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"Interpersonal influence within car buyers' social networks:

Developing pro-societal values through sustainable mobility policy"

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Abstract

Conventional individual-focused perspectives on mobility decisions suggest only two levers of influence for policymakers: price change and information provision. Although interpersonal influence is known to play in important role in pro-societal mobility decisions, these processes and their policy implications are not well understood. This paper identifies five theoretical perspectives on interpersonal influence (contagion, conformity, dissemination, translation, and reflexivity) and applies them to consumer perceptions of plug-in hybrid vehicles (PHEVs). PHEVs can be perceived as having functional, symbolic, private and societal attributes. The context is a PHEV demonstration project where 275 interpersonal interactions were elicited from interviews with 40 individuals in 11 different social networks in northern California. Results demonstrate the power and importance of interpersonal influence in sustainable mobility policy. In particular, translation and reflexivity provide language and theoretical depth to describe elicited consumer perceptions and motives, while also addressing dynamics in these perceptions and in consumer values. Utilizing these differing perspectives facilitated observation that participants are more amenable to developing new, pro-societal interpretations of PHEVs if they: i) easily form a basic functional understanding of PHEV technology, ii) are in a transitional state in their lifestyle practices, and iii) find supportive pro-societal values within their social network. Results suggest that the design of effective sustainable mobility policy requires improved understanding of interpersonal influence and consumer valuation of pro-societal mobility.

1. Introduction

Understanding consumer purchase behavior will facilitate the successful deployment of pro-societal mobility technologies and practices—such as electric-drive vehicles—and aid the design of sustainable mobility policy. To anticipate and explain behavioral processes, researchers and policymakers rely on behavioral models about what consumers do and why. Consider Jackson's (2005) description of five categories of consumer behavior model relating to pro-societal consumption:

1. Expectancy-value models, such as the rational choice model, assume consumers are rational, deliberative and autonomous, calculating costs and benefits of multiple options and selecting the one that maximizes their preferences, e.g. Train (1980).
2. Adjusted-expectancy-value models, such as the theory of planned behavior (Ajzen, 1991), maintain the notion of cognitive deliberation, but interject the influence of attitudes, subjective norms, perceived behavioral control and intervening conditions.
3. Normative models, such as value-belief-norm theory (Stern *et al.*, 1999), represent the development of personal pro-environmental norms based on strong altruistic or biospheric values.
4. Habit models, such as heuristics (Tversky and Kahneman, 1974), account for the cognitive limitations of consumers.
5. Sociality models, such as symbolic-interactionism (Blumer, 1969), in which consumers negotiate and create meaning for different products through social interactions.

The dominant perspective on mobility behavior is expectancy-value and rational choice models. These models suggest only two levers for policymakers to influence consumer behavior: changing price (via financial incentives or disincentives) and providing functional information about the product or behavior. However, behavioral economists, psychologists and sociologist have long established that consumers do not typically follow "rational" decision processes (e.g. Thaler and Sunstein, 2003; Tversky and Kahneman, 1974). The present paper explores social influence as a potentially powerful lever, where social conditions can cause households to alter values and behavior. Careful consideration of how different policies and types of information can influence consumers can help policymakers to better design policy, predict its effects, and measure its impacts.

Only recently have transportation researchers begun to explore the role of social interactions in individuals' mobility behavior (Carrasco *et al*., 2008; Paez and Scott, 2007). Several researchers have incorporated social factors in rational choice models, such as by adding parameters representing aggregated preference changes resulting from increased market share (Axsen *et al*., 2009; Mau *et al*., 2008), word-of mouth effects (Struben and Sterman, 2008), information search channels (van Rijnsoever *et al*., 2009), as well as the consumer's position in a social network (Paez *et al*., 2008). However, such approaches rely on aggregated outcomes of unobserved behavioral dynamics and yield little insight into the role of social interactions in individual purchase behavior. Presently, little is known about processes of interpersonal influence at the individual level.

To overcome the absence of previous theoretical frame and empirical observation, a qualitative research design is employed. I assess multiple theoretical perspectives rather than test specific hypotheses drawn from a single theory (McCracken, 1988). This paper starts with a review of literatures addressing consumer perceptions and interpersonal influence. Currently, diffusion of innovations is the dominant approach to interpersonal influence research (Rogers, 2003)—a form of what I call the contagion perspective. This paper summarizes contagion and four additional perspectives. Through these perspectives, I interpret interpersonal interactions observed within the social networks of 10 households that participated in a multi-week plug-in hybrid electric vehicle (PHEV) trial in northern California. Four research questions guide this paper:

1. How do these five perspectives characterize processes of interpersonal influence observed among participants in this PHEV trial?
2. What are key differences between these characterizations, including implications for PHEV market research?
3. Taking these perspectives together, under what conditions might car buyers become interested in societal benefits of PHEVs?
4. What are the implications for sustainable mobility policy?

2. Literature Review

2.1. Conceptualizing consumer perceptions

A PHEV can be powered by gasoline, electricity from the grid, or both. By using electricity, PHEVs are expected to reduce the environmental impacts of driving, such as greenhouse gas emissions (Samaras and Meisterling, 2008). Technology-focused perspectives characterize PHEVs as a technological "innovation" (Rogers, 2003) due to physical and functional differences from conventional vehicles. However, several streams of research indicate that consumer perceptions are more complex and amorphous than a purely technological focus allows.

PHEVs are functional innovations because of what they physically do, such as reducing fuel costs or improving driving experience. These are examples of private-functional benefits. In addition, a new product can be innovative because it conveys a "different social meaning" than previous products (Hirschman, 1981). Such symbolic values have been found to play a role in vehicle use in general (Steg, 2005; Steg *et al*., 2001) and electric-drive vehicle purchases in particular (Heffner *et al*., 2007). These are private-symbolic benefits.

PHEVs may also be innovations because they can benefit society. Purely private goods are characterized by "exclusive and personal consumption and individual payment," and public goods are characterized by "nonexclusive consumption and collective payment" such as "clean air" (Green, 1992). Arguably, conventional vehicles are primarily perceived as private goods by consumers and other stakeholders (Canzler, 1999). PHEVs can be perceived as "mixed goods"—having aspects of both private and public goods (Green, 1992)—because in addition to the private benefits discussed above, they can provide reductions in air pollution, greenhouse gas emissions and national oil dependence (societal-functional benefits), or encourage others to think of and act on such issues (societal-symbolic benefits). I employ

the terms "societal" as a broad category of collective benefits, including environmental benefits and other regional or national benefits such as decreased oil dependence. Based on this discussion, I present a conceptualization of potential PHEV benefits according to two dimensions: functional/symbolic and private/societal (Table 1).

