Parasitism and Internet auction fraud: An exploration

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Abstract

Most research on Internet auction fraud focuses exclusively on the relationship between the con-artist and victim. However, the con-artist and victim are situated in an ecology comprising the auction house, police, and auction community. This paper employs the ‘parasite’ metaphor as a way of building theory about Internet auction fraud. We begin by describing the parasite metaphor. We then introduce three theories from the parasitism literature and demonstrate the insights these theories can produce. The first theory, the competitive exclusion principle, highlights how separate auction markets evolve their own species or types of fraud. It also warns us that fraud elimination may be neither desirable nor feasible relative to constraining fraud to acceptable levels. The second theory details various parasite infection mechanisms to show that on-line fraud is composed of two processes; the actual deception and escape. Finally, virulence theory provides one way to predict how much harm a particular kind of fraud will cause to an individual victim. Virulence theory is also used to suggest that the auction infrastructure encourages low virulence vis-à-vis other kinds of fraud like Nigerian letter fraud.

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1. Introduction

Internet auctions are among the most celebrated and successful new business models of the emerging knowledge economy (Kambil & Heck, 2002). eBay, the largest Internet auction house, has experienced exponential growth in customers, number of items sold, and gross merchandise sales since its incorporation in 1996 (eBay Inc, 2005). However, the rise of Internet auctions has also led to the rise of Internet auction fraud. Internet auction fraud is the most pervasive form of Internet fraud (National Fraud Information Center, 2007; National White Collar Crime Center, 2005). Indeed, Internet auction fraud has literally grown in lockstep with the growth of Internet auction markets. Fig. 1 charts this relationship, cross-indexing three measures of growth in the (by far) largest Internet auction site against the only systematically collected statistics on Internet auction fraud. The correlation between these measures of growth and auction fraud range from 0.89 (items sold vs. auction fraud) to 0.94 (no. customers vs. auction fraud).

That Internet auction fraud is so prevalent is worrisome, especially as Internet auctions rely to a great extent on trust. While existing work has highlighted some important concerns about Internet auction fraud, the problem largely remains unsolved. Novel perspectives are therefore warranted to challenge and refine existing theory.

This paper explores the use of the biological parasite as a metaphor for Internet auction fraud. In using the metaphor, we draw upon three theories of parasitism: (1) competitive exclusion, (2) parasite invasion mechanisms, and (3) virulence theory. We explore how

![Fig. 1. Growth in eBay transactions and fraud. (a) Growth in customers per year – eBay. (b) Items sold per year – eBay. (c) Gross merchandise sales per year – eBay. (d) Fraud complaints to the IFCC/IC3. (The IFCC/IC3 was formed in mid-2000. Formal statistics for the period before this are unavailable.)](image-url)
each of these theories offers novel insights into auction fraud that are consistent with existing evidence.

We contribute to the literature in two main ways. First, we introduce parasitism as a metaphor. We argue that the metaphor sensitizes the researcher to a number of phenomena in Internet auction fraud that researchers have heretofore ignored. For example, we demonstrate that fraud is indicative of a healthy market. Second, we introduce three theories from the parasitism literature and demonstrate their utility in Internet auction fraud. The competitive exclusion principle suggests that fraud in separate auction markets can take distinct forms. This consequently implies that managing fraud requires a more nuanced approach than simple prosecution. The theory of parasitical infection mechanisms reveals that deception involves not only trickery, but escape. Finally, virulence theory is used to demonstrate natural, self-governing bounds on the amount of damage Internet auction fraud con-artists typically do.

The paper proceeds as follows. Section 2 reviews existing research on Internet auction fraud. Section 3 then discusses the potential usefulness of ecological views to the Internet auction fraud problem. Section 4 adapts the views of Section 3 to introduce the parasite metaphor. Section 5 presents our research methodology, the results of which are presented in Section 6. Section 7 concludes the work and discusses limitations.

2. Current research directions

Most work focused on Internet auction fraud relies primarily on three methodological bases: (1) economic modeling, (2) analyses of auction listings, and (3) legal analysis (Wood, 2004).

2.1. Economic modeling

Economic modeling research employs mathematical models to design better auction systems or demonstrate the effectiveness of various kinds of auction mechanisms. For example, research has suggested ways to reduce fraud via economic incentives and certificates (Ba, Whinston, & Zhang, 2003), bidding strategies (Bhargava, Jenamani, & Zhong, 2005; Sinha & Greenleaf, 2000; Wang, Hidvegi, & Whinston, 2002), and escrow (Hu, Lin, Whinston, & Zhang, 2004).

The main limitation of mathematical models is they do not capture all the subtleties of real auctions. For example, Hu et al. (2004) assume that escrow services are perfect trusted third parties. However, real-world escrow has numerous limitations. Escrow allows a buyer to renege on a deal by claiming that a product was not what was expected; or worse, buyers can falsely declare that a good was not received.

2.2. Analyses of auction listings

Substantial research has employed auction listings as a primary data source. Most of this research studies the relationship between trader reputation (measured by on-line reputation score) and others’ willingness to trade (Ba & Pavlou, 2002; Gregg & Scott, 2006; Macinnes, 2005; Melnik & Alm, 2002; Resnick, Zeckhauser, Friedman, & Kuwabara, 2000; Resnick, Zeckhauser, Swanson, & Lockwood, 2004; Standifird, 2001). Other work has been done on shilling (Kauffman & Wood, 2005), certification
mechanisms (Dewally & Ederington, 2002)\(^1\) and psychological contracts (Pavlou & Gefen, 2005).

The main limitation of auction listing research is its reliance on single sources of empirical evidence. Deception is key to auction fraud, and numerical data on auction listings often tell an incomplete story. For example, research suggests that positive reputation scores signal greater trust, while negative ones signal distrust (Ba & Pavlou, 2002; Bakos & Dellarocas, 2002; Melnik & Alm, 2002; Resnick et al., 2004; Standifird, 2001). However, reputation scores can be artificially inflated, or otherwise disguise con-artists’ true reputations.

2.3. Legal

Legal research on Internet auction fraud typically suggests ways governments can impose regulation on auction sites to reduce Internet auction fraud. Generally, arguments in this stream have the following logic: fraud occurs on Internet auctions, the Internet auction houses are not doing much to stop fraud, therefore, governments must impose regulation.

As one example, Snyder (2000) argues that governments should make auction houses liable for fraud because they are in the best position to stop it. Similarly, Bywell and Oppenheim (2001) suggest that Internet auctions are sufficiently distinct from existing auctions that new laws should be imposed. Finally, Lansing and Hubbard (2002) propose alternate dispute resolution mechanisms to settle problems between buyers and sellers.

However, many suggested proposals, such as forced authentication of users or alternate dispute resolution, are prohibitively costly and operationally impractical. Even when such measures are implemented, con-artists develop alternate tactics to circumvent them, such as using a stolen credit card to create a false identity.

Moreover, there is no guarantee that imposed regulation or governmental bodies will be more effective. Internet auctions are a global phenomenon, and issues of legal sovereignty and distinctions between countries inhibit efforts to identify and prosecute fraud (Jarvenpaa, Tiller, & Simons, 2003). Moreover, many proposed methods, such as mandatory credit card authentication, do not work in international environments. Traders from third-world countries often do not own credit cards. Given that a significant proportion of auction crime originates from third-world countries, it is important to consider their special characteristics.

In fact, for modern Internet auction crimes, recourse to the legal framework is often worthless. The criminal is often unable to perform restitution even when prosecuted (US Postal Service, 2002). Also, in both wealthy and impoverished regions, regulatory agencies often do not have sufficient resources to address auction fraud. As such, it is understandable that police forces prioritize violent crimes and few auction fraud criminals are caught and charged (Dolan, 2004).

2.4. Summary

In summary, existing research provides much insight into Internet auction fraud, identifying various strengths, limitations, as well as proposals for addressing those limitations.

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\(^1\) In shilling, a confederate of the seller pretends to be a bidder to up the final sale price. Shilling allows the seller to capture all the consumer surplus of the winning bidder and is not condoned by most auction houses.
However, methodological biases in current research emphasize specific aspects of the phenomena while ignoring others. Thus, policy recommendations ignore cost, while infrastructure recommendations are based on incomplete assumptions of the auction market or data that is not wholly reliable. Thus, existing research enables a deep understanding of specific aspects of fraud, but fails to embrace its full complexity.

