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Commentary

Why we *still* don't eat insects: Assessing entomophagy promotion through a diffusion of innovations framework

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ABSTRACT

A Diffusion of Innovations framework is used to review entomophagy, the human consumption of insects, and its promotion. Overemphasis on changing values and unrealistic goals of insects as alternative to meat hampered entomophagy's diffusion. Supply-side developments to fight passive rejection are essential before a majority of consumers will accept insects as food. Marketing insects appropriately or using them as livestock feed will also facilitate diffusion.

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"I can't eat your chocolate-covered ants ... the chocolate upsets my stomach" – Groucho Marx

1. Introduction

Insect-eating by humans occurs globally (Ramos-Elorduy, 2009), but remains rare or even taboo in most cultures in the developed world (van Huis, 2013). The question of how to encourage Westerners (referring here as in most of the works cited as Europeans and non-Aboriginal Americans, Canadians, Australians, and New Zealanders) to eat insects [plus some arachnids like scorpions] is a perennial topic of discussion for entomologists and anthropologists alike (DeFoliart, 1999). The discussion is motivated primarily by their high conversion efficiency (ratio of feed consumed to edible product produced), theoretically translating into reduced CO₂ output and reduced water needs per gram of protein relative even to plants (Costa-Neto, 2013; Soares & Forkes, 2014). The message is straightforward: "Eat Insects ... Save the Planet" (Martin, 2014). Entomophagy campaigns have focused on raising awareness, with the hope that once people see that insects are edible or taste them for themselves, they will accept the idea and add insects to their diet. This notion is not new: Vincent Holt first raised the question of "Why not eat insects?" in 1885, while

coining the word "entomophagy." Insect cookbooks have been around since the seventies (Taylor & Carter, 1976), and the *Food Insects Newsletter* ran from 1988 to 2000 (DeFoliart, Dunkel & Gracer, 2009). Several companies are developing ways to market or present insects for the Western consumer (Fellows, 2014; Sexton, 2014). Entomophagy advocates appear on television and give TED talks (Dicke, 2010), and the United Nations has repeatedly urged greater insect consumption worldwide (van Huis et al., 2013), most recently via an interview with former Secretary General Kofi Annan that appeared in an insect cookbook (van Huis, van Gurp, & Dicke, 2014). The 21st century has seen a rise in the exposure of entomology to people of all ages and backgrounds (DeFoliart et al., 2009). So why are Westerners still not eating bugs?

Significant changes in cultural tastes are not impossible: consider the global sushi boom, where eating raw fish went from peculiar to chic in only a decade and without the concentrated efforts of scientists or politicians (Johnson, 2010). Foods can rise from obscure to popular or at least trendy quite suddenly, as in the recent cases of quinoa, kombucha, acai juice, and goji berries. By contrast, in many aboriginal populations entomophagy is *decreasing*, as the insect-free Western diet gains in popularity among the very cultures inspiring entomophagy advocates (Menzel & D'Aluisio, 1998; Meyer-Rochow & Chakravorty, 2013; Ramos-Elorduy, 1998; Yen, 2008). Despite over a century of work, entomophagy remains exotic. Holt's (1885) question of "Why Not Eat Insects?" may have been rhetorical then, but today deserves an answer.

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A landmark work on “why” certain novel ideas become widely adopted while others languish or remain restricted to a minority of users is the late Everett M. Rogers' *Diffusion of Innovations* first published in 1962 and now in its fifth edition (Rogers, 2003). It describes the innovation–decision process consumers use when presented with new technologies or ideas, the factors needed for innovations to become widely adopted by a population (such as boiling water to prevent disease in a rural Peruvian village or using snowmobiles instead of reindeer in Lapland), reasons diffusion may fail, and the consequences if diffusion succeeds. Cited in thousands of papers, the theory of diffusion of innovations (DoI) is still being used to analyze public health (Harringer et al., 2014; Sundstrom, 2014) and environmental policy (Islam, 2014; Jager, Janssen, & Bockarjova, 2014) campaigns, in addition to product marketing (Roos et al., 2014) including food (Barska, 2014). Thus DoI provides a tested and well-supported method to measure the progress of an innovation's diffusion and a structure on which to design future advocacy efforts (Sexton, 2014).

Under DoI definitions, entomophagy is a “failed diffusion.” The term does not mean no one adopted the innovation, but that adoption never reached or approached universal acceptance in its target population (Rogers, 2003), which is unquestionably the case for Western entomophagy after over a century of promotion (Gracer, 2010). To date, no retrospective works have critically examined entomophagy as an innovation, to see which techniques have been ineffective or untried. Here I present a review of the literature on and the status of entomophagy in the developed world, through the framework of DoI. The goal is to understand why entomophagy failed to diffuse, and to suggest strategies for the future based on addressing the problems identified through the DoI-based analysis.