Table 1. **Conceptualization of PHEV benefits** (illustrative examples)

	Functional	**Symbolic**
Private	• Save money • Reliable • Fun to drive (experiential)	• Expression of self-identity • Convey personal status to others • Attain group membership
Societal	• Reduce air pollution • Reduce global warming • Reduce oil use	• Inspire other consumers • Send message to automakers, government, oil companies

Further, consumer perceptions change over time: functional understandings are altered as more information becomes available; symbolic meanings change and new meanings emerge (Heffner *et al*., 2007); and pro-societal benefits are negotiated as new perspectives, research, and policies come to light (Calef and Goble, 2007; Gjoen and Hard, 2002; Hess, 2007; Smith, 2005). Thus, to study and anticipate the consumer purchase of PHEVs, researchers must acknowledge that PHEV benefits and perceptions will change over time.

2.2. Five perspectives on interpersonal influence

What can be observed is a matter of perspective. As a qualitative exploration, the first step was to identify a variety of perspectives to facilitate observation of social interactions pertaining to the different types of benefits in Table 1. This section summarizes five theoretical perspectives on interpersonal influence, categorized according to process: contagion, conformity, dissemination, translation, and reflexivity. I select these perspectives as a broad—though not necessarily exhaustive—overview from several disciplines. This review is presented in more detail elsewhere (Axsen and Kurani, 2010).

In contagion, influence is transmitted through the point-to-point flow of information. Typically, this flow occurs in a particular direction, from a "core" of individuals to the "periphery" which is distinguished based on expertise or some other trait (Blaut, 1987). Diffusion of innovations (DOI) is an example of a contagion model, where diffusion is "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003). In DOI, the core and periphery are differentiated by the trait of innovativeness. The adoption process is driven by unidirectional communication from "innovators" (members of the first group to adopt an idea) and "early adopters" (members of the second) to other consumers. Despite its popularity, DOI has been criticized for many drawbacks, including its: unsuitability for prediction; lack of focus on symbolic attributes; lack of emphasis on underlying motivations to adopt (Rogers, 2003) including an over-reliance on the tautology of "innovativeness" as a personality trait (Hirschman, 1980); oversimplification of interactions (Centola and Macy, 2007); and inability to account for dynamics and multi-directional influence among relevant social systems (Blaut, 1987). Other contagion approaches include social network analysis, which explores the structure of linkages between individuals (e.g. Degenne and Forse, 1994; Valente, 1995), but suffers many of the same limitations as DOI. Overall, contagion helps conceptualize the diffusion of simple information regarding new products or ideas, but is typically too simplistic to represent the complexity of interpersonal influence at the individual level, particularly for dynamic and complex products like PHEVs.

Conformity addresses individuals' perceptions of others' thoughts and actions, and may best apply to symbolic benefits (private and societal). Conformity includes threshold models, where an individual's threshold is the proportion of the relevant social system that must engage in the behavior before the individual will join (Strang and Soule, 1998). Thresholds may vary according to the strength of ties with other individuals (Granovetter, 1978) as well as physical proximity, structural equivalence, and other factors (Valente, 2005). Threshold-based decisions may be linked to social learning theory—where individuals vicariously learn from the actions of others (Bandura, 2006; Efferson *et al*., 2008), as well as to social norm theory (Cialdini, 2003)—where an individual is more likely to act according when they observe descriptive and injunctive norms supporting the action. Some researchers have also utilized elements of the conformity perspective to improve the behavioral complexity of contagion models (e.g. Centola and Macy, 2007). However, while conformity conceptualizes the influence of thresholds, it neither represents specific interactions between members of a social group nor explains social norms arise or change.

Dissemination is "diffusion that is directed and managed" by an organized group (Rogers, 2003); here I apply the term to the provision of societal benefits. As an example, collective action seeks to explains how motivated individuals interact and collaborate to provide societal benefits that would not have been provided otherwise (Marwell *et al*., 1988). Collective action approaches look for the appearance of a critical mass: a small group with strong interest in the societal benefit that is willing to contribute resources to sustain more widespread action (Oliver *et al*., 1985). Because the aggregate societal benefits of a new technology rely on previous and subsequent buyers, potential adopters also assess the likelihood of further adoption. Success of further adoption is improved by the intentional coordination among the critical mass to adopt, test, promote and/or assign value to a new technology. Thus, dissemination may best apply to interpersonal influence concerning societal-functional and societal-symbolic benefits.

Translation treats innovations as dynamic, socially-constructed artifacts (Bruun and Hukkinen, 2003), and can address all benefit types in Table 1. At first, a newly introduced artifact has a high degree of interpretive flexibility; different social groups may have differing interpretations of its meaning and content which influences further technological development (Pinch and Bijker, 1984). Eventually a state of closure or stabilization occurs as the interpretations of various social groups converge (Bruun and Hukkinen, 2003), or in some cases remain in a less definitive state called alignment (Callon, 1991; Hannemyr, 2003). Introduction of the new technology can also redefine and transform social groups (Kline and Pinch, 1996), or the entire social system (Law 1992; Law and Hassard 1999). Purchase is driven by translation, where new ideas and objects change as a result of context and interactions among actors (Pentland and Feldman, 2007). Translation is similar to Blaut's (1987) concept of crisscross diffusion, where reinvention is a continuous aspect of communication between social actors. An example can be drawn from Heffner *et al*.'s (2007) exploration of hybrid vehicle (HEV) symbols: although several common symbolic denotations were discovered among early HEV buyers, each individual translates these denotations into unique, personally relevant symbolic connotations.

Finally, reflexivity is drawn from Giddens (1991). Modernity is described as lacking the roles and expected behaviors enforced by tradition. In modernity, individuals must actively create their self identity, taking on "a reflexive project." Reflexivity is the dynamic, continuous, self-aware process of defining and expressing oneself. An individual's behavior is guided by efforts to establish a sense of order, direction, and development for their self-identity. As part of this project, individuals seek a lifestyle as a package of practices that are associated with their particular lifestyle, such as fashion, eating, or any other "means of symbolic

display." An individual's self-concept and lifestyle practices are open to change if they are in a liminal state—characterized by "ambiguous and indeterminate attributes" (Turner, 1969). The adoption of an innovation offering societal benefits, e.g., a PHEV, may be one component, or trial, of a more fundamental shift towards a societally-conscious lifestyle. After adoption, a user may solidify or modify their initial interpretations of the vehicle. Thus, similar to translation, the innovation and its social context are subject to continuous uncertainty and revision of interpretations and meaning.