As such, it is important to find new ways of studying Internet auction fraud in a holistic manner that broadens the empirical focus beyond the dyadic transaction between buyer and seller. An examination of how con-artists and traders interact in the comprehensive Internet auction environment may extend previous perspectives. A holistic view is especially important given that Internet auction fraud remains a large, and effectively unsolved, problem.

3. Ecological views of Internet auction fraud

Ecological views of Internet auction fraud are one potential holistic perspective of the fraud phenomenon. In ecological views, the unit of analysis (often organizations or individuals) is perceived as inhabiting a particular environment.

3.1. Ecological views

The use of ecological views is not new to organizational research (Astley, 1985). Ecological views appropriate concepts from the study of living organisms in their environment (i.e., ecology), and how living organisms change over time (i.e., evolution). Views employed include survival of the fittest (Darwin, 1872), punctuated equilibrium (Eldredge & Gould, 1972), colonial organization (Porra, 1999), and population genetics (Wright, 1932).

3.1.1. Survival of the fittest

The survival of the fittest view appropriates natural selection (Darwin, 1872) to examine changes in organizations, projects, or individuals across time in response to environmental variation. One key assumption in this view is that changes occur gradually throughout the organization’s, project’s, or individual’s life. Survival of the fittest models have mainly been applied to organizational ecology, which studies the growth and diversity of organizations over time (Dobbin & Dowd, 1997; Hsu & Hannan, 2005). However, it has been applied elsewhere, e.g., in studying bureaucratization (Schulz, 1998).

These models generally examine groups that move slowly towards some homogeneous state. In part, this is an artifact of the perspective (Astley, 1985; Gersick, 1991). Because researchers look for slow changes across populations, subgroups that change rapidly are defined as outliers in the population of study (Dobbin & Dowd, 1997). Unfortunately, auction fraud tends to adapt fairly quickly to changes in the auction environment.

3.1.2. Punctuated equilibrium

The punctuated equilibrium model has been applied both at the organizational level and at the organization population levels of analysis. When applied to organizational transformation, the model suggests that organizations go through stable times followed by periods of radical change. When applied to populations of organizations, the model suggests that mutations in organizational characteristics will lead to the proliferation of
populations of best adapted forms and the extinction of others. In both cases, effective adaptation into the local environment is the key to survival and prosperity (Gersick, 1991). Punctuated equilibrium has been applied to explain numerous phenomena such as how organizations or industries undergo sudden rapid change (Sastry, 1997; Street & Meister, 2004), how the behavior of project groups rapidly changes across time (Chang, Bordia, & Duck, 2003), and the relationship between systems analysts and users (Newman & Robey, 1992).

3.1.3. Colonial systems

The colonial systems view (Porra, 1999) attempts to explore characteristics of sustainable social groupings formed by one or more individuals. The phenomenon of interest is treated as a colony, where members of the colony share common ideals and goals and cooperate to achieve these. Colonies create off-spring by dividing themselves into sub-colonies, which mutate (Ives, Parks, Porra, & Silva, 2004; Porra, Hirschheim, & Parks, 2005). Sub-colonies that best adapt to their local environment survive (Porra & Parks, 2006). Colonies can change gradually and slowly over their life-times (survival of the fittest). Or they can change radically over generations by dividing and mutating (punctuated equilibrium) (Porra, 1999).

3.1.4. Population genetics

The population genetics view attempts to understand organizations, projects, or individuals’ strategies in relation to others in their environment. The focus of population genetics research in organizations is the eventual outcome of a set of circumstances or stable equilibria which accommodate different species/actors. In contrast, the other views focus more on the process as an ecology changes over time.

Evolutionary game theory (Smith, 1982) is perhaps the best exemplar of the population genetics view. Evolutionary game theory attempts to determine the optimal strategy for an individual, project, or organization, given a set of circumstances. Often, separate strategies are optimal, depending on the percentage of the population that plays a particular strategy.

As a primarily economic model, evolutionary game theory is used to establish mathematical models for exploring real-world phenomena. Such models apply not only to business, but other domains, including biology (Riechert & Hammerstein, 1983) and crime (Cohen & Machalek, 1988; Vila & Cohen, 1993). Comprehensive reviews of evolutionary game theory are available (Mailath, 1998; Samuelson, 2002; Vanderschraaf, 1999).

3.2. Limitations of existing ecological views

Given the flexibility of the ecological view, it is likely to provide insights to Internet auction fraud. Survival of the fittest models suggest con-artists face little competition, but do adapt to the auction environment. Punctuated equilibrium models suggest that such adaptations are rapid. Colonial systems models are useful given that cooperation has been observed in groups that fight fraud (Chua, Wareham, & Robey, 2007). The formal modeling of population genetics is useful for predicting how fraud evolves.

However, several adaptations to the ecological view are necessary. Survival of the fittest, and punctuated equilibrium models generally assume the population under study competes for the same resources. In Internet auction fraud, victims are the resources of
the con-artist. Similarly, many con-artists work alone, and thus are difficult to analyze using colonial systems. Finally, population genetics models focus mainly on pairwise tournaments between individuals adopting competing strategies (Mailath, 1998; Samuelson, 2002). However, most frauds involve a con-artist and a victim who do not compete in strategic interactions.

4. Towards a parasite metaphor

Viewing the world in a particular way is both necessary and dangerous in research. Research is fundamentally about finding patterns and organizing reality. The identification of patterns relies very much on how one views the world (Morgan, 1980). However, a view also constrains the researcher by encouraging him or her to see some things, while ignoring others. As widely respected biologists Eldredge and Gould note (1972 p. 82):

> The expectations of theory color perception to such a degree that new notions seldom arise from facts collected under the influence of old pictures of the world. New pictures must cast their influence before facts can be seen in different perspective.

This paper uses the technique of metaphor, specifically that of the parasite, as an interpretive lens to analyze data. Metaphor is especially suitable when the subject of inquiry is poorly understood; it analyzes the unfamiliar by drawing comparisons with the familiar (Hatch, 1997; Morgan, 1986). Metaphors encourage different ways of thinking (Tsoukas, 1991). They enable the compression of complex meanings into simple phrases (Srivastava & Barrett, 1988), and can enable different perspectives (Sackmann, 1989) thereby leading to a broader understanding of a phenomenon.

However, metaphor must be used with caution, because the comparisons made can be inappropriate (Hatch, 1997; Pinder & Pourgeois, 1982). Also, as they often possess less conceptual granularity, metaphors are better for young scientific fields (Tsoukas, 1991).


Given the need for a fresh understanding of Internet auction fraud, we believe metaphor is a legitimate tool for inquiry. The analogies drawn by the parasite metaphor are relevant because parasitology researchers share a number of problems with Internet fraud researchers, specifically:

- **Direct observation of the living parasite/active criminal is difficult.** Often, clues concerning the parasite/criminal are only inferred through ‘disease’ symptoms, and through observations of the host ecology. Occasionally, direct observation of the parasite is possible, but is performed in constrained circumstances such as a post-mortem of a patient. In rare cases, a living parasite is cultured from host tissue. However, the parasite's lifecycle or activities cannot be observed when isolated from the host.
- **Observation is tempered by intervention.** The scientist observing a parasitic infection/criminal behavior cannot passively observe, but is ethically obligated to intervene.
• **Process is as important as variance.** Most auction fraud research is based upon variance theories, where the change in one variable or construct is predicated upon changes in other variables or constructs. However, other theories such as process theories that explain and predict sequences of events, are useful for Internet auction fraud (Markus & Robey, 1988). The parasite life-cycle, or the modus operandi of a criminal are process theories.

It has been suggested that the effective application of metaphor requires the transformation from the metaphor to the thing being studied at three levels (Garud & Kotha, 1994; Tsoukas, 1991):

- **Insight:** At the insight level, the researcher identifies parallels between some source (the metaphor) and the object of study. The researcher recognizes that the metaphor and the object of study simultaneously are similar and different. The goal is to ensure the metaphor has sufficient power of imagery that it offers a novel view of the object of study (Morgan, 1986). The researcher therefore, must ensure similarities and differences between the metaphor and object of study are balanced (Morgan, 1980). The two cannot be too dissimilar, else no comparison can be obtained. Yet the two cannot be too similar; otherwise the metaphor will not generate novel insights. As an example, a metaphor might be drawn between documents (the metaphor) and the Internet (the object of study).

