but historic periodization (as fully explained in the paper) is a necessarily flawed but useful andragogical tool for understanding complex histories. Furthermore, you mentioned having read the paper, so I'm sure you saw our explanation of the defining features of the waves as well as the clear exposition that the waves are not discontinuous.

After which I received no response from Dr. Jackson, until he posted again on a different post, a copy-paste of his original critique which again implies that there has not been a response nor an invitation to debate.

Dr. Jackson writes: I was, with Bob Flood, the person who initiated the notion of three waves of systems thinking (in 'Critical Systems Thinking: Directed Readings', 1991), as Derek has acknowledged. I now regard the idea as very misleading: 1. The approaches listed under the 1st wave are very different in orientation. It is simplistic to see them as similar enough to constitute the same 'wave'. 2. Different systems thinkers/practitioners prioritising a quantitative orientation,

¹ D Cabrera, et al., The Four Waves of Systems Thinking, in *The Routledge Handbook for Systems Thinking*, edited by D Cabrera, et al., Routledge Press, London, UK, 2022



a qualitative orientation, and seeking to address power issues have existed in all of the time periods indicated. For example, Boulding and Churchman were working in the 50s-60s but were qualitative in orientation and with an interest in power. Systems Engineering and System Dynamics continue to dominate in the 2000s. 3. The 3rd wave lumps together critical systems heuristics, which is a particular methodology, with critical systems thinking, which is a multimethodological approach. They are radically different. 4. I have no idea what philosophical or methodological shift has taken place to justify the notion of a 4th wave (if we must) in systems thinking. The idea of 3/4 waves of systems thinking, in my view, is misleading. Something I'd be happy to debate with Derek.

Some months later, Dr. Jackson comments the following on another of my posts:

Derek still pushing his 'four waves'! Amazing. As posted on another thread about this: I was, with Bob Flood, the person who initiated the notion of three waves of ST, in 1991, as Derek has acknowledged. I now regard the idea as very misleading: 1. The approaches listed under the 1st wave are very different in orientation. It is simplistic to see them all as part of a 'wave'. 2. Different systems thinkers/practitioners prioritising a quantitative orientation, a qualitative orientation, and seeking to address power issues have existed in all of the time periods indicated. For example, Boulding and Churchman were working in the 50s-60s but were qualitative in orientation and with an interest in power. Systems Engineering and System Dynamics continue to dominate in the 2000s. 3. The 3rd wave lumps together critical systems heuristics, which is a particular methodology, with critical systems thinking, which is a multimethodological approach. They are radically different. 4. I have no idea what philosophical or methodological shift has taken place to justify the notion of a 4th wave (if we must) in systems thinking. The idea of 3/4 waves of systems thinking, in my view, is misleading. Something I'd be happy to debate with Derek.

It was at this point that I chose to write this article in order to establish the facts. Each time Dr. Jackson posts, a host of his followers join in to the typical social media snark and half-facts. Again, while I am not willing to engage in long-form social media fights, I am willing to engage in a civilized debate. Hopefully, the above sets the stage for a few comments and also that the reader benefits from the conversation thus far.

Dr. Jackson is making three major claims.

- First, he came up with the "waves concept."
- Second, he no longer agrees with himself.
- Third, I am being misleading by using the "waves" concept.

Dr. Jackson did in fact develop the waves concept with Flood. He used the concept to help readers understand the first two waves in

order to build the third wave around his framework he calls, “Critical Systems Thinking” or CST. Dr. Midgley, one of Dr. Jackson’s students and now Professor of Systems Thinking at Hull University has been fond of the idea. As I stated in my social media reply, I personally am not at all invested in the waves idea, nor is it terribly important to my own research or work. I do think it is a good heuristic for helping people roughly understand the differences in eras and thinking in the field. The waves concept is not a scientific finding, but merely a heuristic device that helps aid understanding, much like the “Iceberg” concept or the “7 blind men surrounding an elephant.” In audiences around the world, I have seen people have a positive response to the waves as a way of generally understanding the hundred’ish year history of the modern field of systems thinking. Below, I said as much in a post to Dr. Jackson:

To be fair, I’m not committed to the idea of 4 waves (as you say it’s not really the thrust of my work and I didn’t come up with the idea) but historic periodization (as fully explained in the paper) is a necessarily flawed but useful andragogical tool for understanding complex histories. Furthermore, you mentioned having read the paper, so I’m sure you saw our explanation of the defining features of the waves as well as the clear exposition that the waves are not discontinuous.