3. Methods and Data: Observing Interpersonal Influence

I used these five perspectives to interpret the social interactions reported by 11 social networks participating in a PHEV demonstration project conducted at the University of California, Davis. The PHEV is a Toyota Prius converted to allow the recharging of an additional 5 kWh battery using any 110-volt outlet. Each household's trial lasted four to six weeks. Researchers worked with each of these 10 households (one household produced two social networks) to stimulate and record episodes of social interaction within their social networks.

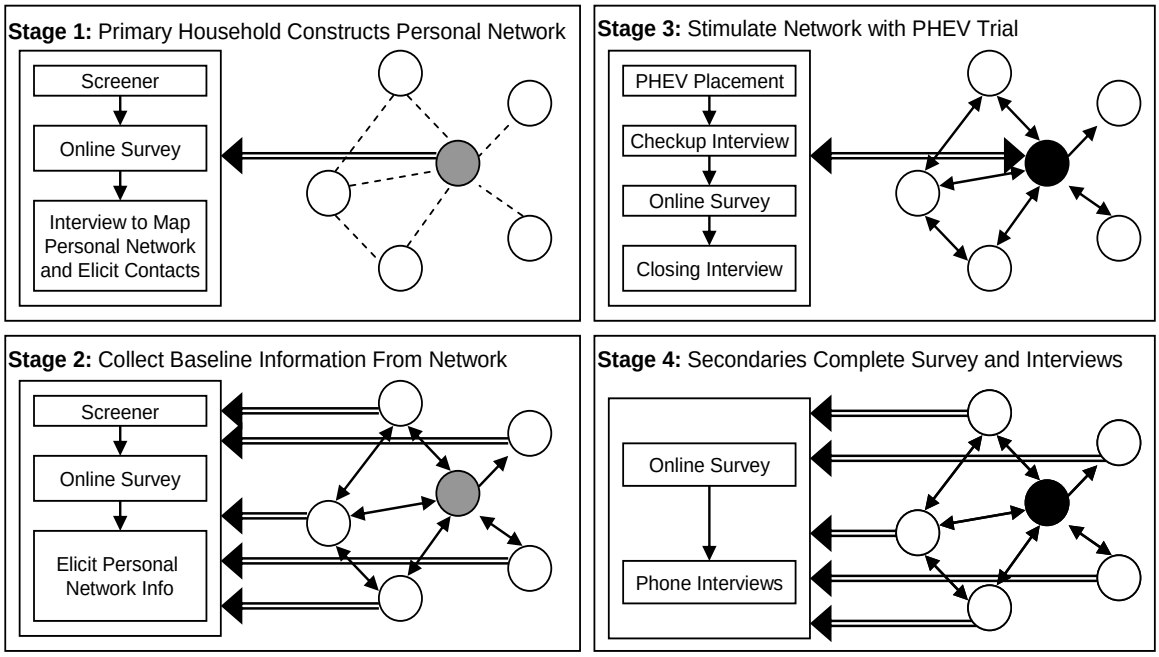
While it may be ideal to study social processes and structure of "total" social networks—by accounting for every link among all individuals in a social system—in most situations it is only feasible to collect data from personal networks (Carrasco *et al*., 2008; Degenne and Forse, 1994). A personal, or egocentric, network is represented by: i) the primary individual (the grey and black circle in Figure 1), ii) the other individuals, or alters, they are socially connected to (the white circles), and iii) characterizations of the relationships between all individuals (the connecting arrows) (Carrasco *et al*., 2008). In this study, I differentiate between the "primary" households that serve as the center point in a given network, i.e., those households actually driving a PHEV, and the members of their social networks they recruit to be "secondary" participants, who complete separate interviews and questionnaires.

Eliciting personal network data can be challenging, including efforts to scope network size, overcome limitations in respondent recall, and mitigate respondent burden (Carrasco *et al*., 2008; Marsden, 1990). In this project, I use Hogan *et al*.'s (2007) technique to assist participants in the creation of a sociogram—a graphical depiction of their personal network. Participants are asked to generate a list of "very close" and "somewhat close" alters on a series of post-it notes, then to arrange the names on a poster with four concentric circles representing social closeness. I follow a "multi-method" approach (McCracken, 1988) including structured interviews and web-based questionnaires, as well as social episode diaries—the latter of which can enhance recall of interactions (Degenne and Forse, 1994). A more complete description of this methodology is available in Axsen (2010). The four stages illustrated in Figure 1 were implemented as follows.

In stage 1, primary households were selected from a sampling frame consisting of American Automobile Association (AAA) members in the Sacramento area recruited for a PHEV demonstration study at UC Davis. Along with being screened for eligibility and completing a web-based questionnaire, primary households engaged in an extended face-to-face interview designed to elicit their: 1) vehicle purchase history, 2) future vehicle purchase intentions (if any), and 3) social network. Primary participants did not receive any incentives other than the opportunity to drive a PHEV.

In stage 2, the primary household recruited members of their personal network to complete the study (secondary participants). Secondary participants completed the same screener and web-based questionnaire as the primary household. Secondary participants were provided gift cards worth $50 to $75.

Figure 1. **Stimulating social networks with a PHEV trial**



In stage 3, the primary household began their four to six week trial of the PHEV. During this time, each primary household completed several tasks, including bi-weekly interviews, and reporting any PHEV-related social episodes in a diary. The closing interview elicited the household's narrative of their overall experience with the PHEV, including: recharging, driving and fueling behavior; functional, symbolic, private and societal interpretations of the vehicle; the dynamics of these interpretations over the course of their trial; and interests in future vehicle purchases. Primary households rated the perceived influence of social episodes—including discussions, dialogues, and other contacts—over their assessment of PHEV technology.

In stage 4, secondary participants were again contacted to share their observations of the primary household's PHEV trial. All secondary participants completed a web-based questionnaire, which elicited information about any social episodes that occurred with the primary household during the trial. Secondary participants also took part in a telephone interview eliciting details of experiences with the primary household and PHEV.

Following this methodology with 11 social networks, 40 individuals were interviewed (18 primary participants, and 22 secondary participants) and 275 social interactions germane to the PHEV were examined. (Pseudonyms are used for all participants.) Table 2 details each network according the number of: total (very and somewhat) close alters, social interactions with close alters, and total social interactions (including casual acquaintances and strangers). Billy Woods' sociogram is detailed in a companion paper as an illustration of this method (Axsen and Kurani, 2011).

