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Complex Modeling and You: A Review of *Would-Be Worlds* by John L. Casti (New York: John Wiley & Sons, 1997)

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Abstract

In *Would be Worlds: How Simulation is Changing the Frontiers of Science*, John Casti lays out the history, methods and evolution of simple and complex systems as they exist in the digital world of our computers and manifest themselves in our daily lives. He does this through a plethora of examples, ranging from football simulators to internal computer warfare between lines of code. Casti presents a framework approach to creating one's own complex systems for research purposes, and enduringly fosters in his reader an appreciation of the fundamentals: how such systems behave, what the best practices are, and how best to think about complex systems.

To escape the grip of computer modeling and its effect on daily life in the 21st century would be, in a word, difficult. In the media models show up in our weather forecasts, sports predictions, and political vote counts. The video game industry has exploded with simulation and management-type games, ranging from managing a football team over multiple seasons to running one's own virtual farm. Even the behind-the-scenes models of traffic prediction for road engineering and marketing strategy for advertising have moved us, physically and metaphorically, to desired locations and products. For all their worth, however, many of these simulations are "simple" models, consisting of plugging numbers into a calculation or algorithm, not accounting for the preferences of each individual agent, how their choices affect those around them, and, more broadly, the system as a whole; we would call a model that aims at these more detailed interactions a "complex" system. 1

In *Would-Be Worlds*, John Casti examines the growth and application of such "complex" systems. He sets an initially broad goal: to give "an account of the computer as a laboratory for studying the *informational* structure of complex systems" ([Casti 1997, x] Casti's emphasis). This manifests in his assessment of modern computer technology, its ability to handle simple systems, and demonstration through examples of what this looks like. As the text proceeds, he further breaks his main purpose down into its component parts, namely how these worlds relate to their counterparts in reality, what purpose such models present to researchers, and, perhaps most anticipated by the reader, how to build such complex systems for themselves [Casti 1997, 7]. While Casti leaves this more pragmatic final question for the last three pages, he uses the bulk of *Would-Be Worlds* to present his reader with a deep and functional understanding of what complex systems are, their history, and how they work on the most fundamental level. This allows the text to serve as more than just a simulation how-to guide; instead, it gives the patient reader the necessary background and analytic tools for assessing complex systems and implementing them, for whatever purpose, to their maximum efficiency. 2

Casti's structure is complicated to define, in that it neither presents a history of complex systems by going chronologically through their evolution, nor does he write thematically, tackling one aspect of systems at a time. Instead, *Would-Be Worlds* is designed to throw the reader into various systems, sometimes almost entirely unrelated to one another, and show one or two of their features, from which Casti can then draw relevant conclusions for the reader and then move on. This is accomplished almost exclusively through examples of simple – and, later, complex – systems, with the former making up the vast majority of the book. While some examples can seem superfluous or confusing at first glance, such as the relationship between Picasso and the fidelity of a system, Casti is playing the long-game, laying 3

out terms and concepts that will be essential for later discussion. While these examples would greatly benefit from a more explicit tie-in to Casti's main objectives, Casti, as I will discuss later, accomplishes a great deal more for his readers by using this particular structure of rolling examples and minimal guidance.

4 With examples occupying such a prominent position in *Would-Be Worlds*, they require a more thorough look into their effectiveness. Throughout, they are the main vehicle by which Casti leads his readers to the book's end – he often leaves conclusions to the readers and moves right onto the next set of examples to demonstrate a new concept. This appears early on when Casti moves from a football simulator to a solar system model to basic mathematics all in the first fifteen pages. Similar fluctuations continue, appearing in discussions of computer science simulations such as Codewars [Casti 1997, 142–50] and the later, more brief section on complex systems ([Casti 1997, 162–79], as just two examples). Yet Casti leaves many questions unanswered: Where does subjectivity come into play when, in a football simulator, one must assign a hard number to a player's ability to catch a ball? Does this come from his ratio of catches to drops? Is this number understood in the football world, but foreign to readers who have never watched a game? Questions like these arise throughout the text, but Casti chooses to single out the relevant information of a system, to extract its fundamental purpose as it relates to his demonstration, and move on. This can leave the reader guessing at his purpose at times, even when the writing and descriptions are brief and clear.

5 Similar issues arise in his less scientific examples. Casti is reminiscent of *Ceci n'est pas une pipe* by René Magritte in discussing a bullseye painting, only to drop the discussion entirely by relegating these philosophical issues to a two-world sentence — "Hard questions" [Casti 1997, 30] — before moving on. This can lead the reader to feel somewhat exasperated by so many unconcluded examples after a while. By my own notes, I noticed this fatigue around Chapter Three, in which Casti presents multiple examples that all point to his perhaps implicit conclusion that, sometimes, systems can surprise their operators with unexpected difficulties [Casti 1997, 123]. His style lends itself to this torpor, with each new section being introduced by a demonstrative example rather than the author's own guidelines for the topic to be addressed next. Each instance of example-making might leave the reader asking the question "to what end?" and one will not always find a sufficient answer.