- **Analogy:** At the analogy level, the researcher articulates some of the ways the metaphor and object of study are similar. These similarities between the metaphor and the object of study are further investigated to determine if they can achieve useful insights. For example, ‘data on the Internet is structurally similar to paper documents’.

- **Isomorphism:** Finally, at the isomorphism level, the similarities between the metaphor and object of study are explicitly mapped to become testable. For example, ‘Documents can be explicitly defined using the Standard Generalized Markup Language, so Internet documents should be defined in the same way (e.g., through XML)’.

4.1. **Insight**

We use the parasite metaphor to adapt the ecological view to Internet auction fraud. Parasitism always involves at least two actors, the host that the parasite invades, and the parasite itself. For con-artist parasites, the host is an individual Internet auction system like eBay or Amazon auctions. The traders, auction houses, supporting institutions (e.g., payment systems like Paypal, and delivery systems like the postal service), technology, and governmental authorities (e.g., the police) are organs, tissues, or specialized functions of the host. The police might be likened to the immune system, the auction house to the skeleton, etc. eBay or Yahoo auctions, etc. are thus not hosts. Instead, the entirety of eBay, including traders, servers, etc. is the host.

Like biological parasites, the con-artist invades tissues in the host to feed. Each variety of parasite targets individual organs or tissues. Thus, a con-artist who sells a non-existent product victimizes the ‘buyer’ organ, while one who pays with a bounced check victimizes the ‘seller’.
4.2. Analogy

At the analogy level, we attempt to articulate parallels between the metaphor and the subject of study (Tsoukas, 1991). We argue that con-artists who inhabit auctions behave like biological parasites, displaying three properties: residency, dependency, and harm (Matthews, 1998).

1. **Residency:** The parasite lives for an appreciable portion of their lives in or on the host. In a social context, the parasite can only be understood in terms of its social relationship to the host. Internet auction fraud meets this definition of parasitism, as most Internet con-artists are professional criminals (Kubic, 2001) and hence ‘live off their hosts.’ Some, like Jay Nelson, Anthony McEnroe, and Teresa Smith earned their living almost exclusively from Internet auction fraud (Cambanis, 2002; Federal Trade Commission, 2000; Mahoney, 2001). Others consider Internet auction fraud only one element of their crime portfolio. For example, the Deputy Assistant Director of the FBI Criminal Investigative Division noted that:

   Subjects engaged in one type of fraud scheme such as on-line auction fraud are frequently involved in other types of fraud schemes such as bank fraud, investment frauds and/or ponzi/pyramid schemes. (Kubic, 2001)

2. **Dependency:** The parasite is dependent on the host organism. When a biological parasite is removed from the host prematurely, the parasite dies. This renders parasitic behavior irrelevant when the host does not exist. Thus, auction fraud is highly specific to Internet auctions where the parasitic relationship is manifest.

3. **Harm:** The parasite must benefit and the host must suffer. From a social perspective, this means that the host must be a victim. Thus, perpetrators of ‘victimless crimes’ such as drug traffickers and prostitutes are not parasites, because their activities result in fair economic exchange, despite any negative social externalities. Note also that nominal suffering levels can be insignificant. A hacker who steals 1 dollar from an account is still a parasite.

Our use of the term ‘parasite’ is distinct from that employed as a casual metaphor in research. For example, economists use it to describe those who do not reciprocate gifts (Carmichael & McLeod, 1997), and firms that steal innovations from other firms (Carmichael & McLeod, 2000). In sociology, the term has been used for a category of villain roles such as gold-digger, pimp, kept woman, and extortionist (Klapp, 1956). In political science, special interest groups and guerillas have been assigned the label (Reynolds, 1995; Suarez, 2000; Wilson, 1985). Even researchers have been called parasites, especially when they study and exploit marginalized communities (Stone & Priestly, 1996).

When we employ the term ‘parasite,’ it must meet our three criteria of residency, dependency, and harm. Furthermore, we distinguish between harm to the host, and harm to the social ecology. Thus, we accept the possibility of beneficial parasites. For example, in Internet auctions, vigilantes disrupt the auctions of con-artists by bidding on fraudulent auctions and refusing to pay (Chua & Wareham, 2002). These vigilantes are parasitic as they harm the con-artists. Nevertheless, vigilante activities reduce the overall level of crime, and thus benefit the con-artist’s host, the Internet auction system. Finally, the casual metaphor is often employed to denigrate the ‘parasite’ and signal pejorative moral prejudice. Here, the parasite’s abilities are always studied in relation to how they enhance their
own success or failure. Thus, the casual metaphor might ascribe laziness to criminals who take more than they give to society. Our metaphor focuses more on the ‘lazy’ parasite’s ability to realize gains in a more efficient manner than ‘law-abiding’ hosts (Lewis & Mhlanga, 2001; McCarthy & Hagan, 2001). We attempt to avoid any pejorative moral prejudice.

We appropriate the biological terms ‘species’ and ‘niche’ to denote specific types of fraud. A biological niche is an \( n \)-dimensional space, each dimension representing an environmental condition or resource required by the species (Hutchinson, 1957). Possible dimensions include degree of warmth, availability of food, and availability of nesting sites. Biologists distinguish between fundamental and realized niches. A fundamental niche is the total range of possible environments the species could inhabit if there were no competing or predatory species. The realized niche is the range of environments the species actually inhabits. As each species has unique requirements, it is difficult to identify a niche a priori without first observing the species. This paper uses the term niche to denote the areas of the auction system affected by a given con-artist, where species connotes the specific type of fraud employed.

4.3. Isomorphism

To explore the effectiveness of the parasite metaphor, we adapt three theories from the parasite literature, one related to each part of the definition of parasites to determine whether they shed insight into Internet auction fraud. Table 1 maps each theory to its component in the definition.

4.3.1. Residency/competitive exclusion principle

The competitive exclusion principle is a theory of speciation and niche habitation in biological organisms. The competitive exclusion principle suggests that when two species of parasite invade a host organism, either one species will be eliminated, or more commonly, the two species will partition resources in the host organism between themselves (Gause, 1934). In other words, each species will occupy its own unique niche. Extended to auction fraud, the competitive exclusion principle suggests that different auction markets in an auction house will have their own unique types of fraud.

We used the competitive exclusion principle to examine differences between the two auction markets for which we had the most data, specifically, the laptop and philatelic markets. We reviewed our data on these two markets, cataloged the predominant strains of auction fraud and compared how the environment encouraged these strains to develop.

4.3.2. Dependency/parasite infection mechanisms

A parasite that invades an organism is a foreign body that the organism attempts to fight off. Biological parasites have developed a suite of mechanisms to overcome host

<table>
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<tr>
<th>Definition</th>
<th>Theory</th>
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<td>Residency</td>
<td>Competitive exclusion principle</td>
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<tr>
<td>Dependency</td>
<td>Parasite infection mechanisms</td>
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<td>Harm</td>
<td>Virulence theory</td>
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Table 1: Mapping of definition to parasite theory
immune systems. Here, we explore parallels between these biological mechanisms and auction fraud mechanisms and demonstrate that the metaphor reveals insights about the nature of deception.

In our study, we reviewed our qualitative data to catalog various species of fraud and how they worked (i.e., modus operandi). We then mapped these species’ modus operandi to the set of infection mechanisms described in Zimmer (2000).

4.3.3. Harm/virulence theory

Virulence theory is a model of infection that relates the amount of harm to the host to the parasite’s success. The parasite that causes too much harm kills its host, and thereby eliminates its own possibility of survival. In contrast, the parasite that causes too little harm fails to maximize available resources. We explore whether virulence theory can be applied as a model for how much damage con-artists do. To do this, we obtained published data on the rate of auction growth and reported incidences of auction fraud. Virulence theory provided support for analyzing the relationships between these two variables.