Table 2. **Characteristics of 10 primary households (18 participants)**

Primary Surname	Total close alters (very and somewhat)	Total social interactions with close alters (very and somewhat)	Total social interactions (incl. casual acquaintances and strangers)	First name	Age	Household income
E-drive novices with private lifestyle						
Noel	101	29	34	Rupert	40s	$80-89k
				Amy	40s	$80-89k
Petrov	26	15	26	Adam	60s	$40-49k
				Katrina	30s	$40-49k
Earhart	24	6	17	Betty	30s	$50-59k
Stashe[1]	46	14	30	Darren	50s	$100-124k
				Pat	50s	$100-124k
	42	16	20	Melissa	20s	$100-124k
E-drive novices exploring pro-societal lifestyle						
Woods	44	11	18	Billy	40s	$100-124k
Ranchero	26	13	15 (20)[2]	Ed	30s	$100-124k
				Silvia	30s	$100-124k
Potter	36	18	24	Ethel	50s	>$150k
Fort	44	15	29	Brett	40s	$100-124k
				Julie	20s	$100-124k
E-drive enthusiasts with pro-societal lifestyle						
McAdam	50	14	31	Craig	40s	>$150k
				Siobhan	40s	>$150k
Rhode	49	23	26	Larry	40s	>$150k
				Cheryl	30s	>$150k

[1] The Stashe household constructed two different social networks: one for the parents, Darren and Pat, and one for the daughter, Melissa.

[2] A sociogram was elicited from Ed Ranchero only. "Total contacted" value in brackets includes 5 additional interactions reported by Silvia Ranchero.

Table 2 also summarizes the characteristics of the 18 primary participants. Although primary households are drawn from one region in northern California, the distributions of socio-economic, demographic and attitudinal attributes among the 40 participants approximate those of a representative, nation-wide sample of new vehicle buyers (Axsen, 2010). However, I note two important characteristics of this sample. First, the sample does not consist only of the "innovators" or "early adopters" (as DOI would label them) that may be the first to buy PHEVs. Instead, I include a broad range of primary households, including potential early PHEV buyers and likely later buyers or non-buyers—permitting observation of the types of assessments that would occur throughout the early and later PHEV market. Second, the sample consists of PHEV drivers rather than actual buyers. Thus, by providing PHEVs to these participants for multi-week trials, I created context for this exploration of interpersonal influence. An exploration of actual purchase behavior can not happen unless and until PHEVs are offered in the marketplace, and then only initially among early buyers. In our judgment, our approach is valid for observing a variety of interpersonal influence patterns to explore our research questions.

4. Household Stories: Three Patterns of Interpersonal Influence

A companion paper discusses empirical results both more broadly and in more detail (Axsen and Kurani, 2011); this paper focuses on the five perspectives. One starting point for differentiation among the observed interactions is the networks themselves, which include individuals engaged in different lifestyle practices, resulting in different levels of experience with, and interest in, electric-drive vehicles and pro-societal behavior. I divide the 11 networks in Table 2 into three categories based on electric-drive vehicle knowledge and lifestyle orientation toward private or societal practices. Before applying the five perspectives on interpersonal influence, I first illustrate each category with the story of one household.

4.1. Electric-drive novices with private lifestyle: The Noels

Rupert and Amy Noel live with their three young children. They are family-oriented—devoting extensive time to their children and frequently interacting with their large extended family (recording 101 "close" alters in Table 2). The Noels had no experience with electric-drive vehicles prior to their PHEV trial and they have no electric-drive experts within their social network. Throughout their trial, Rupert's interactions mainly consisted of "showing off" the vehicle to friends and coworkers, and he perceived these interactions as having little influence on him. In contrast, Amy more actively sought to advance her functional understanding and assessment of the PHEV by eliciting the perceptions of friends, family, coworkers, and even her dentist. Above all else, the Noels' agreed that their PHEV assessment was most influenced by interactions that involved their own children, such as adding the word "plug-in" to their four-year-old's vocabulary. In conversations within their personal network, the Noels only discussed basic private-functional aspects of the PHEVs, such as recharging and fuel economy. The basic functioning of PHEVs was not well understood by the Noels or clearly communicated by them to others—all interviewed secondary participants were unsure of the differences between the PHEV conversion and a regular Toyota Prius, and none had a strong sense of what benefits the vehicle offered, beyond generally improved fuel economy. At the end of their trial, the Noels interpreted the PHEV as a good way to save money and avoid trips to the gas station—so long as such a vehicle could comfortably fit their children.

4.2. Electric-drive novices exploring pro-societal lifestyle: Billy Woods

Billy Woods is recently divorced and lives alone in a detached home. He frequently engages in many social and recreational activities—golfing, skiing, and visiting bars and night clubs. As a self-described "social guy," he discussed the PHEV extensively within his large social network, including his technology-oriented coworkers at a computer company. He explored the PHEV's "bells and whistles" with June, a close work friend and mentioned the car to other coworkers, golf buddies, and family. Many of his conversations consisted of "small talk" and "showing off" the PHEV's private-functional attributes, and he considered such interactions to be of low influence on him. For Billy, his most influential interaction took place with an electric car owner at work, Harry, who wanted to discuss the recharge outlet they were sharing. Billy rated the interaction as highly influential because Harry had discussed the PHEV within a larger perspective of alternative fuel vehicle research, including hydrogen fuel cells. At several points in his trial, Billy demonstrated open-mindedness to exploring pro-societal attributes of the PHEV. He polled several coworkers, eliciting their motivation to purchase a hybrid: saving money or the environment. These coworkers served as one of Billy's most influential reference groups; Billy quickly agreed with their response of financial motivation.

4.3. Electric-drive enthusiasts with pro-societal lifestyle: The McAdams

Craig and Siobhan McAdam have strong environmental and pro-societal values which are demonstrated throughout their home including ownership of solar panels, efficient light bulbs, and a hybrid Toyota Prius. Craig sees the PHEV as an extension to his Prius, i.e., a way to further reduce their environmental impacts and dependence on foreign oil, as well as sending a message to automakers to support the technology. The McAdams' social network includes alters with similar pro-societal values and some interest in advanced technology—Craig has already influenced at least three of their purchases of Toyota Priuses. Surprisingly, the PHEV trial did not stimulate many "real conversations" in the McAdams' network; Craig and Siobhan explain that because environmental issues and actions are already such a big part of their lives, the trial of a converted Prius did not have an enormous impact. Two secondary respondents in the McAdams' social network described their ongoing dialogues with Craig regarding environmental technologies. The McAdams' PHEV trial was just another experience in lifestyles they regarded to be pro-societal.

