In a 2015 Congressional hearing on the apparent ineffectiveness of the Dietary Guidelines for Americans (DGA), Secretary of Health and Human Services Sylvia Burwell admitted, "We are on the wrong trajectory" with regard to the health of Americans [1]. This hearing led to items in a spending bill meant to "fix" the DGA through policy changes. Others have suggested "fixing" the DGA through more and better science [2]. However, considering the vast network of operations that reinforce and perpetuate them, the DGA should be thought of as something besides a public health policy or scientific statement. The DGA are, and function as, a system and should be understood as such. When attempts are made to "fix" the DGA through changes to policy or science, what is assumed in both instances is that the "new" system will somehow escape the flaws inherent in all systems.

New Systems = New Problems

The fundamental systems theorem is that "New systems mean new problems" [3]. This can be understood two ways: First of all, a new system implies "new" problem exists. In the U.S. concerns about an "obesity epidemic" began in the 1970s, when obesity rates were rising at less than 1% per decade [4]. This slight rise in obesity rates was perceived as a "problem" that needed fixing; the solution was the creation, in 1980, of the first DGA. In the years following, it seems, at least as far as public concern goes, the problem was considered solved. For about seven years, the phrase "obesity epidemic" fell out of popular and scientific discourse to a large extent. An increase and drop off in proposed legislation about obesity follows a similar timeline.

However, "New systems mean new problems" can also mean that new systems *create* new problems, which is also what seems to have happened with the DGA. Since their creation, rates of obesity—the problem the DGA were meant to address—have more than doubled [4]. It seems an "epidemic" of obesity was created by attempting to prevent it. This is not to say the recommended diet was itself the primary "cause" of obesity, but that from a systems perspective such failure is expected; the natural state of a complex human system is failure [3].

"A system is no better than its sensory organs"

Central to the (mal)functioning of any system is communication and information. Early systems theory proposed that all system failure stemmed from failures of communication and information: "A system is no better than its sensory organs" [3]. The sensory organs of the DGA, namely methods from nutritional epidemiology, have been in question from the start. Nutritional epidemiology has long relied upon a process of extracting information from specific populations of

individuals, sequestering it away in unwieldy if not proprietary datasets, filtering it through obscure modeling and statistical methods, and distilling it into dietary guidance by experts burdened with ideological and institutional allegiances [5, 6]. This information is then projected back on individuals who are treated as if everyone is a statistical average of the uniquely situated people participating in nutritional epidemiological data collection.

The problem here is two-fold: First, nutritional information is treated as if it is collected in a vacuum, disregarding the fact that the DGA system changes the behavior of people invested in it. The result is a self-perpetuating "consensus" of findings: people with the social and cultural capital to be concerned about dietary health, who are frequently the same individuals queried about their dietary habits in nutritional epidemiology studies, eat a "healthy diet" as defined by the DGA; thus, a "healthy diet" is the one those people eat. For example, in studies from the U.S., where nutrition policy has indicated that eating eggs increases risk of chronic disease, egg consumption is associated with increased risk of diabetes; in studies from countries where eggs aren't considered "unhealthy," this association is not found [7].

This anomaly points to the second issue with information and the DGA. Katherine Hayles refers to this as "the Platonic backhand," where simplified abstractions—Plato's ideal forms—are extracted from a complex and varied world, and then the abstraction is assumed to be the same as the original source of the observation or information [8]. The ideal forms become the "real" reality, and complexity and variety in individuals appear as failed outcomes of the system.

Within the DGA system, this closed loop of information and communication—where messy realities become idealized guidance that real bodies are expected to respond to in a uniform, idealized way—benefits those who can leverage it for their own purposes, while excluding others who can participate only as targets of interventions. Policymakers and bureaucrats benefit by appearing to address a problem they helped create, even as they place responsibility for the problem on individuals who didn't ask for their help. The healthcare industry benefits from the unavoidable failure of the DGA system; in having no impact on the problem it was meant to fix, the DGA system helps to maintain a steady supply of customers who need healthcare services. The academic nutrition research industry benefits tremendously as well, with some scientists suggest that nutrition research had been "rescued" by obesity [9]. The U.S. alone spends about $100 billion dollars annually on nutrition research [10]. In contrast, excluded from the system are individuals who are asked to comply with guidance that may have little relevance to their own health status, and providers who are compelled to treat their patients as statistics instead of individuals.

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A problem central to thinking within systems is that it becomes extremely difficult to think outside of them. A system becomes a "given." Even perspectives that oppose it do so on the terms set up by the system. One of the terms set up by the DGA is that the public needs an overarching nutrition policy to direct their eating habits in order to prevent chronic disease. Although this has never been determined to be the case, once established, a fundamental purpose of the DGA, as with any enduring system, is to justify its own existence.

Disrupt the System: Universal and Individualized Nutrition

There is an alternative to trying to reform the guideline system, which has been an uncontrolled experiment on the population [11]. Instead, we can disrupt it. The term disruption has several meanings. The most general definition carries a negative connotation. In the entrepreneurial space, disruption is generally understood as a radical change in an industry, pursued with rabid furor among some entrepreneurs. Finally, disruption has been studied in the academy, notably through the work of Clay Christensen as a way that new market entrants, often with scant resources, can outcompete entrenched incumbents [12]. We'll examine one aspect of Christensen's disruption theory: value networks [13]. A value network describes the social and technical resources within and between businesses. Disruption theory predicts that a novel solution implemented within a status quo value network will likely end up co-opted. If you take the ingredients of a cookie, mix them in a different way, you still end up with something cookie-like.

