Social Network Analysis and Consumption Dynamics: Research Review and Prospects

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[to cite]:

[url]:
http://www.acrwebsite.org/volumes/13949/eacr/vol8/E-08

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ABSTRACT
Responding to Consumer Culture Theory’s call for increased research into consumption dynamics, this paper records recent advances in social network analysis. The elements of a longitudinal method for analyzing the co-evolution of group structure and behaviors is outlined and illustrated by the substantive issue of adolescent substance use as a worked example. This new method is compared and contrasted with existing consumer research in respect to group interactions / processes and social network analysis. The paper concludes by indicating the potential for new network methods – both qualitative and quantitative – in consumer research.

INTRODUCTION
David Mick’s ACR presidential address in 2005 was entitled “Meaning and Mattering Through Transformative Consumer Research.” (Mick 2006). The address was a call-to-arms to the consumer research community to address the pressing issues of our time, notably poverty and the environment. Complementing Mick’s call for a transformation in the content of consumer research, Arnould and Thompson (2005) called for an extension to the theoretical basis of consumer culture research. These contributions can be regarded as manifestos for re-directing consumer research in terms of theoretical, methodological and substantive issues. In response, the focus of this paper is on a new method for analyzing the co-emergence of structure and behavior in social networks. Far from being a mere technical analytic exercise, this method arises from the need for a better understanding of group dynamics, which is at the heart of much consumer research. We introduce the method via the substantive issue of adolescent substance abuse.

adolescent substance use: research issues
Research on legal pharmaceuticals and illicit drugs is vast. A significant research stream is dedicated to the question: “What legal frameworks, policy recommendations, action programs and interventions will reduce the use of all ‘substances’ by adolescents?”

One driver of this current research stream stems from the recognition that mass social marketing campaigns have been only partially successful: adolescents still use tobacco and alcohol illicitly, and some also take illegal drugs. In dealing with substance use by this population segment, new strategies have been developed. These targeted strategies are often based on an understanding of the structure of adolescent peer relationships. For example, if there is a tendency amongst the most popular students to smoke, then successful anti-smoking interventions directed towards these students may halt the spread of the habit (Valente et al 2005). Such strategies are subject to scrutiny and further refinement.

The contextualized deployment of a range of proven substance abuse prevention strategies is the ultimate aim of this international research program. Consumer researchers clearly have an interest in the substantive issues (e.g. Pechmann & Knight 2002). However, from the perspective of consumer research as a disciplinary field, an additional consideration is the ontological refinements and methodological advances associated with this research program. For example, the ontological refinements permit a more disciplined approach to what constitutes a social relationship as distinct from a cultural one. Methodologically, research efforts have produced the means for analyzing the interaction between social structures and individual behaviors longitudinally. Reporting on these advances and relating them to consumer research is the main theme of this paper.

DYNAMIC NETWORKS AND BEHAVIOR
In respect of dynamics, the development of network research falls roughly into three time periods. Up until the mid-1990s, network research studies were mostly static, characterized by snapshots of inter-personal or inter-organizational relationships. These studies tended to be structuralist in orientation, with behaviors understood as differentially determined by structural arrangements. Notable theoretical and empirical exceptions to this static structuralist approach include: diffusion studies (e.g. Rogers 1975); small world research (e.g. Milgram 1967); and the evolution of research collaboration (e.g. de Solla Price 1965).

Prompted especially by the growth of the Internet and the World Wide Web, the mid-1990s onwards witnessed the growth of research dedicated to tracking the structural changes of networks over time. Suffice to say that this research stream has featured a rainbow of disciplines including: physics, social psychology, mathematics, computer science, biology, and economics (see Newman et al 2006).

The third wave of these network research developments has scarcely begun. This latest wave is directed towards understanding the co-evolution of structure and behaviors in human networks. Corresponding to ‘structuration’ (Giddens 1984), this latest development takes up the challenge of modeling the recursive relation between structure and action. In human groups, the patterning of relationships (structure) impacts on the behaviors of individuals, whose actions in turn can modify the relationship structure. Analytically, this new development goes beyond a structuralist conceptualization of ‘network structure as independent variable and behavior as dependent variable’ towards a view of structure and action as being co-dependent; effectively, the quantitative counterpart of symbolic interactionism (Prus 1987, 1996).

