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The promise and prominence of digital agriculture has attracted critical scholars who are guided by the underlying question: what, if anything, distinguishes digital agriculture from its industrial counterpart? Many have weighed in on this debate, but few have done so with such a deeply thoughtful, sharply argued, and empirically rich approach as Kelly Bronson in *The Immaculate Conception of Data: Agribusiness, Activists, and their Shared Politics of the Future* (2022). She begins a book about agriculture in a curious way by detailing the Cambridge Analytica saga, one of the biggest data privacy scandals in recent history that changed the way everyday people engage with (and trust) popular platforms like Facebook and Google. After it was revealed that Big Tech was collecting personal data and selling it to political advertisers (ultimately used to influence United States presidential elections and Brexit), the public responded with a growing skepticism and even outright anger toward these companies, what Bronson and others refer to as “techlash” (p. 9). Bronson argues that despite the public’s increasingly critical eye toward Big Tech’s amassment of sensitive data, there has not been a similar reaction to analogous forms of data extraction within the agri-food sector. This is where her book makes a crucial and timely intervention.

No longer concerned solely with synthetic implements, seeds, or tractors, Bronson demonstrates through extensive fieldwork how incumbent agribusinesses like John Deere and Monsanto (recently acquired by Bayer) have shifted toward the mass accumulation of “big data” on farms enabled by sophisticated digital technologies like sensors and drones. These agricultural-cum-data firms also devour start-ups aimed at disrupting agriculture, further concentrating their hold on the agri-food industry with drastic consequences for farmer autonomy. To be sure, most of Bronson’s Canadian interviewees operate capital- and resource-intensive farms, contributing to scholarship surrounding the bifurcated market for agricultural technology (Bronson 2019). In other words, these technologies are built for and available almost solely to industrial farmers with access to credit. She accordingly pays heed to this uneven dynamic by recalling the ever-relevant technological treadmill, where farmers become trapped within a predatory agricultural innovation adoption cycle (Cochrane 1993).

John Deere tractors, for example, are now equipped to collect plant-by-plant data through machine learning algorithms as they roam through the row crops. Just like Google or Facebook, John Deere—not the farmer—owns the data, which contains intricate information on everything from soil health to water levels. In a similar fashion to how Instagram orients its advertisements

to a person's browser searches, a farmer's agricultural data is used by agribusinesses to sell tailored information back to the farmer who supplied it. The packaged data helps constitute farm-level "decision making platforms" aimed at influencing farmers with data-driven predictions and suggestions, such as when or what to plant. Farmer data is also sold to other companies who can use it to improve their products or develop new ones. Bronson cleverly calls this process the "corporate exploitation of crowdsourced data" (p. 128), which locks in farmers' reliance on data-driven technologies while undercutting market competition. She thus makes the case, as others have done (see Fairbairn et. al. 2022), that digital agriculture is not disrupting or dramatically changing industrial agriculture, but continuing to concentrate its power in a way that mirrors consolidation in the tech industry. The parallels between Big Ag and Big Tech are further revealed by Bronson's plethora of engaging empirical material ripe with juicy quotations. Case in point: a representative for a precision agriculture company told her, "Our biggest competitor is no longer Monsanto, it's Google" (p. 34). With vivid examples like these, Bronson drives home that we should think about agribusinesses like John Deere as big data companies like Google and treat them with a similar unease.

Crucially, Bronson helps us think about *how and why* this data-driven shift is happening in agriculture, as well as its political stakes, through the framework she calls "the immaculate conception of data" (ICD for short). ICD is "the view of big data as raw—or immaculately conceived and as powerful" (p. 4). Importantly, the actors using this framework are not tricked or duped by its immaculateness ("false consciousness" p. 14), but rather actively use this "rawness" to fashion it in their image and likeness. ICD is a powerful tool that legitimates their work and practice while also hiding the politics of data. Within this framework, it is the seemingly intangible, almost omniscient quality of data that allows all sorts of imaginaries, hopes, and futures to be conjured up and believed in. For instance, firms leverage the ICD framework to convince farmers that data-driven tools will make their operations more sustainable and efficient. Companies like Bayer/Monsanto, Bronson states, "... emphasize the utopian potential that big data has to contribute to food production while reducing chemical inputs in agriculture, making farms greener and the world a better place" (p. 37). In this way, the increased reliance on data in agriculture is built on the belief that if more data is collected, then better, "greener" decisions can be made, as if sustainability is tantamount to increased efficiency through the gathering large of quantities of minute information.

The perfectly coherent organization of the book begins with a pithy introduction to the increasing similarities of Big Ag and Big Tech. She follows with two core chapters, one engaging the positivist future envisioned by North American data-driven agribusinesses and farmers, and the other detailing how data might enact a different future if wielded by activists and watchdog groups. The final two chapters concern her theoretical intervention—ICD—and its politics. Indeed, what sets this book further apart from other critiques of digital agriculture is that Bronson's third chapter traces the way that ICD is wielded not just by powerful agribusiness, but

by largely North American “activists” from organizations like farmOs (open-source farm management platform), Farm Hack, and GOAT (Gathering for Open Agricultural Technology) interested in imagining and building a farmer-driven future distinct from agricultural corporations, or so it seems. Indeed, Bronson’s symmetrical attention to both corporate actors and activists paints a rich empirical picture of the slipperiness of terms like open and accessible data (see also Fairbairn and Kish 2023, in press). The malleable ICD framework allows descriptions like “data-driven” to be used favorably by both sides of the agricultural spectrum while also burying its true stakes. ICD thus allows data to be held in an unquestionably positive light by those upholding the current food system and those presumably attempting it to change it. Data is beautiful in the eyes of both beholders.