Again, Gerald, Laura and I wrote a 34 page paper for the expressed purpose of defining some of the characteristics of the waves as we see it and, specifically, pointing out the many flaws associated with using a “waves concept” chief among them being periodization. Indeed, there is a section in the paper entitled, “Caveats of the Waves.” We also point out that despite these flaws, it’s a good heuristic tool for understanding, something I explained to Dr. Jackson.

That’s why Gerald [Midgley], Laura [Cabrera] and I took the time to provide a thorough explanation in a published paper, which, as you know, you can respond to by publishing a response paper or I would be happy to arrange a formal public debate in which I’d love to hear the empirical basis for CST as I haven’t found one that is commensurate with its longevity [link to paper provided]².

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Dr. Jackson is familiar with the academic process and he knows that it would be perfectly reasonable to submit a paper to any systems journal critiquing our paper. But he does not, while he also implies that I do not wish to debate him. He must know, too (because he “obviously” read our paper) that there is a table in the paper outlining the characteristics we consider to be defining of the waves.

The four waves are summarized in the following table, with more explication afterwards:

We then go onto define the first wave:

Wave and Origin point	People and Frameworks	Thrust, Assumptions about the World	Evolution
The First Wave: 1950s	Prominent methodologies include: system dynamics [60], systems analysis [61], systems engineering [62], and the viable systems model [63].	The structure and function of real-world systems can be known (quantified), more or less as they are.	Started in reaction to inadequacies in traditional, reductionist science. Continues to evolve to this day.
The Second Wave: late 1970s	Methodologies include: soft systems methodology [64], interactive planning [65], Strategic Assumption Surfacing and Testing [66], and Churchman's [67] systems approach.	Critical of the first wave. Includes qualitative modeling and participatory practice; accounts for human and non-technical factors; emphasizes multiple perspectives and intersubjective construction of meaning/action.	Started in reaction to identified weaknesses of the first wave, and continues to evolve to this day.
The Third Wave: late 1980s	Approaches and methodologies include: critical systems heuristics [68], critical systems thinking [1,2], boundary critique [18,24,69], systemic intervention [32]; and theories of power [70], conflict [71], and marginalization [22,72].	Critical of the first and second waves for an inadequate approach to power, and for clashing in a paradigm war. Focuses on dealing critically with power relations, and embraces methodological pluralism. Influenced by critical social theory.	Started in reaction to identified weaknesses in the first and second waves; and continues to evolve to this day.
The Fourth Wave: Early 2000s	DSRP/systems thinking [18,21,31], VMCL/systems leadership [73]. It is possible that competitors or complementors could appear as the fourth wave grows.	Universality in mind and nature. (1) the search for universality (universals or "consilience"), (2) systems thinking bridges physical/cognitive complexity), and (3) facilitates approachability and maturation of the field.	Started in reaction to the first three waves and "Cambrian explosion" [18] of frameworks. We are currently [at least] at the end of the beginning...

Table 1: Summary of the Four Waves of Systems Thinking (from [1])

The first wave is sometimes known as ‘hard systems thinking’ [64]: it is characterized by expert analysis, striving for objectivity, and primarily relies on quantitative modeling. It began in the 1950s and flowed into the 1960s, but with some advocates continuing to develop their ideas after new waves had already started. The first wave involved a structural-functionalist approach to systems [76]: i.e., assuming that we live within coherently-structured societal systems, and our roles are functional in terms of maintaining and evolving those systems, with an emphasis on expert, quantitative modeling, mostly done by engineers and operations researchers. In many ways, systems were seen as primarily physical, and a computational metaphor undergirded most approaches to systems at the time. The first wave of systems thinking was like a tidal wave. It was new and exciting, and challenged some of the places where science was failing in its purpose to expose the mysteries of the universe. Systems thinking was largely a critique, not only of science itself (which it was in total alignment with at the start of the wave), but with the way science was being done: it had become absurdly reductionistic, trying to explain things by decomposing systems into their smallest possible parts, as if causality lay in the parts of the system rather than in their collective interrelationships. It often missed the larger, containing system, so lacked context; and it focused too much on simple, linear causalities. Early on, systems thinking carried over one critically important bias of scientific practice: pure objectivity, as if systems are not always seen from a perspective. Interestingly, the underlying ideas of this first wave remain prominent in the fields of engineering and operations research today, although there are sub-communities in both fields that challenge them. This remained the dominant paradigm throughout the 1950s and 1960s, but in the 1970s and 1980s, it came under sustained attack from second-wave systems thinkers as well as planners and social scientists [77–79]. While new ideas were to be developed in the second wave, some authors (especially in systems engineering, systems analysis and to a lesser extent system dynamics) continued to develop first-wave-style thinking³.