5. Application: Characterizing Patterns of Interpersonal Influence

The above stories and their supporting data help to answer our first three exploratory questions. Among other things, participants' interpersonal interactions included seeking help to understand private-functional attributes, polling networks about private versus societal motives, and disseminating pro-societal values. This section describes such interactions from the five perspectives of contagion, conformity, dissemination, translation, and reflexivity. Table 3 summarizes these perspectives as applied to each primary household.

5.1. Contagion

Contagion views interpersonal influence as the unidirectional flow of functional information. For example, Billy Woods frequently informed people he was driving a PHEV and briefly explained that it was different from a regular Toyota Prius. In another example, Rupert Noel's work supervisor learned from Rupert that the PHEV had reasonable acceleration capabilities: "I was always wondering about that issue of having enough guts so that you don't get run over…so I was impressed." Such interactions can be described as instances of contagion of information from the primary household to an alter, influencing the latter's assessment of PHEV technology.

Contagion neglects important nuances of interpersonal influence. One criticism is that functional information is not the only type of information shared. While, Billy Woods engaged in several social interactions to inform his own functional perceptions of the PHEV, his conversation with Harry brought Billy into contact with a broader perspective on mobility: "[Harry's] the one that pointed out the hydrogen technology…he just opened up some questions…[that] I couldn't answer." In contrast, Harry initially saw Billy's PHEV as a signal that such technology was finally "commercially broadly available." Further, when Billy polled his coworkers about environmental motives, he wasn't collecting functional information about PHEV technology, but rather was testing whether a certain perspective and lifestyle fit with one of his reference groups. Social interactions that were limited to passing functional information tended to be rated by participants as less influential to their overall PHEV assessment, for example, Billy Wood's and Rupert Noel's descriptions of non-influential "small talk."

A further criticism of the contagion perspective is the limiting assumption of unidirectional information flow from some core group, e.g. electric-drive enthusiasts or experts scoring highly on the trait of innovativeness (whether specific to electric-drive or more generally), toward the periphery, e.g. those with low expertise or innovativeness. However, I observe that in many cases, influence is multi-directional. For instance, Billy is an electric-drive novice whereas Harry is an electric-drive enthusiast that built his own electric vehicle. However, both Billy and Harry described their influence as bi-directional—not just flowing from expert to novice. Similarly, contagion might identify the McAdams as likely early PHEV buyers due to their electric-drive expertise and experience, e.g. buying and operating a hybrid vehicle. However, even the McAdams learn from, and exchange information with, others—and others who are not necessarily innovative or knowledgeable—on an ongoing basis. Primary households and their network members did not generally draw their perceptions from one particular expert or set of experiences. Rather, they formed a general understanding of the PHEV through an ongoing discourse of social interactions that they integrated with their pre-existing background knowledge.

5.2. Conformity

Conformity views interpersonal influence through individual's perceptions of what others are doing. This perspective illustrates that parting from certain norms may be either undesirable or desirable. Billy Woods describes that although he generally liked the PHEV, he thought the Prius was ugly, and as a "single guy" he didn't want to drive downtown "in a car that looks like an egg." Billy was not describing a particular interaction, but a general perception of the expectations and norms of one of his reference groups—the night club crowd—that a car should be attractive. June, a secondary participant in Billy's network, echoed this sentiment, describing that her household would prefer a PHEV that was more "normal" than the "funny-looking" Prius design. The McAdams also highlight the importance of supporting the existing norms of their social network. However, because their network consists of individuals with pro-societal motives, where "the idea of…plugging in a car is not that…'Jetsons' to our group of friends," driving the Prius PHEV actually supported these norms. (The Jetsons© was a futuristic cartoon television show created in the US in the 1960s.) On the other hand, the Noels' initial excitement about their PHEV trial was at least partially derived from its lack of conformity; they describe how driving the PHEV would "turn heads" because it was a "status symbol" potentially in a sense of wealth as well as environmental motives. Thus, the conformity perspective helps to conceptualize the influence of current norms, symbols and social pressures on individual adopters. However, it does not explain how such norms, symbols and pressures emerge and develop.

5.3. Dissemination

Our sample does not include any members of formal groups engaged in PHEV dissemination. Further, although Billy Woods and the Noels described instances of "showing off" the PHEV, such interactions were not dissemination as I define it—they appear to be reactions to the novelty of the PHEV trial. I note that the very nature of our sample and methodology may have precluded observation of further, or more formal, dissemination processes. For example, if any of our participating households had been the entrepreneurs, environmentalists, and electric vehicle enthusiasts who pioneered the very PHEV conversions provided to households in this research, I may have found dissemination processes to be a more relevant and widespread.

Table 3. **Five perspectives on interpersonal interactions for each primary household**

	Approach:				
Network:	**Contagion**	**Conformity**	**Dissemination**	**Translation**	**Reflexivity**
E-drive novices with private lifestyle					
The Noels	Telling others the PHEV saves trips to the gas station.	Perceiving the PHEV as "turning heads," as a "status symbol."	None observed.	Interpretive flexibility: consulting others about private-functional PHEV benefits, such as "less trips to the gas station."	Becoming vaguely aware of a pro-societal lifestyle trajectory, but remaining far more concerned with family-oriented living, emphasizing vehicle space and cost savings.
The Petrovs	Telling others about their PHEV trial.	Perceiving the Prius as a more "age appropriate car" for Katrina.	None observed.	Interpretive flexibility: asking others about PHEV's performance and learning that it would not save them money because the battery was too unreliable.	Approaching his PHEV trial as another handy-man project, Adam uses his expertise to assess vehicle practicality and efficiency. In contrast, as a recent immigrant and current student, Katrina learns from friends and links PHEV technology to EV development in her home culture.
Betty Earhart	Telling others about her PHEV trial.	Perceiving that like her, others in her network also want to save fuel, but prefer an SUV model.	None observed.	Interpretive flexibility: discussing PHEV performance with others, determining that an SUV version would best fit her driving patterns.	As an entrepreneur, Betty assesses financial savings and PHEV practicality for her job. Financial values are reinforced throughout her social network, so driving a PHEV could fit into her current lifestyle trajectory.