Separating selection from influence
The paper by Steglich et al (2004) represents an early contribution to this third wave. Their interest is in understanding the social processes that eventually lead to ‘network autocorrelation’ – the phenomenon that in human groups over a period of time sub-groups will form, identifiable by social or cultural characteristics, for example friendship or playing football, respectively. The substantive issue addressed by Steglich et al (2004) is whether network autocorrelation in adolescents’ smoking or drinking groups is the result of the processes of influence or selection. By ‘influence’ we mean: a person adopts the cultural behavior of a friend who is already aligned to a social sub-group, e.g. smokers or drinkers. By selection we mean: a person already has a cultural behavior and joins a sub-group who share that behavior.

The core of the matter is an attempt to understand the interactions between the social world as defined by relationships of friendship and the cultural world as defined by the (consumption) behaviors of smoking and drinking alcohol. Whether selection or influence is the dominant process connected to specific consumption behavior has been the subject of a contested research debate (see, for example, Kirke 2004). With reference to the policy stream
outlined above, determining whether selection or influence is the dominant process has obvious implications in terms of interventions.

The ontological and methodological interest of the paper can be described as follows. The Steglich et al paper builds on the SIENA (Simulated Investigation for Empirical Network Analysis) program, of which one use is the analysis of repeated data (longitudinal and dynamic) on complete social networks. ‘Complete’ means that all members of some population are connected by a universal relation, e.g. in a school, ‘all students in year 9’ defines a complete network.

Snijders (2006) offers this overview of SIENA:

“The basic approach used by SIENA for modeling network dynamics is an actor-oriented model, in which it is assumed that the social actors who are represented by the nodes in the network play a crucial role in changing their ties to other actors; in the case of associated behavior dynamics, also in changing their behavior.”

By using this model, collecting the relevant network and behavioral data, and performing the statistical analysis, it is possible to test for the underlying process driving the network-behavior dynamics. For example, in the case of adolescent smoking and drinking: Is selection or influence the dominant process?

As exemplified by Steglich et al (2004), the elements of the model are:

- Network members or actors—the nodes—characterized by behavioral attributes, such as (non-)smoking. In addition to these behavioral variables under direct investigation, data is gathered on actor-based exogenous co-variates such as gender and intelligence. That is, co-variates that are constant or relatively constant over the time period of the investigation.
- Directed relationships between pairs of network actors operationalized as dichotomous variables, e.g. friendship. Dyadic co-variates can be specified, e.g. students belonging to the same registration class.
- Typically, these network-behavior variable sets should be populated by at least three waves of data collection—network panel data. This contrasts with more traditional longitudinal studies in which data is collected at two time points.
- The co-evolution of network structure and behaviors is understood as arising from two types of actor decisions (independent in the paper under discussion). Network decisions are relational, that is, creating or breaking a tie with any other actor in the network. Starting or stopping smoking is an example of a behavioral decision.
- These decisions are modeled as being the results of myopic optimization by each actor of an objective function that includes a random term reflecting unexplained preferences and changes. This approach implies that the central model components will be the actors’ preferences and their behavior; the myopic nature of the optimization implies that the model represents the preferences that actors seem to have in the short term.” (Steglich et al 2004, pp. 4-5). The logic of this statement (justified by references) generates two types of decision dimensions: occurrence and decision rules.

◊ Occurrence is modeled by network and behavioral rate functions—respectively, these represent the differential opportunities that actors have to change their network ties and their behaviors.

◊ The decision rules require lengthy explanation. To be brief. With reference to the above quote, actors are modeled as myopic in having both relatively restricted global network information and the potential for action. In addition to these limitations, actors are postulated as ‘calculating’—modeled as utility or gratification functions. Crudely, actors ‘choose’ from a menu of 19 network and 11 behavioral options so as to optimize satisfaction. As the authors write: “This endogenous part is the crucial element of the models proposed, and to our knowledge the only technique developed so far for data analysis of co-evolving dynamic networks and behaviour.” (Steglich et al 2004, p.10).

- After formalizing the above set up and classifying it as a continuous time Markov process, relevant data can be analyzed to test hypotheses about, say, the underlying processes of network-behavior co-evolution.

In summary, the model has both the conceptual power to represent the network dynamics of the interaction between structure and behavior and also the analytic tools capable of identifying the underlying processes determining those dynamics.