5. Methodology

Data for this study originates from a larger study of auction fraud initiated in 2002 and completed in 2005. Data on Internet auction fraud were obtained primarily from publicly available sources on Internet sites. We searched for the term ‘auction fraud’ on six sites: AltaVista, Google, and Yahoo (to identify web pages and articles), the eBay and Yahoo discussion forums, and Google groups. Snowball sampling (Kuzel, 1992) was employed to identify additional articles and postings using keywords associated with fraud. For example, as we learned more about the auction community, we searched using specific terms such as ‘Jay Nelson’ (a well known con-artist), ‘IFCCFBI’ (the Internet Fraud Complaint Center, now called the Internet Crime Complaint Center-IC3), and ‘escrow.’ Refinements in the search led to other sites and postings, such as the eBayExodus web ring (now defunct), fraud.org, AuctionWatch (an auction community), the On-line Auction Users Association (now defunct), and eSafe2Bid (an auction security software). Public documents included:

- **Web pages devoted to auction fraud.** These included official web pages such as those of the National Consumers League, as well as personal web pages of experienced traders who offered advice about fraud.
- **Bulletin board postings.** These included postings on the bulletin boards of major Internet auction houses (e.g., eBay, Yahoo), on UseNet news (archived on Google groups), and postings on bulletin boards of auction communities (e.g., On-line Auction Users Association, paypalsucks.com, AuctionWatch).
- **News articles.** Sources included general news outlets like CNN and The New York Times, and specialized sources such as PCWorld and CNet Central.

Most data originated from publicly available sources. Thus, a substantial portion of our data can be retrieved and validated through an Internet search employing the quoted text as a search string. In qualitative research, this form of measurement validity is referred to as ‘objectivity’ or ‘confirmability’ (Miles & Huberman, 1994, p. 278). Unfortunately, data gathered from websites and bulletin boards that are now defunct, or whose archives
have been erased, cannot be retrieved. Such data is available from the authors upon request.

Once these sources were exhausted, we posted requests for information to several electronic bulletin boards and newsgroups. Various people expressed interest in our work, and we arranged and conducted discussions on the forums. Respondents directed us to specific fraudulent auctions, which we then monitored to observe interference by community members. Finally, we conducted semi-structured interviews via e-mail with nine traders who observed or actively fought fraud. In all cases, e-mail interviews commenced after authors engaged traders in a bulletin board/Usenet discussion. The nine traders were willing to discuss auction fraud with the authors in private. We posed questions in an open-ended fashion that encouraged respondents’ elaboration. In some cases, individuals provided private documents describing interactions with con-artists and victims. Traders were generally well anchored in the community. Some, such as George Kopecky of the organization Stamp Collectors Against Dodgy Sellers, were active members of anti-fraud organizations.

While the number of interviewees in our sample is small, in keeping with the ecological focus of this paper, our data gathering methodology relied principally on triangulating information from multiple sources. For example, interviews helped us gather data from bulletin boards, or from actual fraudulent auctions. Similarly, bulletin board postings helped us frame interview questions. Thus, a substantial number of auction participants are represented in our sample. Auction participants participate in bulletin board postings, as members of auction-affiliated organizations, as interviewees in news accounts, and as official government sources.

Table 2 summarizes our data sources. Overall, more than 2000 documents were obtained. Documents ranged in type from individual bulletin board postings to web pages.

Each theory was applied as a lens on a pre-existing data set. The data was gathered as part of an overall study of auction fraud, portions of which have been published elsewhere (Chua & Wareham, 2002; Chua & Wareham, 2004; Chua et al., 2007). No additional data was collected specifically to support or reject any lens.

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<tr>
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<td>Source</td>
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<td>Auction watch</td>
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<td>Personal records of interviewees</td>
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6. Results

This section presents the three theories from the parasitism literature and applies them to our analysis of fraud data to demonstrate the insights these theories can produce.

6.1. Competitive exclusion

The competitive exclusion principle states that when two parasite species are in competition for an ecological niche, only one species prevails; the parasite that can most efficiently utilize the resources available in the niche (Gause, 1934). If two species coexist, resource partitioning must occur. The resources consumed by one parasite differ from those consumed by others such that the species occupy separate, clearly demarcated, niches. Competitive exclusion has been observed in a range of parasites, including paramecia (the original discovery) (Gause, 1934), lice (Reed, Hafner, Allen, & Smith, 2000), plasmodium (malaria) (Roode, Culleton, Bell, & Read, 2004), and fungi (Hood, 2003).

While no two species can coexist within a niche, the competitive exclusion principle allows niches to be occupied by disparate parasites over separate time frames. For example, non-drug resistant strains of Plasmodium thrive in antibiotic free environments, where drug resistant strains cannot take hold. However, once antibiotics are introduced, non-drug resistant strains perish, and drug resistant strains move to occupy the niche (Roode et al., 2004).

Interestingly, there exists only one case where removal of a species does not result in the reoccupation of the niche by a replacement species; when the niche becomes hostile to life, both host and parasite (Marcogliese & Cone, 1997; Sures, Siddall, & Taraschewski, 1999). Marcogliese and Cone (1997) compared eels in polluted vs. unpolluted rivers, and found that eels in clean water had a greater quantity and diversity of parasites. Thus, parasites are often important indicators of an ecology’s health; an ecology with many, diverse parasites often has excess bio-energy. In contrast, an ecology with few parasites is fundamentally ill (Lafferty, 1997).

To explore the relevance of the competitive exclusion principle in Internet auction fraud, we reviewed our data to look for two predicted patterns: (1) differences in fraud types across separate markets, and (2) changes in fraud types over time as a response to anti-fraud strategies.

6.1.1. Fraud differences in the laptop and Philatelic markets

The competitive exclusion principle argues that each species of fraud is dominant in a given Internet auction niche, and other species of fraud should find it difficult, if not impossible, to enter that niche while the dominant species occupies the position. A review of fraud types in the laptop and philatelic markets on eBay suggests that fraud colonies have well demarcated borders.

6.1.1.1. Laptop market. The eBay laptop market is characterized by the transient nature of its buyers. Most consumers do not purchase laptops frequently. Legitimate sellers may be transient (e.g., someone selling their secondhand laptop), or non-transient (e.g., a permanent eBay auctioneer). Con-artists in the laptop market prey on buyers’ inexperience:
You can see the other swindlees on the Comments About Seller link. While over three quarters of the buyers were newbies to Yahoo auctions, but there was two buyers who had more experience than I (3). (alt.marketing.online.ebay, January 20, 2000)

The most common swindle in the laptop market is non-delivery fraud where the con-artist advertises a good that does not exist, requests money, and fails to deliver the good. The following quote describes a common occurrence:

According to prosecutors, [name withheld], who sometimes used the alias [alias withheld], posted false listings with eBay in May 1998, including phony offers to sell-IBM laptop computers... After the auctions closed, [name withheld] contacted the winning bidders and asked them to send payment for the merchandise through the mail. Accepting and cashing some $37,000 in checks and money orders from bidders [name withheld] never delivered the merchandise. (Communications Media Center, New York Law School, November 5, 1999)

Various species of non-delivery fraud exist in the laptop market, all of which exploit buyer unfamiliarity with how the market works. For example, one common species is escrow fraud where the con-artist attempts to falsely assure the victim that he or she is protected by placing the non-existent good in escrow. Under escrow, both buyer and seller deliver the goods/payment to a third party who holds the buyer’s payment until the buyer inspects the good and pronounces that he/she is satisfied. The monies are then transferred to the seller. In escrow fraud, the seller creates a false escrow service. The buyer sends money to the escrow service, but no good is delivered. For escrow fraud to work, the buyer must be ignorant of the differences between legitimate and illegitimate escrow services.

Another common fraud species uses a hacked account. The con-artist selects an account with a good reputation score, but has not been active for a long time (i.e., the account owner has left the auction business, but has not closed the account). Buyers rely on the high reputation score, but are ignorant of the fact that the reputation does not belong to the con-artist:

Ever wanted to run a fake auction and rake in the cash? What better to buy a hacked one from [name withheld] with high feedback and fool ebay users with running a fake auction with a hacked account! (news.admin.net-abuse.sightings, January 29, 2004)

Yet a third variant involves a real exchange. The seller offers one particular kind of good, but substitutes it for another at the point of sale. In most cases, a low-end laptop is substituted for a high-end one. In others, a completely different product is substituted.