Table 3. **Five perspectives on interpersonal interactions for each primary household** (continued)

	Approach:				
Network:	**Contagion**	**Conformity**	**Dissemination**	**Translation**	**Reflexivity**
The Stashs	Telling others about their PHEV trial.	Perceiving that others also valued fuel savings and practicality above all else.	None observed.	Interpretive flexibility: initially focusing on the economic savings, Darren discovered that others were not as enthusiastic and he lost interest.	As an engineer, Darren's trial is an opportunity to rationally assess financial and functional performance. Though peers are like-minded, their lack of interest in the PHEV subdues his own initial excitement—his calculation remains incomplete.
Melissa Stash	Telling others about her PHEV trial.	Perceiving that most friends are not interested in the PHEV.	None observed.	Interpretive flexibility: Melissa and her inexperienced peers were unsure of how to value the vehicle altogether.	As a young college student, Melissa excitedly shows novel PHEV features to her friends. She has little experience with energy costs, but after talking with a more experienced friend, begins to link the PHEV to a more responsible lifestyle: adulthood.
E-drive novices exploring pro-societal lifestyle					
Billy Woods	Explaining how the PHEV differs from an HEV.	Perceiving that the Prius PHEV is not attractive enough for the bar/club scene.	None observed.	Interpretive flexibility: asking others if cost savings or environment is more important motive for purchasing a PHEV.	Using the PHEV to learn more about a pro-societal lifestyle trajectory, but remaining more engaged and interested in his recreational lifestyle.

Table 3. **Five perspectives on interpersonal interactions for each primary household** (continued)

	Approach:				
Network:	**Contagion**	**Conformity**	**Dissemination**	**Translation**	**Reflexivity**
The Rancheros	Telling coworkers how 80% of CO_2 emissions come from power plants (which he heard on a news program).	Discovering that the PHEV did not fit in with the "gas guzzlers" and muscle cars owned by their network	None observed.	Interpretive flexibility: discussing how family is more important than environment—the PHEV is too small for their family, and inconvenient and potentially unsafe to recharge.	Previously single and into sporty cars, Ed is prompted by his recent marriage and young child to become a "family guy." The Rancheros value the environment for their daughter's future, but don't want to sacrifice safety, economics or comfort in the meantime.
Ethel Potter	Telling her family about her PHEV trial.	Finding others' within her network that also wanted to have a positive enviro. impact.	None observed.	Interpretive flexibility: Discussing with coworkers if PHEV benefits environment given battery toxicity and electricity emissions.	Ethel perceives the PHEV as benefiting the environment. Inspired by her trial, she subsequently increases her commitment to environmental practices, such as scheduling home installation of solar panels.
E-drive enthusiasts with pro-societal lifestyle					
The McAdams	Telling others about their PHEV trial.	Seeing the PHEV as fairly normal in their social circle.	Advocating electric-drive technology, and buying a Prius to promote further production of green technology.	Interpretive closure: McAdams and alters view the PHEV as an extension of their Prius—pro-environment and supporting green technology.	Remaining fully engaged in a pro-societal lifestyle, where a PHEV is just another stage of the trajectory—supporting further production of electric-drive vehicles, but not as big a step as purchasing their conventional Prius.

Table 3. **Five perspectives on interpersonal interactions for each primary household** (continued)

	Approach:				
Network:	**Contagion**	**Conformity**	**Dissemination**	**Translation**	**Reflexivity**
The Rhodes	Detailing the fuel economy of the PHEV relative to their HEV.	Feeling an added sense of "fitting in" with a pro-environmental reference group by driving the Prius.	"Spreading the word" about PHEV technology to improve the technology—also taught a preschool class on batteries.	Interpretive closure: discussing with pro-environmental alters how PHEV reduces oil use, but renewable electricity source is needed to make it "green."	Remaining fully engaged in a pro-societal lifestyle, using the PHEV to further "spread the word" about green technology—seeing the PHEV as a "stop-gap" to clean technology, and encouraging pro-societal values in the next generation.

As one example of less formal dissemination, the McAdams described themselves as advocates for electric-drive technology, where Craig explained one motive for buying his Prius: "I wanted to put my money in my beliefs…and buy a hybrid car to help promote the production of further hybrid cars…that year they were making….100 000 and now they're making 400 000 because there were those of us that bought them five…years ago." Siobhan added that within their network, Craig "has single handedly sold multiple Priuses." One of these fellow Prius buyers was Donna, a friend of the McAdams that Craig had helped to realize she was "much more comfortable sending that money off to Toyota who has hired scientists and engineers to design this car…[which] promotes better choices among drivers." In this sense, the dissemination perspective addresses the enthusiasts that see their societal goals as more achievable if they expend effort to test, promote and assign value to PHEVs to positively influence future buyers. However, the dissemination approach does not directly address the formation and spread of pro-societal values.

5.4. Translation

Translation highlights how individuals engage in interactive, ongoing dialogues in which they interpret, negotiate and redefine what PHEVs mean to them, and potentially to other groups, or society. Translation allows social interactions to play a role in the formation and development of interpretations, whether functional or symbolic, private or societal.

From the perspective of translation, participants with less electric-drive experience are generally in a state of greater interpretive flexibility. Social interactions help to settle such controversies. For example, the Noels were coming to terms with the basic functions of the PHEV, and became excited when someone observed that the PHEV allowed them to "make less trips to the gas station." Amy Noel continually sought the perspectives of others in her network to help her form and refine her own functional interpretation of the PHEV. In this sense, she used social interactions to translate information and perceptions into her own PHEV assessment.

Similarly, Billy Woods partially formed his functional understanding of the PHEV from interactions with some of his friends and coworkers, but also engaged others to discuss (and in a sense negotiate) the broader interpretations of electric drive—private, e.g. saving money, versus societal, e.g. helping the environment. This dialogue helped Billy to solidify his interpretation of the PHEV as a way to save him money. The translation perspective acknowledges that some participants begin their PHEV trial with relatively open minds (interpretive flexibility), and their ultimate interpretations of the PHEV are in part informed through dialogue with alters (social construction).

In contrast, those participants with more knowledge about electric-drive vehicles are approaching a state of interpretive closure. The McAdams had already reached a state of interpretive closure prior to their PHEV trial, understanding PHEV technology to represent the same societal benefits already portrayed by their (non-plug-in) Toyota Prius. In this case, the McAdams did not actively engage in negotiations with alters—the PHEV was already well defined.

5.5. Reflexivity

The reflexivity perspective complements translation by linking participants' PHEV interpretations to their self-concept and lifestyle practices. Further, reflexivity illuminates the reality that lifestyle trajectories are not static for an individual, but like interpretations are constructed, shared, and negotiated over time. The visibility of the PHEV can facilitate reflexivity by prompting some users and observers to share and negotiate not just interpretations of the technology, but also lifestyle trajectories. Consider each of the three households introduced above.