THE SOCIAL NETWORK TRADITION IN CONSUMER RESEARCH

One of the original drivers for the development of social network analysis was the recognition of the limitations of both under- and over-socialized conceptions of human group life. For example, in the neo-classical economic model individual actions are characterized by actor independence. At the other extreme, in rigorous forms of structuralism, behavior is determined by structure and the possibility of agency disappears. In contrast, Consumer Culture Theory (CCT):

“… refers to a family of theoretical perspectives that address the dynamic relationship between consumer actions, the marketplace, and cultural meanings.” (Arnould and Thompson 2005, p.868)

This ‘real world’ orientation of CCT is reflected not only by Steglich et al (2004) but also in the tradition of ‘small world’ research initiated by Milgram (1967). The empirical focus is on what people actually do in everyday situations— for instance, passing on a package to a contact. This orientation stands in marked contrast to laboratory experiments in social psychology and much consumer research.

Hence, in comparing and contrasting the contribution of Steglich et al to the body of consumer and related marketing research outputs the following selection criteria emerge:

- the substantive concern is with group structure and interactions in non-laboratory, i.e. real world situations (cf ethnomethodology);
- reference to social processes, e.g. influence, especially word-of-mouth;
- studies consider changes in social structure or behavior;
- studies are longitudinal;
- social network analysis is the main methodological approach.

The above record indicates the low incidence of network consumer research. However, classification issues were apparent in that, for instance, Ward & Reingen (1990) appears under 3 different headings. It is likely that JCR Subject List contains other relevant papers not listed under the network rubric. Post 2003, Cotte & Wood (2004) is a case in point as the authors use network theoretic terms, dyad and triad, although without employing social network analysis (SNA).

Critical reading of the JCR papers against the selection criteria resulted in a drastic reduction in the number of eligible papers. There were notable exclusions that on a superficial scan would have been included. Although rich in terms of networks dynamics, Frentzen and Nakamoto (1993) was rejected on account of its simulated nature. Frentzen and Davis (1990) uses sociometric (dyadic) data but was excluded because it does not investigate the dynamics of group interactions as a whole. Further, a large number of papers on reference groups were excluded because the research was conducted within very different paradigms from that under review.

For the remaining papers, the next search stage consisted in noting citation impacts and following through on JCR reference and other database (EBSCO) citations. This method produced the following sample of papers suitable for comparison and contrast with Steglich et al (2004). No claim is made for exhaustive representation. In addition to assessing the general prevalence of SNA in consumption research, the other main intention was to generate a set of exemplar papers focusing on the processual group dynamics of cultural behaviors and social structure. Brief reviews of the selected papers are now presented.

**Stafford (1966)**

The neglect of Stafford’s paper on “Effects of Group Influences on Consumer Brand Preference” is testimony of the general neglect of consumption dynamics research. Stafford pioneered some of the essential elements for investigating the interactions between group structure and behaviors in the sociometric tradition. Stafford investigated the variation in brand loyalty within 10 groups, with membership approximately 4 women, in respect of group cohesiveness and leadership–operationalized through ratings of friendship, communication and expertise. The study generated tentative conclusions. These are comparatively unimportant compared to the methodological interest. An additional point of interest is the reference to Markov techniques used by Steglich et al (2004). The reference is in part to Frank Harary, a major figure in the development of SNA in this period.


After Stafford’s pioneering effort, the literature search failed to identify any significant network consumer research until Peter Reingen’s considerable contributions over a period of just over ten years. Post-Reingen, there has been another fallow decade. It appears that apart from the work of Reingen, Dawn Iacobucci and Kent Grayson, network approaches to consumer research are few in number.

In keeping with SNA developments then current, Reingen at al (1984) provides a snapshot of the congruence between brand choices and social structure in a sorority in a South-Western University. Despite its static approach to structure and behavior, the study features concepts foundational to the analysis of dynamic networks. The authors rightly record their advances on, for example, Stafford (1966): “… previous studies have not systematically examined types of social relation and basic structure, and their methodologies have been found to be suspect …” (Reingen et al 1984, p.781). From its citation record, Reingen et al (1984) appears to have little impact on the use of SNA in consumer research. However, citing authors have taken up the relationship/relational theme that is at the centre of the network paradigm: culture and cognition (Roth and Moorman 1988); the Black extended Family Network (Cohen and Kaufman 1992); power (Mallalieu and Faure 1998), and consumer-consumer relationships (Grayson and Iacobucci 1999).