What is so deeply intriguing about big data on the farm is the juxtaposition between dirty boots and clean data. The former signifies the clunky, labor-intensive, and inefficient agriculture of the past, while the latter represents “an inevitable revolution in food production practices that will deliver power to farmers to better predict and manage risk” (p. 40). This future is innovative, data-driven, and de-materialized from both natural resources and humans. This agricultural imagery is further exemplified by Bronson’s interviewees, both agribusiness actors and activists, who consistently refer to data as “raw,” or “untouched by the human” who is “simply a shepherd of” it (p. 84). As Bronson describes this supposed dichotomy, “... ICD as a framework for imagining big data and the future it supposedly delivers contradicts the daily grind of digitally mediated scientific and farming practices” (p. 13). But by carefully analyzing how the ICD framework is used by both agribusinesses and their counterparts, Bronson draws attention to the messy, human-driven nature of agricultural data, contrasting the idea of data as raw and untouched. Even the most sophisticated data-collecting agricultural technologies rely on the labor of scientists and farmers to ground-truth soil algorithms and feed crop information into machine learning systems, for example. This aspect of her argument contributes to a growing body of scholarship on the invisible “ghost” work enabling algorithms to function (see Gray and Suri 2019; Vertesi et. al. 2020). The point that agricultural data are not so immaculate after all is indeed the point of Bronson’s book. Clean data still require dirty boots.

As Bronson suggests, data-driven agriculture holds unknown consequences to farm workers in particular, which is a stone only beginning to be unturned by a growing body of scholars including Bronson (see also Baur and Iles 2022; Rotz et. al. 2019; Sparrow and Howard 2021). With the influx of digital technologies, Bronson argues that farm workers will become “machine minders” (p. 124), meaning that they will become so alienated from their labor that the vast skill they possess becomes no longer necessary; the laborer becomes an appendage to the machinery, just as Marx observed of the textile workers in the *Grundrisse* (1993). However, Bronson also acknowledges that the desire to automate crops not readily suited to mechanization may produce new human-robot relations and potentially new forms of exploitation that do not fit so neatly into the machine minder model. For instance, she makes clear that not all crops are as amenable to

data-driven technologies as the common monocultures grown by most of her farmer interviewees (p. 123). Specialty crops like tomatoes, green beans, and leafy greens often still require human labor, which pose problems to the fully-automated farming future desired by many ICD enthusiasts. This point is tangential to her overall argument, but the sober assessment of big data in agriculture only adds to the urgency of this inquiry. As Bronson argues, “Farms, it turns out, do not behave like widgets” (p. 26), and therefore they should not be treated as such, especially when it comes to the humans working on them. This is yet another important provocation from Bronson that should not be overlooked.

If there is anything deserving of more attention in this thoroughly engaging book, it is the dichotomy between the corporate and activist actors. While the treatment of these two groups helps Bronson make a key point—that ICD is a dangerously convincing framework to different sides of the agricultural spectrum—it also does not deeply engage other actors with different ways of relating to data. Bronson’s activists are often highly trained and educated experts wanting to use their skills for positive, data-driven food systems change. In other words, while these activists accept ICD and provide important insight into its enactments and implications, this framing risks leaving out other avenues to food systems change. For example, many indigenous people and farm workers—not farmers—would likely have a different relationship to the ICD framework, perhaps challenging its positivist politics and blind faith in data. To an uncritical eye, then, Bronson’s framing of “activism” might give the false impression that attempting to change an increasingly data-driven agri-food system requires data-driven actors. Then again, perhaps this is the point that Bronson helps make crystal clear: data can’t be fought with more data, regardless of intention or orientation.

The Immaculate Conception of Data shines in its ability to speak meaningfully to a variety of audiences from those interested in data privacy, the future of agriculture, and science studies. The book needs to be read far beyond academia, and indeed it would be a shame if it was not. Bronson makes a generative contribution to a lively, pressing conversation concerning the continued, seemingly inescapable seepage of digital technologies into our food system and our daily lives. She helps us think about the question of digital agriculture by empirically demonstrating the ways in which it emboldens and concentrates already-powerful agri-food actors through their accumulation of big data. At the same time, she gestures toward what might be different through the framework of ICD given the distinct nature of its data-driven extraction akin to Big Tech giants like Google. The book also importantly reminds us that, despite their prominence, agricultural technologies and the data they collect are not immaculate. They are produced, trained, and contained by agronomists and even activists. While I have been left contemplating these critical, nuanced arguments, I walked away with a practical point: despite all the hype, data did not grow the wheat in my breakfast cereal.

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