The Noels were not initially interested in societal attributes of the PHEV, nor did they become significantly interested by the end of their PHEV trial. The Noels are firmly entrenched in a family-oriented lifestyle; home, children, and careers are stable; no vehicle purchases are anticipated; they participate in, and by doing so help to create, an active extended family. The Noels also do not have any strong connections with environmental or pro-societal alters or groups. They are integrated into a family-oriented community, so they focus on the family aspects of the PHEV, such as enjoying the excitement of their children and judging they would need a PHEV larger than the Prius to accommodate their family.

Billy Woods' lifestyle trajectory was susceptible to change during his PHEV trial—he was in a liminal state. He recently became divorced, bought a new home, and was searching for new ways to spend his time and prioritize his values. To an extent, Billy used his PHEV trial as an opportunity to try an alternative lifestyle trajectory and assess how it fit within his current trajectory as represented by his social network—demonstrated by his query to coworkers about their private versus societal motives. Billy ultimately rejects prioritizing societal motives (at least for now) after failing to find support among one of his most influential reference groups—coworkers—and so concludes with primarily private interpretations.

The McAdams see themselves as living a pro-societal lifestyle. They first began to seriously engage this trajectory several years ago, after moving from the East Coast to a city in Northern California known for societal values. Having researched hybrid vehicle and other pro-environmental technologies for years, the McAdams had already constructed and become integrated within a network of dedicated pro-societal people. Ultimately, their PHEV trial was not viewed as being particularly novel for the McAdams or their network—more like business as usual in a pro-societal lifestyle trajectory.

In summary, from the perspective of reflexivity, when participants talk about the PHEV, they not only share information about the technology, they are also sharing information about, and negotiating different identities and ways of living. Incorporation of these processes adds a more rigorous and behaviorally realistic theoretical backdrop to the other four research perspectives.

5.6. Section summary

This exercise demonstrates how a selected research perspective can shape observations and characterizations of interpersonal influence processes. Observed differences between perspectives also suggest relative strengths and complementarities; I summarize three.

First, each perspective focuses on, and is suited for, different types of PHEV benefits (as portrayed in Table 1). Contagion represents the spread of private-functional information. Conformity's concept of thresholds can represent valuation of symbolic benefits (private and societal). Dissemination characterizes enthusiast efforts to promote societal benefits (functional and symbolic). Translation and reflexivity can account for each type of benefit, perceptions of which are negotiated in a social context. Thus, exclusive application of perspectives representing a subset of benefit types, e.g. contagion, to consumer perceptions of products with several types of benefits, e.g. PHEVs, will inevitably miss and/or oversimplify some processes of interpersonal influence. On the other hand, translation and reflexivity are perhaps too general to represent specific perceptions relating to private-functional, symbolic or societal attributes—suggesting that an integration of perspective may be valuable.

Second, each perspective emphasizes different social interactions: contagion diffuses information; conformity is a perception of others' actions; dissemination is intentional, coordinated information sharing; translation is multi-directional negotiation and discourse, and reflexivity is the perpetual, iterative dialogue of identity. Empirical observations illustrate that each of these processes occurs to some extent, again suggesting benefit of integration. For instance, while reflexivity may better represent processes of value formation and negotiation, contagion more precisely details the diffusion of simple, functional information.

Third, each perspective categorizes people differently in relation to each other and to the object or idea of interest. Only reflexivity represents the construction, negotiation and renegotiation of self-identity and thus allows observation of dynamics in values formation. Other perspectives assign individuals to static categories: contagion has the core and periphery, often distinguished as innovators, earlier adopters and later adopters; conformity has instigators and conservatives; dissemination has a critical mass; and translation has relevant social groups—though some applications of translation allow for social system dynamics (e.g. Kline and Pinch, 1996). Origins of these static categories are not typically explained, and membership is not permitted to change. However, participants in this study demonstrate that identity and values do change, particularly as they relate to societal PHEV benefits. Thus, reflexivity is particularly well-suited for representing interpersonal influence and value change. I explore value change further in the next section.

Each perspective offers strengths and weaknesses. While translation and reflexivity allow for more in-depth, detailed representations of interpersonal influence and "the project of the self," such concepts can be more resource-intensive to operationalize or quantify as contagion, conformity or dissemination. Further, there is a lack of precedent and thus familiarity in doing so. Future research should explore the integration of concepts from these perspectives, including applying translation and reflexivity concepts to broader applications.

Table 4. **Three factors relating to societal valuation of PHEV**

Primary household	Functional understanding of electric-drive		Lifestyle		Pro-societal values		Value societal PHEV benefits?
	Already familiar?	Easily learn?	Practices	Liminality	Initial individual interest?	Network support?	
E-drive novices, "private lifestyle"							
The Noels:	No	No	Family	Low	No	No	No
The Petrovs:	No	No	Construction/ family	Mod	No	No	No
Betty Earhart:	No	Yes	Work	Mod	No	No	No
The Stashes:	No	Yes	Work/family	Low	No	No	No
Melissa Stashe:	No	No	Student	High	No	No	No
E-drive novices, "pro-societal explorers"							
Billy Woods:	No	Yes	Recreation/ social	High	Yes	No	No
The Rancheros:	Yes	Yes	Family/ technology	Mod	Yes	No	No
Ethel Potter:	No	Yes	Family	High	Yes	Yes	Yes
The Forts:	No	Yes	Family/ recreation	High	Yes	Yes	Yes
E-drive enthusiasts, "pro-societal lifestyle"							
The McAdams:	Yes	Yes	Environment/ technology	Low	Yes	Yes	Yes
The Rhodes:	Yes	Yes	Family/ environment	Low	Yes	Yes	Yes

6. Valuing Societal PHEV Benefits

The third objective of this study is to identify conditions that support development of pro-societal values. Applying five perspectives to PHEV trial participants, particularly reflexivity, helped to identify which households and social networks may be more amenable to developing new, pro-societal interpretations of vehicle technology. I highlight three factors:

1. The household's basic functional understanding of the PHEV technology (are they already familiar with PHEVs or do they easily understand it?),
2. The household's current lifestyle practices and whether they are in a state of liminality, and
3. The existence of supportive pro-societal values within the household's social network.

Table 4 depicts these factors for each primary household. For illustration, I again briefly consider each household introduced in Section 4.

At the beginning of their trial, the Noels had little idea of what a PHEV was or how it worked. Without a technical background, they devoted much time and effort towards learning basic functionality, e.g. the benefit of plugging in. Further, the Noels are firmly entrenched in their lifestyle (low liminality) and lack support for pro-societal values within their social network. Thus, they begin and conclude their trial with a private valuation of the PHEV—similar to several other "private lifestyle" primary households in Table 4.