Brown and Reingen (1987) explored network word-of-mouth referral. This work is more dynamic than Reingen et al (1984) in so far as it considers stages in the referral process–necessarily requiring a time dimension. Thus, it is more akin to diffusion studies than the dynamic interplay of structure and behavior. Indeed, the transactional or transitory character of some referral links is central to the paper in the analysis of relative impacts on weak and strong ties. Further conceptual interest takes the form of the analysis of interclique information flows, of which a more general treatment is awaited in the consumer behavior literature. Whilst indicating that their paper addresses shortcomings in the understanding of diffusion phenomena at the micro and group levels, the authors call for “… future research with a focus on … applying tools characteristic of the “social world” rather than the “structural” tradition of network analysis.” (Brown and Reingen 1987, p.361).

Ward and Reingen (1990) provide insights into the impact of social structure on interaction patterns at group and sub-group levels and the consequences for individual beliefs. The dynamic orientation is clear, even though only two data points, separated by 10 days, are used. This paper represents a methodological development on previous work. It also extends knowledge on the correspondence between brand selection and socio-cognitive structure–particularly into providing a more finely grained analysis of intra- and inter-subgroup characteristics.

As indicated by this literature review, Reingen’s final contribution to consumer network research is represented in the set of three papers published in 1996. Moreover, after this date there appears to be no significant developments in research concerned with the dynamical interplay between social structure, culture and the actions of individuals.

Chandrashekaran et al (1996) is an extensive reworking of the data from the Ward and Reingen (1990) study. The authors supply a very clear articulation on the uni-directional conception of structure-determines-action dynamic. “We explore how the group’s social structure directs the flow of influence within and between cohesive subgroups residing within the larger group of decision-makers.”

In this brief review, it is not possible to do justice to the sophistication of Sirski, Ward and Reingen (1996). In using a mixed method–ethnography and social network analysis–the authors return to archetypal studies of the 1950s (e.g. Bott 1955). Their study also shares more characteristics with Steglich et al (2004) than the
papers reviewed above. Notably, the authors state: “We propose a different perspective that treats neither the group nor the individual as the primary unit of analysis but rather examines how intracultural variation in causal reasoning about consumption behavior is explained by individual, social and cultural variables.” (Sirs et al 1996, p.346).

Ward and Reingen (1996) is a complementary paper, further developing the conceptual framework in terms of intermeshing networks, e.g. cognitive-cultural and social-cognitive networks. These papers mirror the state of knowledge then current both in the theoretical development of SNA and its applications. Given the potential of Sirsi et al (1996), it is puzzling to record that the paper has zero citations in the EBSCO database.


Dawn Iacobucci’s edited volume, *Networks in Marketing* (1996), can still lay claim to being the definitive work linking the respective disciplinary fields. Iacobucci has a distinctive place in this review as she holds an eminent position both in SNA and consumer research. Consumer research is well-represented in the edited edition. The paper by Bagozzi et al (1996) is structuralist in orientation. However, the authors suggest how knowledge of the socio-cultural patterning of re-cycling could be used to formulate a social marketing program—thus proposing a dynamic intervention, testable through further application of SNA.

The contributions to *Networks in Marketing* by Martin & Clark (1996) and Grayson (1996) are via the network relationship paradigm rather than SNA. Qualitative approaches to network relationships have been advocated (Lazega 1997) and Grayson has made further contributions in this respect (e.g. Grayson 1995; Deighton & Grayson & Iacobucci 1999). Perhaps the gradual dominance of the Relationship Management paradigm from the mid-1990s onwards accounts for the stagnation of SNA in consumer research. Somehow, relationships are understood as being ‘soft’ and SNA is perceived as being too positivistic. That such polarity—if it does indeed exist—is unnecessary features in one of Grayson’s papers: “Consumer influence is arguably most interesting when it is most protracted and subtle: when it is most seductive. This article has dealt with a class of influence phenomena that may require a time scale of the order of months or years to unfold, may demand a less psychological, more sociological lens with which to be observed, and would tax the ingenuity of an experimentalist to reconstruct in the laboratory.” (Deighton & Grayson 1995, p. 673)

The quote also emphasizes some of the key themes of this paper, the importance of time; sociological principles of structure; and real-world research settings.