6 It is not until just before the end of *Would-Be Worlds* that Casti's purpose begins to come to light. This opens up with his own admission that, after over 150 pages of text, he has yet to answer the reader's foremost question: how do I create a complex world [Casti 1997, 179]? The more attentive reader will have also noticed that Casti includes no concessions, no counter-examples among the many positive ones throughout the book. Casti addresses this too, in dedicating a chapter to addressing the limits that both science and nature place on these systems – with each case of constraint harkening back to the examples given in previous chapters [Casti 1997, 196–207]. One of the book's final acts is to give the reader what they have sought since the Introduction: a tool with which anyone, even those who have no knowledge of computer science or coding, can create their own complex system [Casti 1997, 180–1]. The reader thus becomes increasingly aware that Casti had these resources at hand, but chose to leave them until the end, placing cornucopia of examples and discussion questions – sometimes unanswered – in between the interested reader and the tool they most desire. As I will now show, however, this deliberate delay allows Casti to get his reader comfortable and informed about relevant issues before complicating them further.

7 A broader interpretation of the text shows why Casti might have set up *Would-Be Worlds* in this way. By allowing the examples' subject matter to range across the board, Casti can demonstrate every potential issue – and every best practice – one might face in designing a complex system. By doing this, I believe Casti creates a reader who is now not only interested in complex systems and has the means to create one, but who can understand them from their most basic levels and can now, since they have so many models to work from, think laterally rather than linearly about their own projects. He creates a touchstone to which all would-be world makers can return when the inevitable difficulties and roadblocks in the creative process occur.

8 It is important to note that the preceding analysis is purely speculative on my part; Casti never explicitly states that this is his purpose in *Would-Be Worlds*. Nevertheless, the way in which he presents multiple genres of examples, beginning with the most foundational, basic, and historic, allows the reader to adequately approach his more high-minded, ethereal concepts (e.g. system fidelity, relativity, and bias) from multiple angles rather than from one set approach. His

scheme is almost Socratic, leading the reader on these incremental steps toward a goal already worked out in his head, while allowing for the reader to question the efficacy of this goal at each step along the way by providing many ways to accomplish similar tasks.

9 More so, his ultimate question of “What are complex systems” recalls the “What is Digital Humanities” debate, which is to say that it is a question whose answer is most effectively given in the form of examples rather than in a one-line dictionary entry. Complex systems, like the Digital Humanities, are a set of processes with unrelated goals that are accomplished through common, related, and sometimes antithetical techniques; and the best way to understand and, ultimately, generate a system of one’s own is to see others in action, learn how they were made, and innovate accordingly. This is what Casti offers in *Would-Be Worlds* through his numerous examples and minimal, though helpful, narrative voice.

10 We have left only some final notes about Casti’s style in *Would-Be Worlds*. Though the book’s second title, “how simulation is changing the frontiers of science,” may strike the humanities-oriented reader as irrelevant to their own work, Casti is unexpectedly philosophical and even humanist throughout this text. In one particularly vivid example he illustrates the boundary between the real world and art by describing the absurdity of someone calling the police in the middle of Desdemona’s onstage murder [Casti 1997, 30]. This clear, relatable, hypothetic scenario is indicative of every one of Casti’s examples: they are concise, often no longer than two pages; broad in scope, from modern biology to ancient Greece; and, despite their technical complexity, accessible to a lay reader. They are also simply interesting, a refreshing break for a reader who might expect droning paragraphs of authorial lecturing about such specialized texts.

11 As mentioned before, the book is notably philosophical in its aims. The only pieces of pragmatic advice – something a reader might expect in a computer science-related book – are his criteria for assessing the suitability of a system [Casti 1997, 26–9], a list of system “surprises” [Casti 1997, 87], and his final thoughts on creating a complex system for oneself [Casti 1997, 213–15]. The others, after his examples, are his deeper questions about what such models can allow us to ask about the real world. Often these have no answer, as evidenced in his “hard questions” comment mentioned above [Casti 1997, 30]. But this initial frustration of receiving no help is alleviated by realizing that this is less indicative of a field that has no answers than it is an acknowledgement that complex systems require one to make one’s own complex choices, and the questions Casti asks are the guide to executing those choices more fully.

12 Overall, *Would-Be Worlds* is a thorough philosophical tract for the development of complex worlds, with a bit of state-of-the-field work thrown in. With the technical strength and speed of computers increasing exponentially every month or so, the 21st century researchers are more poised than ever before to model and explore complex systems. John Casti’s text lays out this position by showing how we got here, what developments are at play, and what questions remain to be answered. While it is, at times, distressingly indirect in approach, I believe Casti’s book fosters in the reader more organic, well-rounded means to creating a complex system for research, and still presents the most necessary components, albeit in the final pages. *Would-Be Worlds* should be held as an exemplum of how to combine good thinking with pragmatic results and, more broadly, scientific tools with a humanistic mindset – a fusion that will become more essential as growing, hybrid fields such as Digital Humanities become greater players in academic research.

Works Cited

Casti 1997 Casti, John L. *Would-Be Worlds: How Simulation is Changing the Frontiers of Science*. New York: John Wiley & Sons, 1997.

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