...who ordered the laptop computer from an eBay.com seller about six weeks ago. Days later, he received a laptop-sized FedEx package – but inside was a Montreal phone book. (MSNBC, July 29, 2002)

Many buyers who do not receive a good by a stipulated time are likely to complain immediately to auction authorities. However, they do not open the package upon receipt. This gives the con-artist precious time to escape. Alternately, buyers may not have sufficient skills to ascertain that the product delivered is not of the advertised quality.
Each of these three species of non-delivery fraud exploits a buyer with unique characteristics. Escrow fraud cheats a buyer, who while ignorant, is mistrustful of the con-artist. The false escrow service uses the buyer’s misplaced trust in auction institutions to encourage the buyer to trade. A hacked account creates a false sense of trust of the con-artist in the buyer. The buyer relies excessively on the con-artist’s reputation score, without understanding how that reputation was actually earned. Finally, the use of substitute goods works best on buyers who are too busy or ignorant to quickly appraise the good they purchase.

6.1.1.2. Philatelic market. Buyers in the eBay philatelic market tend to be wealthy, non-transient, and close to retirement. The quote below describes the profile of this community:

The average age of the visitor of this board is 51.5. (Since this was calculated over full years, the real average is 52.0)... It is striking that of the 23 youngest in the 2001 survey, only two were represented this year... The youngsters don’t stay. (Ebay Stamp Chat Discussion, January 30, 2005)

As a result, non-delivery fraud does not work well in the philatelic market. Buyers know who regularly trades in the market, and are suspicious when new sellers enter with large quantities of purportedly rare stamps:

Seldom do they get any bites. If they had the common sense and patience to actually spend six months or more selling real, but cheaper stamps, and THEN going in for the kill, they might be more successful. (George Kopecky, personal interview, January 31, 2005)

Instead, the most successful species of fraud in the philatelic market involve the creation or alteration of an existing stamp. There are three main genera of such fraud, (1) alterations, (2) forgeries, and (3) fantasy labels/illegals.

Alterations are genuine stamps modified by the con-artist to falsely increase their value. Stamps can have widely differing values based on their condition (e.g., the stamp gum is dirty), whether they have been used (i.e., cancelled), and the grade (e.g., whether the picture is correctly centered on the stamp). In addition, many stamp collectors value misprints and other stamps that came off the press with errors. In alteration fraud, the con-artist buys the common stamp and alters it so it appears to be a misprint. Alternately, the con-artist ‘repairs’ the stamp, but claims that the stamp is in its original condition. The list below exemplifies a number of stamps altered to increase their value. A ‘perf’ is a perforation, the jagged edge of the stamp:

5c (bought 11 October 2002, sold 30 November 2002) – cleaned, repaired, cancel added to hide repair, perfs recut;
90c (bought 18 September 2002, sold 30 November 2002) – re-repaired at top left and right corners;
#99 (bought 11 October 2002, sold 10 November 2002) – perfs added at top;
#118 (bought 11 October 2002, sold 10 November 2002) – entire bottom of stamp added;
(http://www.sheryll.net/Forgeries/Fraud/Forgeries_article_Fraud.htm, undated).
A forgery is a stamp created by the con-artist and passed off as a stamp issued by a post office. The following quote is written by an investigative reporter for Linn’s (a magazine devoted to stamps) who was investigating how forged stamps were created:

I experimented with many different methods of “dirtying” the paper. Finally, I found that a mixture of mud, coffee, and soy sauce would, after about 3 days of soaking, sufficiently discolor the back of the paper to that of a considerably older stamp. (As described in http://www.stampuniverse.com/library/article_view.html?artid=705.)

Finally, a fantasy label is a forgery created by a territory (e.g., country) not entitled to issue stamps, or a stamp issued in the name of a territory without that territory’s permission:

The recently produced attractive six dog stamps, purportedly from Batumi, shown in Fig. 4, are fantasy labels... Batumi has not been a legitimate postal authority since the British occupation ended in 1920. (Klug, 2003)

A victim of an alteration, forgery, or fantasy label may know the philatelic market, but such an individual often does not have the requisite skills for detecting a fake. Furthermore, while some individuals in the market may detect a fake as such, it is often difficult for these people to communicate that fakes are being sold in time to warn off potential buyers.

Contact after the auction is completed is also hazardous, because of laws which prevent third parties from interfering with the completion of a contract. I have heard from lawyers on the chats that in this case, TRUTH IS NOT A DEFENSE, and the harmed party can sue for the lost revenue. (George Kopecky – Discussion, 07/09/2002)

6.1.1.3. Comparison. As predicted by the competitive exclusion principle, the separate characteristics of the laptop and philatelic market give rise to distinct types of fraud. Buyers are transient in the laptop market, and so con-artists are able to sell non-existent or defective products. A con-artist who attempts to sell non-existent product in the philatelic market does not survive, primarily because of the larger base of non-transient buyers.

Instead, to survive in the philatelic market, con-artists must create and sell a product. The creation of fakes, forgeries, and fantasy labels, however, does not make sense in the laptop market because doing so takes a great deal of effort. It is easier for a laptop con-artist to send the buyer a phonebook or inferior laptop than to create a fake laptop from non-working parts.

That certain kinds of fraud are unique to particular auction markets is novel, and illustrates the value of the parasite metaphor. Most existing work on fraud assume all auction markets behave in the same way (Dewally & Ederington, 2002; Hu et al., 2004; Kauffman & Wood, 2005). In contrast, the competitive exclusion principle suggests that frauds that work in one auction market are often inapplicable to others. Some markets can even be hybrids of other markets. For example, the coin collecting market suffers from both non-delivery fraud and forgery, the victims primarily being determined by the subsegment of the coin collecting market they are in. Thus, buyers of newly minted coins are often victimized by non-delivery fraud, while collectors of antique coins are victimized by forgeries.
6.1.2. Fraud evolution in the laptop market across time

The competitive exclusion principle also highlights that multiple parasites can potentially inhabit a niche. Only one parasite species inhabits the niche because of competition or predation. The niche contains parasites precisely because resources in the niche are ideal for parasites. Thus, when one kind of parasite is removed from the niche, other kinds will replace it.

We found evidence of this phenomenon in the laptop market. In that market, the use of hacked accounts to steal money first appeared when eBay revised its feedback policy. Initially, feedback about a trader could be made by anyone. Unfortunately, con-artists created mock accounts to artificially boost their reputations. eBay modified the feedback system so that only the actual buyer or seller of a good could give feedback. This reduced the operating range of the initial fraud species. However, because feedback was now a valuable commodity, con-artists began surveying eBay users to find those with high feedback accounts with easy-to-guess passwords. In effect, a new species of highly virulent fraud moved into the vacated niche.

Escrow fraud similarly emerged with the creation of escrow services. Rather than relinquish their access to revenues from the sale of fraudulent high-ticket items, con-artists began creating fake escrow sites.

6.1.3. Managing Internet auction fraud

The competitive exclusion principle’s applicability to auction fraud suggests that methods for dealing with parasites suggested by the competitive exclusion principle are adaptable to Internet auctions. Parasitologists recognize that it is difficult to eradicate parasites. In fact, only two types can potentially be eradicated, (1) filarial worms, and (2) tapeworms (Matthews, 1998). Instead, parasitologists seek methods to maintain parasites at acceptable levels.

The key distinction between elimination and management is one of mindset. An elimination mindset only recognizes the destruction of the parasite as an acceptable outcome. A management mindset recognizes other outcomes such as migration of a parasite elsewhere, or decreased virulence of the parasite as acceptable.

In a management mindset, prosecuting the con-artist does little good, because a niche will always be filled by another perpetrator. Prosecution, like antibiotic treatments, creates an arms race as con-artists develop resistance to current forms of detection and eradication.

Education, in contrast, alters the way the niche works. Teaching people how to filter water and cook meat decreases the likelihood that filarial and tapeworms will infect people. Similarly, teaching auction goers about the latest scams decreases the ability of the scam to work, and therefore, may successfully lower the incidence of auction fraud. Currently, there is a dearth of such education in Internet auctions. Most educational materials are found on websites and have limited effectiveness, because individuals must actively seek websites, and may not know what to seek. In addition, most official materials (i.e., as released by the auction house or post office) are generalized (see http://www.ftc.gov/bcp/conline/pubs/online/auctions.htm as one example). As we have demonstrated,

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2 A parasite must be an eukaryote (i.e., have a defined cell nucleus). Thus, bacteria, viruses, prions, etc. are not parasites.
individual auction markets have their own unique kinds of fraud that generic tips for avoiding fraud fail to address.