³ 1

Yet, despite reading the paper Dr. Jackson writes [on social media],

Since you do not seem eager to debate the matter, let me ask you one simple question: What do you see the systems approaches you lump together in the ‘1st Wave’ as having in common?. Best, Mike.

Not only does the table above (from the paper he read) answer Dr. Jackson’s specific question, the paper goes on to raise many of the same concerns and critiques (e.g., periodicity, the heuristic nature of the waves, the tendency to think of waves as static and not evolving, and categorization problems).

If Dr. Jackson indeed read the paper referenced, he would have also seen the section entitled, ‘Caveats of the Waves’ in which Gerald, Laura and I explicitly lay out five caveats⁴:

⁴ 1

1. The boundaries of systems thinking that are drawn, both in time and scope, matter to the field;



2. The inherent bias in establishing historical periods in any given field (i.e., periodization bias);
3. The identification of the *origin point* of the field of systems thinking, and the distinction between explicit and formal versus implicit and informal attempts at systems thinking;
4. That many historical artifacts are lost to 'extinction' (usually quite a few more than remain today); and
5. One must distinguish between the *thrust* of the wave and its continued *evolution*.

Indeed, regarding #1 and #5, there are also two images that parallel the text in explaining these caveats, specifically pointing out that the wave represents a "thrust" but that they continue to evolve and do not supplant each other. Despite an ample amount of real estate dedicated to this caveat, Dr. Jackson persists that, "Systems Engineering and System Dynamics continue to dominate in the 2000s." This is true, they do; as we said, in the paper, that he claims to have read. In fact, in one sentence, we italicized the following:, "With these caveats in mind as context, it is important to understand that the frameworks associated with each wave *did not stop evolving when new waves occurred.*"

It is perhaps the case that Dr. Jackson believes that because he (and Flood) came up with the waves concept that he has some special jurisdiction over its destiny. He does not. Periodization and its problems is something all historians are familiar with and yet, for the sake of human heuristic comprehension, we isolate fuzzy-bounded histories into bounded eras. In our paper, we were exceedingly explicit about the dangers and anomalies.

That said, it really misses the point—which is the waves concept is merely a heuristic—a pedagogical (or andragogical tool). It is something lot's of people could have lots of differing opinions on. If so, it did its job, it got people talking about and increasing their understanding about the history of systems thinking as a field. The point is, the waves concept is not a scientific concept. It's a heuristic. Little more than an opinion.

Opinions Masquerading as Science

THIS BRINGS ME to the far deeper issue of *opinion* in systems thinking. Opinions are ubiquitous things. Everyone has them. And they can be valuable for discussing, debating, etc.



Where opinions are dangerous is when they are treated as if they hold anything more than the weight of opinion, especially from “experts.” Dr. Jackson created the waves concept. He now disagrees with himself. I agree with his previous self. All of those are opinions and they should be presented as such.

Where opinions become problematic is when they have had plenty of time to be validated and they have not been.

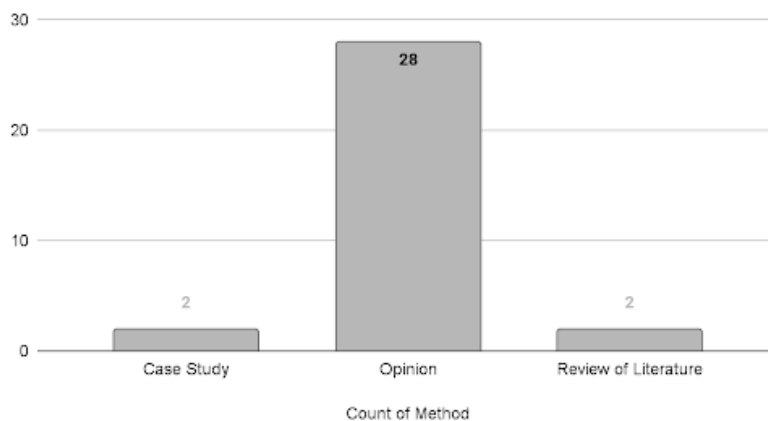
After some 50 years, there is still little to no empirical evidence of the existence or effect of CST, which leads me to the inevitable conclusion that CST is just Dr. Jackson’s opinion.