2. Diffusion of entomophagy

Rogers identifies five essential attributes an innovation needs to diffuse in a society: relative advantage, compatibility, low complexity, trialability, and observability. I examine each of these factors and how they relate to entomophagy, plus whether and how advocacy of the past addressed them. The initial hypotheses were that entomophagy advocacy has focused too highly on some of these factors to the neglect of others, makes false assumptions about how entomophagy truly rates in these attributes, and/or uses inappropriate tactics for the target populations.

2.1. Relative advantage

At a minimum, an innovation must be “perceived as better than the idea it supercedes” (Rogers, 2003). Much of the drive for entomophagy is based on the idea that producing insects requires fewer resources (land area, labor, water, etc) than producing meat, while still providing the same nutrition (Martin, 2014; van Huis et al., 2014). Relative advantage, however, covers more than economic, ecological, or health benefits: it includes social benefits [prestige], convenience, and satisfaction (Rogers, 2003). For the Western consumer, how does entomophagy fare relative to existing food technologies?

Poorly. Certainly eating insects provides no status benefit: even in countries where entomophagy exists, such as Mexico, only the rural, indigenous persons consume insects regularly (de Conconi, 1982). The more wealthy and urban populace looks down on insects as food for the poor or primitive (Costa-Neto, 2013; Ramos-Elorduy, 1998). Worldwide, indigenous persons themselves are increasingly abandoning traditional foods for a Western diet of prepackaged foods, even though it is both ecologically and nutritionally disadvantageous, because it is seen as socially superior

(Menzel & D'Aluisio, 1998; Meyer-Rochow & Chakravorty, 2013). This problem of social status cost is compounded in the West: one author asked Thai and Cambodian immigrants to the USA who run specialty food stores that carry insects, whether they eat what they sell. Invariably they reply, “No... back home, we ate this. Not anymore” (Gracer, 2010).

Furthermore, while insects may be more ecologically friendly sources of protein than larger animals, vegetarianism and veganism are even greener. Other options for reducing food's environmental footprint include the nose-to-tail movement—reducing food waste by consuming every part of already acceptable animals, namely by eating offal (Strong, 2006)—and the new [and even less accepted] field of *in vitro* meat (IVM) grown from stem cells (Sexton, 2014; Tucker, 2014). Also, commercial insect collecting can be environmentally destructive (Johnson, 2010), as in the deforestation associated with the Sago Palm grub harvest or local extirpations of Africa's Mopane Worm (Menzel & D'Aluisio, 1998). If the demands of entomophagy are not balanced against the needs of conservationists, via sustainable harvests with appropriate habitat management or with farming, the ecological advantages might be lost (Yen, 2009b). Thus, if one's goal is feeding a growing human population on diminishing land and in the face of climate change (Nadeau, Nadeau, Franklin, & Dunkel, 2014), then promoting non-animal diets, nose-to-tail feeding, or IVM may be better alternatives than entomophagy, as their relative advantages are higher (Tucker, 2014).

A major disadvantage of entomophagy rarely mentioned in the literature is convenience: commercially available insects are difficult to find (Ramos-Elorduy, 1998; Taylor & Carter, 1976). One might assume this is a non-issue and that the low supply is due to lack of a market, but DoI theory predicts and anthropological studies (Costa-Neto, 2013) suggest that the reverse is true: accessibility drives demand. Aside from the aforementioned specialty stores (Gracer, 2010), few major Western supermarket chain carries unprocessed insects, so would-be entomophages wishing to prepare an insect-based dish must buy their insects at a different location [a pet shop or bait shop] than all the other ingredients, if not online and waiting for the insects to be delivered by mail (Meyer-Rochow & Chakravorty, 2013): a significant loss of convenience. [Note that this is changing: Belgian supermarket groups Delhaize and Carrefour and Dutch supermarket group Jumbo are now carrying insect products]. Most such insect rearing companies primarily cater to pet owners, so their reference in a cookbook runs against the stigma most Westerners associate with eating food meant for animals (Menzel & D'Aluisio, 1998; “The Chef's view...”, 1992). In addition, wherever insects are sold (including in the developing world), the price is often higher than for a comparable amount of meat (Ramos-Elorduy, 1998), providing an economic disadvantage.

2.2. Compatibility

To successfully diffuse, an innovation must be “consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 2003). For example, entomophagy advocates rarely target the Middle East, despite its high levels of economic development, as most insects [except certain locusts] are neither halal nor kosher and thus incompatible with local values. Compatibility is the most targeted aspect of insect eating advocacy; changing humanity's mostly negative perceptions of insects has long been a goal of entomologists and entomophages alike (DeFoliart, 1999; Gracer, 2010), and some anthropologists have claimed opening Westerners up to entomophagy would also open them to different cultures and reduce racism and intolerance (Looy, Dunkel, & Wood, 2014). At least for the former, these efforts are largely successful: positive contact with insects and/or

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