6.2. Parasite infection mechanisms

Biological parasites inhabit a hostile world. The host organism generally does not want to be infected, because the parasite consumes resources the host could have otherwise used. In the same way, the auction system generally does not want con-artists, and hence takes action to dissuade them. Both the relationship between the parasite and the host, and the con-artist and auction system can be likened to an arms race. The parasite/con-artist develops a stratagem, which the host/auction system eventually counters. Given this tit-for-tat relationship, it is likely that parasite infection mechanisms will have analogs in the auction fraud world.

6.2.1. Example infection mechanisms

In fact, many Internet auction fraud schemes closely parallel mechanisms that real-world parasites employ to infect hosts. While it is not possible to describe all the myriad mechanisms currently available to Internet auction con-artists, the techniques described here are representative.

6.2.1.1. Imitation of host body. One way parasites survive the immune response is by imitating the host’s body. When the blood fluke *Shistosoma mansoni* enters the host body (typically by drilling through a body part such as the ankle), it sheds its outer skin and grows one that imitates the surface of a red blood corpuscle. The immune system then believes the fluke to be (an abnormally large) red blood corpuscle.

Con-artists who engage in ‘phishing’ appear to do the same thing. In ‘phishing,’ con-artists acquire mailing lists of auction house users. They send users e-mails simulating official ones sent by the auction house that encourage the user to visit a website. At the website, the user is invited to divulge an account number, password, and/or credit card number for ‘verification’, as exemplified in the following quote:

Anyway, I entered my e-mail ID and my password... I realized, after staring at the screen for 7.25 s that I had been HAD! (AuctionWatch posting, October 9, 2001)

6.2.1.2. Rapid movement. Some parasites overcome host immune defense through speed. The immune system takes time to recognize a parasite invasion and develop an appropriate response. Parasites such as *Plasmodium*, which causes malaria, change identification so the immune system is always one step behind. *Plasmodium* first infects the human liver. There, it multiplies rapidly, changing into its blood infecting form before the immune system responds. In the blood, *Plasmodium* periodically changes its shape so that the immune system does not recognize it.³

³ The periodic changes of shape cause malaria victims to experience chill and fever cycles. The immune system learns to recognize *Plasmodium* and kills 90% of them (the ones that did not mutate). Slain infected red blood corpuscles burst and release fluid into the blood, thereby cooling the body. The immune system then determines that the body is still sick, and so causes a fever.
In Internet auctions, one kind of con-artist behaves similarly. They run large numbers of auctions lasting anywhere from 1 to 3 days (most Internet auctions run for at least seven (Lucking-Reiley, 2000)). Once victims have sent money, the con-artist disappears, later reemerging under a new user ID. The auction houses have difficulty tracking these con-artists, because they take time to investigate complaints:

Your biggest clue to a fraudulent auction (other than a 3 day listing with an unusually low price with no reserve) is that seller won’t respond to your e-mail questions. (rec.video.marketplace, May 6, 2002)

6.2.1.3. Infection trickling. Some parasites rely on the host immune system’s internal cost-benefit analysis. For example, rats do not mount resistance to *Nippostrongylus brasiliensis* (a roundworm) when it invades their bodies in small amounts. However, when the rat is infected by large amounts of the worm, it self-cures, ejecting all worms, thereafter building immunity.

Similarly, law enforcement is deluged with various forms of violent crime and only reacts to complaints when large sums (e.g., in the US, $5000–50,000, depending on the agency) are at stake. The median loss in Internet auction fraud is $385 (National White Collar Crime Center, & Federal Bureau of Investigation, 2005), which suggests that con-artists minimize the impact of their frauds to avoid excessive reactions from victims and legal agencies:

However, the FBI will only be willing to investigate if the amount taken is large ($5000 minimum). (rec.games.deckmaster.marketplace, August 7, 1994)

6.2.1.4. Immunopathological damage. Because parasites are often superbly adapted to evade the host immune system, the host immune system can damage the host while causing minimal harm to the parasite. For example, blood fluke eggs circulate through the host’s body before being ejected through the feces. If there are too many blood fluke eggs, the body creates an immune response that damages the liver.

In the same way, many payment systems (e.g., credit card companies, Paypal and other e-payment systems) allow the buyer to chargeback a payment when a problem occurs. The payment system refunds the buyer and deducts money from the seller’s account. Often, such chargebacks are automatic as there is no practical, cost-effective method to verify the buyer’s complaint. This enables buyers to purchase a good and then fraudulently complain, thereby obtaining the good for free, as shown in the following:

I was getting ready to ship the item to the customer, and my first mind told me to check the status of my pending transfer to my personal savings. WHOA! I see a reversal back to the eBay buyer who paid for my item, and then a cancellation to transfer funds to my savings. (paypalsucks.com, March 21, 2002)

6.2.1.5. Luring. In some cases, the parasite creates enticing lures. For example, the fungus *Entomophthora muscae* causes the abdomen of its host, the housefly, to swell. Houseflies are attracted to swollen abdomens and are more likely to mate with infected housefly corpses than with normal houseflies (Møller, 1993; Moore, 2002). During the mating process, the fungus rubs off on its new host, and propagates.
Some con-artists employ ‘too good to be true’ prices to lure victims. The following quote describes a seller who purchased computers to (falsely) resell as more powerful versions. To attract buyers, he advertised the computers at prices below the cost price of the powerful computer, but above his own purchase price:

“Selling one or two a week, that would take me forever,” he said. “So I decided maybe I can forge the speed and features of laptops I’m selling. (MSNBC, August 5, 2002)

6.2.1.6. Physical discomfort. Still other parasites ensure hosts behave by causing discomfort. When the guinea worm (*Dracunculus medinensis*) is ready to reproduce, it migrates to the host’s skin causing a hot blister to form. The host cools the blister by bathing it in water. The worm larvae escape into the water where they infect further hosts.

A con-artist will sometimes create discomfort by threatening an honest trader with ‘retaliatory feedback’ if they report the con-artist. As negative feedback is highly damaging (*Ba & Pavlou, 2002; Lucking-Reiley, Bryan, Prasad, & Reeves, 2000*), and cannot be removed once posted to an auction site, retaliatory feedback is a strong disincentive to report fraudulent trades.

buyers are reluctant to post negative feedback about a seller out of the entirely justified fear that the seller will post “retaliatory” negative feedback. (Business 2.0, August 2002)

6.2.1.7. Mental control. Many parasites exude neurotransmitters, drugs, or other chemicals that change their hosts’ behavior. For example, *Plagiorhyncus cylindraecus*, a parasitic worm, infests starlings through their intermediate hosts, pillbugs. Infested pillbugs become suicidal, walking out into open, well-lit terrain to increase their likelihood of being eaten by starlings.

In Internet auctions, various criminals exert control by breaking into and usurping auction trading accounts (possibly using passwords obtained through host body imitation). They then employ these trading accounts to advertise large numbers of non-existent products. When the auction house is alerted to the problem, the auction house closes the ‘mind-controlled’ accounts:

Someone other than Gloria Geary had access to the Washington artist’s eBay account last week. Using Geary’s user ID, the person set up an auction for an Intel Pentium computer chip. (ZDNet News, March 25, 2002)

6.2.2. Insights from infection mechanisms

Examing Internet auction fraud from the perspective of parasite infection mechanisms suggests extensions to existing work on deception. Most of the current work examines deception from the perspective of tricking the victim. For example, Grazioli and colleagues propose that all deception falls into the seven categories found in Table 3 (*Grazioli, 2004; Grazioli & Jarvenpaa, 2000; Grazioli & Jarvenpaa, 2003a; Grazioli & Jarvenpaa, 2003b; Johnson, Grazioli, Jamal, & Berryman, 2001*).

The assumption is that the trickery inherent in deception allows the con-artist to both obtain resources and to escape. The better the trick, the slower the victim will be to detect,
respond to, or retaliate to the trick. The parasite metaphor suggests that deception and escape are separate components of fraud. *Plasmodium* initially employs masking by hiding in the liver. However, once it is discovered, it employs rapid movement. In the same way, con-artists in the laptop market may disguise themselves as legitimate traders. However, their auctions are only three-days long (i.e., rapid movement) to avoid retaliation. Similarly, a con-artist may relabel by falsely advertising a fake stamp as a genuine one. When the buyer complains, the con-artist could employ physical discomfort by threatening the complainer with retaliatory feedback.