While Dr. Jackson may have presented some interesting ideas, the lack of evidence in the field of systems thinking is concerning. The failure to provide empirical evidence to support either CST’s observable existence or effectiveness, even after so many years, suggests that it is merely Dr. Jackson’s opinion.

Moreover, the fact that CST has been around for so many years without any concrete evidence is troubling. One would expect that after so many years, there would be some empirical evidence of CST’s observable existence or effectiveness, but this is not the case. In fact, in a cursory review of Jackson’s most cited papers, we found that of 32 papers, 2 were case studies and 2 reviews of the literature, and 28 were opinion pieces. Furthermore, in the 2 case studies and 2 literature reviews no statistics were mentioned although some potentially dubious claims were made such as, “The results are promising⁵” despite offering no actual results, methodology, findings, etc.

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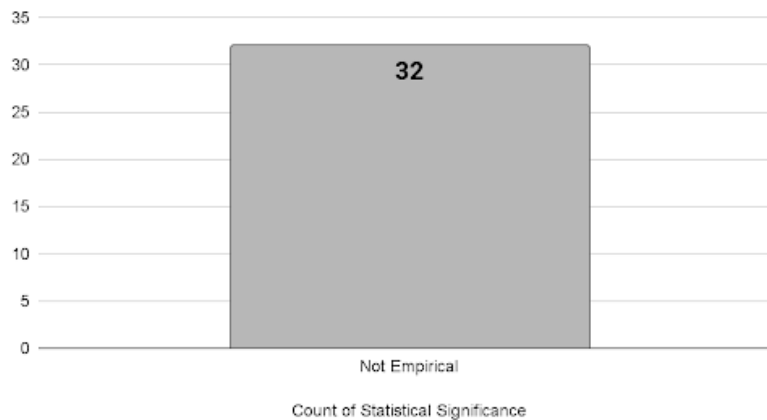
Methods of CST Papers (n = 32)



Because none of the publications we found show any results,

findings, data (qualitative or quantitative), it goes without saying that the number of publications that showed any statistical validity was 0.

Statistical Significance of CST Papers (n = 32)



Overall, it is clear that CST is not a reliable or effective tool for system thinking. While it may have some interesting opinions, the lack of empirical evidence makes it difficult to take seriously as a legitimate systems thinking “theory.” A theory is an idea which has accumulated and is accumulating evidence. CST has done neither. It is time for the field of system thinking to move on from CST, and move on from the “opinion-based debates” that mire the field in philosophical ramblings that turn off practitioners and scientists alike. Systems Thinking as a field needs to aspire to more than just opinion, more than merely debate. It must “put up or shut up” and actually contribute to the scientific and practical landscape by focusing on evidence-based approaches to understanding and managing complex systems.

For example, in contrast, DSRP Theory is a theory that has accumulated evidence and continues to do so. Both in terms of its empirical observable nature and in terms of effectiveness. And, it has accumulated more evidence in a much shorter time⁶.

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Dr. Jackson, if you’d like to debate, let’s do so. But be prepared to set aside the opinion and share the empirical underbelly that supports CST. The waves are a distraction. If I am mistaken, and there is empirical evidence for the existence or effectiveness of Critical Systems Thinking (CST) that shows that it is anything more than one man’s opinion, please share it.

References

- [1] D Cabrera, et al., "The Four Waves of Systems Thinking", in *The Routledge Handbook for Systems Thinking*, edited by D Cabrera, et al., Routledge Press, London, UK, 2022.
- [2] M C Jackson, "Beyond a System of Systems Methodologies", *J Oper Res Soc*, 41(8), 1990, pp. 657–668.
- [3] Derek Cabrera and Laura Cabrera, "A Summary of Findings from Recent Research on DSRP Theory", *Journal of Systems Thinking*, 1(1), 2021, p. 1.