Nutrition Science (and Guidelines) as an Information Management Problem

Despite people's unique experiences and dietary needs, the current dietary guidance system dishes out one size fits all dietary guidelines. For many people there is a mismatch between their dietary needs and government-sanctioned advice. This mismatch can occur for a host of reasons, but from a physiologic point of view, a large proportion of the population has some form of carbohydrate intolerance [14]. We view this mismatch between dietary advice and dietary needs as an information management problem.

At the most basic level, an individual's experiences of diet and health is a data unit, like a unique piece of LEGO. In theory, these LEGO pieces could be used to build just about anything, like a death star or a mermaid castle. In reality, however, the pieces are a jumbled mess. Moreover, where they have been organized, these data units are held under lock and key and scattered throughout the world. Some of this data protection is necessary for privacy protection, but another problem is that in most contexts data sharing is not incentivized. Instead,

there is hoarding and the use of datasets to build empires. In short, the current data architecture makes it extremely difficult to build anything of use to an individual.

Data architecture is how we could take all those various LEGO pieces and combine them coherently to serve a particular function. Consistent with the need for system thinking, our working definition of data architecture is broad and includes: physician records, health administrative data, research data and people's lived experiences. This breadth, while seemingly overwhelming, allows a vision of how the activities of different networks of individuals could be knit together, providing an alternative means to navigate the complexity of nutrition science and practice.

Digital Platform: A Powerful Tool to Accelerate Learning

Among the most powerful learning and data dissemination tools are digital platforms. Digital platforms allow networks of individuals to exchange value [15]. Take the iPhone. On this platform, developers exchange value with the iPhone user community. Apple controls the platform and curates the quality of the apps in its ecosystem. The thriving developer community contributes tremendous value to the iPhone. Google Search is another platform where users benefit from the organization of the web's information while businesses benefit from targeted advertisements. Digital platforms are powerful. This can be gleaned from market valuations and dominance of Google Search, Android, iOS, Amazon and Facebook. These platforms, once established, have a remarkable capacity to scale and accelerate learning. At the societal level, the downside of their dominance is their capacity to exacerbate income inequality. This occurs through complex international tax minimization schemes and an unparalleled capacity to ingest and monetize data, transforming it into share price [16,17].

Starting Over: Platform Requirements

If we had to start over, what characteristics would a digital platform need to disrupt the status quo nutrition system? Standardized data input would be a requirement. Most people don't like entering too much data into apps [18], so minimizing user input would be another requirement. At the health system level, health practitioners are caught between dietary guidelines that don't work well and patient care [19]. So, the provision of practice-based evidence to guide clinical interventions would be important [20]. Health administrators have limited access to good decision-making tools to rationally deploy their finite resources [21]. For example, how do health systems deal with the "diabesity" epidemics

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when there is so much uncertainty in the science? [22] Fund walking interventions or healthy eating interventions? Can administrators know for sure what constitutes "healthy eating" for their targeted population? Thus, a learning platform would need to both integrate a scientific process and provide policy makers with better decision-making tools. The platform would also need to ensure that data flows between different networks of platform participants in a timely fashion; the dominant tool for evidence exchange now is write and publish scientific journal articles, which can take place over a timeline so extended as to render the information exchanged obsolete [23]. Finally, a people-driven information system would have to have financial engineering to ensure benefits are distributed widely to platform participants. Clearly, this is a long and complex list of requirements, a nested problem. However, tackling the nutrition "system" necessarily involves confronting larger issues about who controls the research process, data and information, and financial resources, more generally.

Embracing Humility and the Unknown

An effective digital learning platform (read: system) would have to embody humility, embrace the unknown, and incorporate what works "out there." One of the chief sources of dysfunction in nutrition science is its partisan nature; it is a discipline cleaved along tribal lines (plants versus animals or calories-in-calories out versus carbohydrate-insulin hypothesis). We've observed in practice, however, that there may be less space between these paradigms than there seems to be at first [19]. Between the paradigms is a pragmatic, or "diet agnostic," space, a space where we try to rid ourselves of assumptions of what constitutes a healthy diet. Instead, the focus is on what works (well enough, for now) for different people living in diverse contexts. This takes humility. It also takes humility to acknowledge that there is much we can learn from the existing nutrition science paradigm, particularly nutritional epidemiology. For example, heaping scorn at food frequency questionnaires doesn't make dietary measurement any easier.

Conclusion

On a good day, it is exhilarating to be working towards universal and individualized nutrition guidance, or turning nutritional epidemiology on its head. On a bad day, hiding under a rock seems appealing. But we are learning, and we are finding people with enough of the same vision to begin coalescing our efforts. Through these interactions, these lofty ideas become distilled into tasks, then into projects, and finally into systems, systems that will, no doubt, bring about a new set of problems.

COI: SM holds no shares in the LEGO Group but is the founder of Approach Analytics a start-up building a digital platform which aims to build a grass-roots paradigm for nutrition science and practice. SM also provides consulting services to health service organizations.

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