In some cases, a fraud comprises only an escape component, and requires no deception. A false chargeback (immunopathology), for example, exploits the manner in which credit cards function. The seller can do nothing about this other than to refuse all credit card sales.

### 6.3. Virulence theory

Virulence theory is a generic model of how much of a toll a given parasite will take on its host. In the long term, a parasite moderates virulence (i.e., harm to the host) to maximize its probability of successfully reproducing. Virulence theory has been employed to explain parasitic behavior in numerous hosts (Dybdahl & Storfer, 2003; Hoeksema & Bruna, 2000), including insects (Massey, Buckling, & Ffrench-Constant, 2004), jellyfish (Pennisi, 2003), and of course, humans (Massey et al., 2004). It is normally expressed as the following two equations (Moore, 2002):

\[
P_{t+1} = P_t R_t
\]

and

\[
R_t = \frac{y(a,N)}{a + b + v(a)}
\]

*P*<sub>*t*</sub>+1 refers to the population of a parasite species at time *t*. The population in the future time *P*<sub>*t*</sub>+1 is dependent on the current population, and the ratio of new infections to existing infections *R*<sub>*t*</sub>. If *R*<sub>*t*</sub> > 1, some condition encourages growth in the parasite population. Conversely, if *R*<sub>*t*</sub> < 1, some condition reduces the population. In the long run, *R*<sub>*t*</sub> = 1, because too much growth results in overcrowding which reduces the opportunity for parasite survival and propagation.

<table>
<thead>
<tr>
<th>Tactic</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masking</td>
<td>Hiding or destroying critical information</td>
</tr>
<tr>
<td>Dazzling</td>
<td>Disguising critical information</td>
</tr>
<tr>
<td>Decoying</td>
<td>Distracting the victim’s attention away from critical information</td>
</tr>
<tr>
<td>Mimicking</td>
<td>Assuming someone else’s identity, or impersonating someone else</td>
</tr>
<tr>
<td>Inventing</td>
<td>Making up information</td>
</tr>
<tr>
<td>Relabeling</td>
<td>Presenting information in a misleading way</td>
</tr>
<tr>
<td>Double play</td>
<td>Suggesting to victim that the victim is taking advantage of the deceiver</td>
</tr>
</tbody>
</table>
$R_t$ is computed from five parameters: (1) $a$, the host death rate from the parasite-borne disease, (2) $b$, the host death rate from other causes, (3) $N$, the host population density, (4) $y$, the ability of the parasite to reproduce, and (5) $v$, the virulence of the parasite or the extent that the parasite causes debilitation in the host.

With some adaptation, the equation becomes applicable to Internet auction fraud. For example, $a$ refers to fraud victims who leave the auction house; $b$ to auction traders who leave for other reasons; $v$ represents traders who trade after being victimized by a con-artist; and $y$ reflects opportunities for new frauds of the same type to occur.

Virulence theory enhances Internet auction fraud research in two ways. First, it suggests that the amount of wealth generated in Internet auctions provides a natural mechanism for regulating fraud levels. Second, it provides a framework to apply population genetic-based research on Internet auction fraud.

6.3.1. Wealth as a fraud regulator

Much of the practitioner literature bemoans the existence of auction fraud, and complains about its prevalence. Often, practitioners suggest that fraud will cause the demise of Internet auctions:

One rogue member can do a lot of damage and scare away members – ultimately hurting eBay itself. (Auctionbytes.com, January 20, 2002)

Virulence theory suggests that fraud will never destroy the commercial viability of Internet auctions. If fraud hurts the auction system excessively, the auction market contracts, providing fewer opportunities for fraud. This, in turn, reduces the number of future con-artists, increasing the viability of the auction system. The fundamental harm con-artists do to themselves by being virulent provides a self-regulating upper bound on the harm they do.

In virulence theory, only one variable is fully independent of the parasite, $b$ the host death rate from other causes. In an expanding market (like Internet auction fraud), $b$ is a very small number – the number of entrants to the market vastly exceed the number of individuals exiting. As $b$ becomes smaller, $R_t$ rises, and the parasite population rises. Conversely, as $b$ becomes larger, con-artists have fewer opportunities for fraud, and fraud levels decrease. In essence, virulence theory states that the reason Internet auctions have so many con-artists is because Internet auctions are vastly successful and generate a great deal of wealth.

6.3.2. Virulence and fraud mechanisms

Optimal virulence theory is a branch of virulence theory research investigating general relationships between parasite propagation and virulence. Work in this area argues that the manner in which parasites propagate influences their virulence. Vector borne parasites have high virulence, while directly transmitted parasites have low virulence (Ewald, 1983). Vector borne parasites use animals to convey themselves to target hosts. *Plasmodium* (malaria), for example, uses the mosquito to infect humans. A directly transmitted parasite moves directly from host to host (e.g., fleas).

Vector borne parasites have higher virulence, because an immobilized host is easier for vectors to attack. A bed-bound human suffering from malaria is more likely to be bitten by mosquitoes than one who can slap them away. Conversely, directly transmitted parasites have low virulence, because high virulence levels increase their risk of extension. Normal
Fleas do not kill their hosts, because that decreases their food supply. For further reading in optimal virulence theory, see Day (2002) and Lenski and May (1994).

Fraud mechanisms should also influence the severity of loss each individual victim suffers. To explore whether loss per victim varies substantially across fraud type, we collated statistics issued by the Internet Crime Complaint Center (IC3). To our knowledge, the IC3 is the only organization with usable statistics on dollar losses from Internet fraud. The National Fraud Information Center, a potential other source of information, only began collating such statistics in 2004. The IC3 maintains systematic statistics on seven types of fraud, credit/debit card, auction, non-delivery, investment, confidence, check, and Nigerian letter. Of these seven types, two relate to mode of payment (credit/debit card and check), and two to the vehicle by which fraud is committed (auction, and Nigerian letter (i.e., e-mail)). The other three categories (non-delivery, investment, and confidence) encompass a set of essentially unrelated frauds. Table 4 presents median US dollar losses for the two groups of comparable frauds (i.e., payment type and vehicle of fraud). Data is reported from 2001, the first year the IC3 collects annual data, to 2005 (the latest year for which statistics are available).

As the table demonstrates, the fraud mechanism appears related to the degree of fraud virulence. A victim of credit card or auction fraud will suffer losses of hundreds of dollars. Victims who pay by check or are victims of Nigerian letter fraud suffer losses in the thousands of dollars.

These observations are consistent with optimal virulence theory and suggest that fraud committed in an auction venue will be less virulent than fraud committed solely over e-mail (e.g., Nigerian letter fraud). High virulence in auctions draws the attention of the police, auction house, and auction community, which increases the con-artist’s chance of being caught. E-mail based scams function outside the bounds of commercial institutions like auction houses, and the geographic jurisdictions of most police, thus they do not draw the attention and retaliatory weight of such institutions. E-mail based scams should therefore, have higher virulence.

7. Discussion and conclusion

Previous research on Internet auction fraud relies principally on economic and legal analysis. While such research has shed important light on the Internet auction fraud

Table 4
Median US dollar losses to fraud as reported to the IC3

<table>
<thead>
<tr>
<th>Year</th>
<th>Payment type</th>
<th>Fraud vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Credit/debit card</td>
<td>Check</td>
</tr>
<tr>
<td>2001</td>
<td>450</td>
<td>910</td>
</tr>
<tr>
<td>2002</td>
<td>120</td>
<td>1100</td>
</tr>
<tr>
<td>2003</td>
<td>309</td>
<td>4550</td>
</tr>
<tr>
<td>2004</td>
<td>240</td>
<td>3600</td>
</tr>
<tr>
<td>2005</td>
<td>240</td>
<td>3800</td>
</tr>
</tbody>
</table>

4 Infected parasite vectors like plague carrying fleas tend to be harmed by their parasites as well. The plague, for example, blocks the stomach of the flea, which forces the flea to suck more blood than normal, and vomit, thereby transmitting the plague. The flea eventually starves to death.
phenomenon, it does not consider many important issues. In this paper, we introduced the ‘parasite’ metaphor as an analytical lens for viewing Internet auction fraud in an effort to expand our understanding of the phenomena. We demonstrated that using this lens revealed much about how Internet auction fraud works. Table 5 summarizes the contributions.