*Networks in Marketing* concludes with a paper, jointly written by Iacobucci, in which multi-levels of relational phenomena are discussed. In considering analyses at the actor, dyad, group and network level, Iacobucci and Zerrillo (1996) mirror the then current advances on the set of p* analysis techniques for identifying, probabilistically, the underlying social process leading to a known structural configuration (see, for example, Wasserman & Pattison 1996). The chapter also mentions that “Other dynamic phenomena are easily modeled …” (p. 401). Once again, an observer is left pondering as to the developments of these issues in consumer research.

**SUMMARY FINDINGS & PROSPECTS**

Table 1 shows the findings of the critical literature review of the selected papers evaluated against Steglich et al (2004). First, the table indicates the dearth of consumer network research. Second, coupled with the brief descriptions above, we suggest our analysis demonstrates that this new way of modeling the co-evolution of structure and behavior in groups offers a potentially powerful method for consumer researchers.

Steglich et al (2004) offer a challenge to the existing consumer literature on reference groups. However, the converse is also true. We briefly explore the possibility for mutual learning by examining the papers by Escalas & Bettman (2005), Rao & Steckel (1991) and the much cited Bearden & Etzel (1982). Because they do not investigate group dynamics, these papers did not fit the previous selection criteria. Yet, for current purposes, they provide a nice counterpoint since they span a period of over two decades and work with different conceptions of ‘group’.

This difference is important since in considering the relative strength of influence and selection in adolescent substance use, there is an underlying issue of group membership as compared with reference group affiliation. And here we see one of the limitations of the Steglich et al (2004) actor-based model, as being restricted in its levels of analysis: for example, inter-group interactions require recognition and then linking with p* analysis. Given that Rao & Steckel (1991) use utility functions in connection with individual and group preferences to study group polarization, the question arises as to whether or not this method can be meshed with Steglich et al (2004) to investigate both inter and intra group polarization and stability over time. Also, given that the endpoint of network autocorrelation for some adolescent substance users is hardcore drug use within tight-knit groups, interventions based on better understanding of group polarization and stability have potentially important applications.

Bearden & Etzel (1982) and Escalas & Bettmen (2005)—and, no doubt, many intervening papers—have the potential for adding to the knowledge framework of network consumer dynamics. For, although these papers are cross-sectional, they do generate a number of robust categories that could form the elements of dynamic processes. Both papers provide polar differentials that form the basis of decisions, e.g. private-public; luxury-necessity; and ingroup-outgroup. Taking forward these concepts, nuanced within the papers, in dynamic socio-cultural settings promises to be an interesting and rewarding exercise for Transformative Consumer Research and CCT.

Finally, we return to consider both substantive and research issues. In respect of substance use, the term ‘subculture of consumption’ has validity. Steglich et al (2005) hint at the potential of their model to identify dynamic trends in subculture formation. But of course, within the consumer research literature there already exist exemplar works, most notably, Schouten & McAlexander (1995). Informally checking this paper against the criteria of Table 1 establishes a good level of agreement—apart from the use of SNA. Given that although the econometric basis of Steglich et al (2004) provides us with a powerful analytic method, it also suffers from the general lackness of quantitative approaches, linking this paradigm with an ethnographic approach should prove particularly fruitful in understanding drug and other subcultures. Sounds rather like the point Peter Reingen reached in 1996!

**REFERENCES**


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EXTENDED ABSTRACT
How do the seemingly unrelated elements of the primitive, technology and horror come together to produce new identities and conceptions of life in marketing communications? Are all advertisements, which produce a type of “anti-aesthetic”, unintentional mistakes on the part of the producer and repellent to the visual consumer, as dominant interpretations of advertising would suggest (Shimp et al. 2004)? This paper argues that marketing images can present the consumer with an ambivalent visual encounter, one in which the very notion of the aesthetic is thrown into question. Some research in marketing has recognised the fascination and dread, the marvel and the horror that encounters with such images produce (Schroeder and Borgerson 2003; Toffoletti 2003; Goulding, Saren and Follet 2003). Many of these images incorporate a strange blend of the primitive, technology and horror, integrating themes of pre- and post-modernity, science and sorcery, progress and decline. This paper argues that such “strangeness” has led to the production of an aesthetic which combines the seemingly contradictory elements of the primitive, technology and horror to produce alternative paradigms of life—and new identities—in an age of technoculture.