Relative to the Noels, Billy had more background knowledge about electric drive and more general familiarity with technology (possessing an engineering degree and working for a computer company). Billy also routinely interacted with several technology-savvy alters. Further, Billy Woods' lifestyle was susceptible to change (high liminality), as evidenced by his consideration of pro-societal lifestyle practices. However, Billy returns to his private, e.g. financial, valuation of the PHEV when he finds a lack of support for environmental values among coworkers. Table 4 highlights the importance of this social support condition; two other "pro-societal explorer" households (Ethel Potter and the Forts) concluded their PHEV trials with strong societal valuations after finding support among alters.

In contrast, Brian McAdams was already an electric-drive "expert," and as a household, the McAdams already embraced pro-societal practices. Ultimately, their PHEV trial was not viewed as being particularly novel for the McAdams or their network—more like business as usual in a pro-societal lifestyle trajectory. The Rhodes, another hybrid-owning, pro-societal lifestyle household, exhibited a similar pattern.

These exploratory findings highlight the importance of dynamics in societal valuation. Again, such dynamics demonstrate the importance of perspective—perspectives that assign consumers to static categories will inevitably miss the potential development of new values. Further exploration of value dynamics would improve understanding of markets for PHEVs and other goods with societal benefits. Future research should investigate and validate these insights in different and broader samples and contexts.

7. Policy Implications

Norton *et al.* (1998) explain that neo-classical economists' models, which represent consumer values as static and exogenous, "cannot be expected to correctly characterize or guide decisions that have potential impacts over decades, centuries or longer," such as sustainable mobility policy decisions. Expectancy-value or rational choice models of behavior suggest only two levers for policymakers to influence consumer behavior: changing cost (via financial incentives or disincentives) and providing functional information about the product or behavior (Jackson, 2005).

In contrast, this research suggests the importance of explicitly representing how interpersonal influence can change households' values and expressions of possible future behaviors. The government can be viewed as an influential agent, and implemented policies are a form of interaction between the government and car buyers. Careful consideration of how different policies and types of information and experiences influence car buyers can help policymakers to better design mobility policy, predict its effects, and measure its impacts. In particular, policymakers might consider the differences between the processes of diffusion, translation and reflexivity.

Several policy examples can be considered. A publicity campaign can attempt to intentionally diffuse awareness and functional information about PHEVs in efforts to achieve societal goals, such as awareness of the technology and functional information about what it does. Policymakers might also disseminate this information through labeling standards or energy information websites. Successful policy-driven diffusion may help to establish the awareness and functional understanding that is necessary for consumers to further assess and value the technology. However, diffusion alone does not necessarily impact consumer perceptions or mobility decisions. Translation describes a more sophisticated form of interpersonal influence where consumers develop more refined and stable understandings of the PHEV, how it might benefit them personally, if it might benefit society, and (through reflexivity) if they should care if it benefits society.

What policies might be coordinated with a simple publicity campaign to consumers translate information? Product labeling serves as one type of translation—where policymakers frame the PHEV according to particular benefits, such as cost savings (a private benefit) or GHG emissions (a societal benefit). Other policies may also be indirectly (or unintentionally) translated by consumers. While a subsidy directly affects the price of a PHEV, it may also help diffuse awareness about the technology, and also may be translated through considerations of why the subsidy is being offered, e.g. that PHEVs are good for society, that PHEVs are ineffective technologies that need government help, or that the government is wasting tax dollars. Government purchases of PHEVs (along with appropriate public representations that such purchases had been made) may combat possible negative translations. Further, a government mandate, such as California's Zero-Emissions Vehicle (ZEV) mandate, can also reflexively contribute to social discourse about what kind of vehicles consumers should desire or at least what attributes of vehicles should be pertinent to consumers' self concepts, e.g., whether consumers should value private and societal benefits (Brown, 2001). In short, policymakers need to consider the variety of impacts of a given policy, including the differing processes of interpersonal influence.

Also, future research could explore how policy facilitates social interactions and interpersonal influence. For instance, a consumer's adoption behavior is not just motivated by their own assessment and self-concept, but also by those of other individuals, including non-buyers. Thus, policy might seek to not only influence car buyers, but also to foster discussion and development of pro-societal values with friends, acquaintances, co-workers, club members, neighbors—indeed any social group.

8. Conclusions

In efforts to characterize how social interactions can influence mobility decisions and behavior, I apply five perspectives to empirical observations of participants in a PHEV demonstration project. Results demonstrate that contagion, conformity, and dissemination provide useful concepts regarding interpersonal process that involve functional, symbolic and societal PHEV benefits, respectively. However, translation and reflexivity provide language and theoretical depth to describe observed perceptions and motives, while also addressing dynamics in these perceptions and in consumer values. Further, contagion, conformity, and dissemination hold important variables constant: contagion assumes unidirectional flow of information between groups statically defined by expertise or "innovativeness"; conformity only describes the current pressures and norms of a given social system; and dissemination focuses on a core group of pro-societal lifestyle practitioners. In contrast, translation and

reflexivity acknowledge the ongoing negotiations and development of interpretations, values, and lifestyle practices associated with evaluating an innovation. Comparison of these perspectives suggests potential complementarities and directions for integrating perspectives. However, while translation and reflexivity allow for more detailed representations of interpersonal influence, such concepts may require additional resources to operationalize or quantify on a larger scale. Further, there is currently little precedent to guide such operationalization.

This study also highlights three factors that support the development of new, pro-societal interpretations of vehicle technology. Households are likely to develop such values in this PHEV trial if they: i) already have or easily come to a basic understanding of functional aspects of PHEV technology, ii) are in a transitional state of their lifestyle practices, and iii) find supportive pro-societal values within their social network. Thus, to capture value change, behavioral models should account for perceptions of functional and symbolic benefits, as well as identity and lifestyle practices—perhaps by integrating concepts from contagion, conformity and reflexivity.

Better representing these interpersonal processes will help policymakers to better understand of how consumers might come to value mobility technologies and practices that offer societal and environmental benefits. As a starting point, this paper points to the importance of: disseminating functional awareness of such technologies, stimulating interpersonal discussion of pro-societal benefits, and marketing to a social network rather than only the individual car buyer. Further research can explore how policy can shape the negotiation of societal values—potentially identifying new strategies for policymakers beyond the conventional levers of financial incentives and disincentives and the provision of functional information. Future studies may also employ focus group and ethnographic methodologies to more directly observe translation and reflexive processes, as well as quantitative survey methodologies to validate our findings across mobility contexts, including actual alternative-fuel vehicle buyers (as opposed to trial participants).

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