We began by identifying three key characteristics of parasites, specifically that the parasite must: (1) reside in or on the host, (2) be dependent on the host, and (3) harm the host. We defined the parasite’s host as the Internet auction system. We then differentiated our use of ‘parasite’ from the casual metaphor employed in everyday use. Specifically, we distinguished between harm to the host, and harm to the organizational ecology, and emphasized the pejorative bias of considering parasites as inferior species.

We demonstrated the parasite metaphor’s ability to shed new light on the fraud phenomenon by applying three theories of biological parasites to auction fraud, each theory mapping to one of the three aspects of the definition of parasites. The competitive exclusion principle mapped to residence, parasite infection mechanisms mapped to dependence, and virulence theory mapped to harm to the host.

The competitive exclusion principle highlights the unique characteristics of separate markets and fraud types, suggesting that findings in one market may not be generalizable to others. It also warns us that eradicating some types of fraud may cause more harm than good. Fraud exists because there are strong incentives for individuals to commit fraud. When we eliminate one kind of fraud without eliminating the incentives, another more virulent form of fraud could emerge in its place. Conversely, education and behavior modifications may be a better way of managing fraud.

The literature on parasite infection mechanisms further reinforces the idea that fraud evolves to fill an ecological niche by highlighting the diversity of auction fraud types (i.e., species). In doing so, it deepens our understanding of what deception is. Deception involves not only tricking the victim, but also a strategy for escaping from repercussions.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Fraud is the normal state of affairs. The absence of fraud suggests anomalies in market function.</td>
</tr>
<tr>
<td></td>
<td>The deceptive nature of fraud means that single sources of evidence are unlikely to reveal much about the nature of fraud.</td>
</tr>
<tr>
<td></td>
<td>Fraud must be understood within the context of the market it inhabits. Something lawful in one market may be fraudulent in another.</td>
</tr>
<tr>
<td>Residence/competitive exclusion</td>
<td>Market conditions determine which kinds of fraud thrive. Anti-fraud policy should focus on managing fraud rather than eliminating it.</td>
</tr>
<tr>
<td></td>
<td>Education is more important than policing.</td>
</tr>
<tr>
<td>Dependence/parasite infection</td>
<td>Deception involves not only tricking the victim, but devising an opportunity for escape. Mechanisms for escape are different from trickery.</td>
</tr>
<tr>
<td>Harm/virulence theory</td>
<td>Fraud will never cause market collapse, because the size of the market provides an upper bound to the amount of possible harm a con-artist will inflict. Nature of payment systems/victim/market influences the amount that can be obtained via a successful fraud.</td>
</tr>
</tbody>
</table>
Finally, virulence theory provides a formal way to study the relationship between the amount of harm the con-artist does and the nature of the market the con-artist inhabits. One insight from virulence theory is that con-artists are more likely to appear in successful than unsuccessful markets, and the prevalence of con-artists in auction markets is associated with their overall health and success. A second insight is that the way the market operates will have an influence on how much harm a victim suffers. Evidence from the limited, systematically collected data across fraud markets supports this insight.

7.1. Using parasitism as a metaphor

The contribution of the parasite metaphor goes beyond the contributions of individual parasite theories. The main contribution is that it encourages new mindsets for research on fraud. For example, one important conclusion is that parasitism is the normal state of affairs, and the absence of parasites is unusual and likely not desirable. Thus, when one observes a species of parasite in one fraud market (e.g., non-delivery fraud in the laptop market), but does not observe that parasite elsewhere (e.g., the stamp market), one is sensitized to believe something unusual is going on. In the case of the stamp market, other kinds of parasites are at work. The most disturbing finding would be that no parasites are found in the market – such would be a sign of either excessive policing, or more likely, unhealthy market conditions.

Another important insight is that because fraud has a strong component of deception, analyses using single data sources (e.g., auction listings) are unlikely to reveal all of the myriad fraud species. Certain fraud species may be revealed, but others will have evolved to avoid detection. For example, the standard form of non-delivery fraud comprising a low reputation seller advertising high-priced goods for a short duration is easily identifiable from an auction listing. However, the seller of fraudulently altered stamps is not so easily identifiable. Thus, the parasite metaphor warns us that a study of fraud must employ multiple sources of evidence.

Finally, the parasite metaphor reminds us how critical it is to understand the context in which the fraud is occurring. We need to first understand that pillbugs normally hide in shade to realize that an infected pillbug walking in bright sunlight is unusual. In the same way, we need to realize that selling a self-created painting is not fraud, but selling a self-created stamp is.

7.2. Limitations

While metaphors provide a useful way of viewing phenomena in a new light, care must be taken to partition aspects of the metaphor that do not apply to the phenomenon under study. There are at least four aspects of parasitism that we believe do not apply to Internet auctions.

7.2.1. Transience of virtual ecologies

Internet auction con-artists do not spend all their lives interacting with hosts. For example, they may otherwise lead normal lives or deal in non-Internet crime. The parasite metaphor thus falsely assumes that solutions to Internet auction fraud are only discoverable within the context of the Internet and ignores solutions from other environments.
7.2.2. Specificity of behavior

Human behavior is more alterable than that of biological parasites. For example, the tapeworm must inhabit the host’s intestine and steal the host’s resources to survive. In contrast, Internet con-artists can be socialized to lead productive lives. The metaphor thus artificially constrains the options that we can take to correct deviant behavior.

7.2.3. Parasitic diversity

We presented several examples of parallels between methods of infection in biological and Internet fraud parasites. However, there are infectious mechanisms employed by biological parasites that have not yet been observed in Internet auction fraud. For example, *Cymothoa exigua*, a marine pillbug, devours the tongue of the rose snapper, and then becomes a prosthetic tongue. The pillbug survives by eating a share of the snapper’s food. For most of these unmentioned mechanisms, it is possible to envision a parallel technique in Internet auctions. For example, an organized criminal group could monopolize some critical auction service, and raise fees, but provide no additional benefit to auction traders. While these mechanisms may offer creative models for fraud forms, we have not yet observed evidence of such behavior.

7.2.4. Ambiguity of definition

While parasitism is well defined, it is sometimes difficult to ascertain whether an organism should be classified as a parasite, a predator, or a mutualist. For example, the mosquito is commonly considered a parasite even though it has predatory characteristics (e.g., living apart from its host). Certain kinds of fraud have similar characteristics. The con-artist who defrauds victims, escapes, and returns under a new identity, behaves like a mosquito.

Despite these limitations, the parasite metaphor is still useful for studying Internet auction fraud, because it meets the fundamental characteristics of a good theory precursor; it allows us to develop novel, testable propositions that explain the target phenomenon, and predict outcomes (Bacharach, 1989; Weber, 2003). Specifically, the metaphor suggests: (1) the existence of colonies and niches, (2) new forms of deception, (3) adaptive coexistence between victims and con-artists, and (4) that virulence in Internet auctions is self-restrained. In each case, we presented illustrative examples or evidence to support the predictions of the metaphor.

7.3. Future research

Internet auction fraud is only one example of a growing class of Internet crime that is little researched, but affects a growing number of individuals and organizations. Our exploration into the use of the parasite metaphor suggests that it is also applicable to such problems as Advance Fee Fraud (e.g., Nigerian letter fraud) or unsolicited commercial e-mail (e.g., SPAM). For example, one prediction that can be made is that legislating away SPAM is likely to be ineffective because distributors of SPAM will evolve mechanisms that make SPAM legal, or unprosecutable by legal authorities. Furthermore, as Internet fraud is one variant of fraud and property crime, it could be applicable to other types of such crimes (e.g., petty theft). Future research can benefit from examining the utility of this metaphor on a variety of crime types.
Also, we have only introduced a small sample of theory from parasitology that could be potentially applicable to organizational research. For example, some real-world parasites (e.g., the blood fluke) make their hosts immune from further parasitical infection while they inhabit the host (i.e., premunition). It would be interesting to observe whether classes of Internet auction con-artists that establish monopolies on certain auction markets exist. Such might occur, if the con-artists belonged to organized crime families or other crime cartels that protect their victims from other forms of crime.

Finally, the parasitism metaphor emphasizes the importance of studying the parasite. However, little research has examined the problem of Internet auction fraud from the perspective of the con-artists themselves. Such studies, perhaps performed by interviewing con-artists serving time or reformed con-artists have the potential to enhance our understanding of this expensive problem.

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