The paper first considers the role of technology in disrupting “human” being and creating phenomena for which traditional discourses find it difficult to account. We are at a time in history when our acquired perceptions of the subject are being radically questioned, especially by new technologies (Braidotti 1994, Braidotti 2005). According to the feminist philosopher Rosi Braidotti, we live in the times of the “postmodern Gothic” (2005:173) where the social imaginary of post-industrial societies produces teratological, monstrous formations—monstrous precisely because their technological character transgresses conventions of taxonomical description.

We then discuss the interrelations of the primitive, technology and horror. Technological progress is not a force that is unique to modern “civilised” society; it is intimately bound with art and antiquity—the primitive and the technological arise from the same logic (Heidegger 1977). Further, many subcultures of high technology incorporate primitive icons of shamanism, esotericism, the occult and mythology into their philosophies, exhibiting a strange aesthetic of “technological primitivism” (Davis 1999; Kozinets 2001). Horror is sometimes conceived of as a liberatory, avant-garde, or even postmodern genre because its function is to disturb cultural and ideological categories we may have taken for granted, leading, like technology and the primitive, to a sense of ambivalence (Carroll 1990; Halberstam 1995). Illustrative examples of images and figures in marketing communications that stage the primitive, technology and horror are then presented. Here, ambivalence and liminality become manifest. We argue that postmodern perspectives of biology may provide a useful way for thinking about existence in a technocultural era. Biology as the science of life and the study of living organisms has been extremely influential in shaping the borders of existence—where life begins and ends. The idea of postmodern biology offers an alternative perspective of the subject in late modernity. Contemporary theorists such as Gilles Deleuze and Felix Guattari (2004) and Scott Lash (2001), as well as literary writers such as John Updike and William Burroughs, and film directors such as like David Cronenberg have attempted to invent paradigms of life in the interstices of the organic and machinic. What is created is a type of “posthuman biology”, with the potential to demonstrate that concepts such as “biology” and “anatomy” are not essential, a priori categories, but are themselves products of technoculture (Shaviro 1995:38). This leads to a paradigm of life where “no objects, spaces, or bodies are sacred in themselves; any component can be interfaced with any other if the proper standard, the proper code, can be constructed for processing signals in a common language” (Haraway 1991).

We use poststructural literary and film criticism to analyse in detail Audi’s 2005 advertisement Spider, relating its visual aesthetic to the film work of Ridley Scott and David Cronenberg. Drawing on the literary work on dirt, horror and abjection by Mary Douglas, Julia Kristeva and Judith Halberstam, we present how the technocultural imagination can be identified in the forms of horror it produces.

We contend that this advertisement combines elements of the primitive, technology and horror to introduce alternative ideas about identity, Metamorphing and primal technology emerge as important concepts in this advertisement. When something transgresses its boundaries, such as the ‘morphing’ spider-machine we see in this advertisement, it horrifies because it undermines conventional binary constructs and the natural humanist order. Both Donna Haraway (1997) and Rosi Braidotti (2005) have noticed how contemporary technologies have caused many systems, objects and bodies to exceed their boundaries—the “gene”, the “ecosystem”, the “database”, the “cellular automaton” or the “computer” seem unncategorisable, unbounded, difficult to capture, a symptom of the western era of high-technology. Further, in the Spider advertisement, the viewer is encouraged to contemplate a seemingly paradoxical scene of technology as a primal, instinctual force, something which seems to contradict and undermine its signified “progress through technology”. Primal technology implies that technology is not a sterile, inanimate instrument that the human has mastery over. Rather, the dirt and dampness of primal technology suggests an animate, sweating, breathing life-force; a concept which works to disrupt our normal, humanist instrumental perspective of technology.

This paper highlights how concepts in science and technology are used in philosophy and literature, and drawn into visual texts such as film and advertising. We conclude that “darker” advertisements not only disrupt advertising convention, they inaugurate a new kind of ambivalent aesthetic, one deserving of further study. Sometimes in visual culture we are presented with concepts that disrupt the classic humanist view of technology associated with progress, the primitive with pre-technology, horror with fear. This can result in the production of entities which are “ontologically confusing” (Haraway 2000). Spider collapses the ancient into the high-tech, reflecting attempts in the cultural imagination to understand technology in a longer line of forces and fantasies in the cultural imaginary.

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