The botnet: webs of hegemony/zombies who publish

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With apologies to Mark Twain: rumours of life beyond death have been greatly under-exaggerated online. Every day, amateurs (dangerous for their lack of experience) use pre-weaponized exploits to install covert FTP servers on home and high-bandwidth machines for the distribution of pirated software, films and music – 'pubstros' and the 'FXP' scene (Braithwaite 2003) – while corporate spammers (dangerous for their malice and fiscal motivation) employ sophisticated technicians to illicitly gather machines for their vast relay mechanisms. In each case, the physical owner of the computer is, if the intruder is successful, entirely unaware that their machine has been cracked; to all intents and purposes it still functions, but in reality it is walking dead, working against them. Both of these models of intrusion have been referred to as botnets. The less widely utilized terminology, which resurrects the notion of the undead internet, describes the individually compromised machines that constitute this network not as 'bots', but rather 'zombies' (Cooke et al. 2005).

As the subscription-based academic publishing model is dragged into the twenty-first century, almost all aspects of the existing system are facing changes, arising from technological developments and ideological initiatives such as open access and the CopyLeft movement. They are also, however, under threat of self-subversion. In this chapter, I propose the 'zombies' of the author, the library and the publisher in higher education publishing as sharing much in parallel with the information security inflexion of this same term: a being not only dead and colonizing, but also exhibiting superficial autonomy while covertly acting under foreign influence against its own living purpose. The area in which this concept can most easily be elaborated is in the underlying political tensions in various library-publisher-researcher relations.

This interrogation takes a tripartite structure. The first examines the motivations for a researcher's choice of publication venue when considered as a semi-autonomous agent, within a prevalent audit culture, alongside the current *modus operandi* of libraries and publishers. This takes account of the pressures brought to bear from such elements as 'Impact Factor', the economic interactions between each of these actors, and the coming of age of open access. The second brings focus to the interrelations of power between actors within this network and the constraints that compel them to behave in a self-subverting fashion, which in the botnet typology correlates to the command and control component. The final section examines the means by which such a network could be dismantled, the zombies re-consigned to their rightful resting places, and the repercussions this action would have upon a revitalized, once-again living, academic landscape.

'Another fine mess you've gotten me into': why is academic publishing as it is?

In order to understand the interrelations between the various stakeholders, or factions, within the academic publishing world it is necessary to examine the motivations that drive researchers to publish and the roles played by each of these factions. While in several instances it will be clear that actors are competing against one another in this system, it is the ways in which such competitive behaviour becomes self-destructive that is primarily of interest here.

To begin at the point where material enters the publishing cycle, the motivations for researchers to publish are well covered by Glenn McGuigan and Robert Russell, who split the drivers into two categories: 'the norms of the profession' which 'encourage faculty members to participate in the generation and dissemination of new knowledge based on research', and 'the academic process of promotion and tenure and the role of credentialism in determining faculty advancement' (2008). The latter includes the monograph as standard tenure-track or career progression material in many arts disciplines, a format under huge threat at present (Thompson 2005). While one might conclude from this breakdown that academia has been irredeemably lost to a Weberian framework of quantified economic determination, in omitting the more altruistic, or perhaps egotistic, psychological desires – to be read and to be valued by peers – we are actually led towards a different aspect of Weber. It was common knowledge long before Maslow that this vocational humanism is subordinate to the need to eat, but at the tangible level the motivation is to hold an academic position in order to obviate the work-life dichotomy: to truly answer one's calling.

Already one can begin to see how choice of research publication is hardly autonomous or altruistic, but rather automatic, coerced, and self-centred. While pragmatic encroachments upon ideals are expected in all walks of life, in this case, if researchers wish to find themselves employed, they must select the publication outlet of the longest standing, with the highest 'impact', the most citations; this is zombie-like in its no-brainer logic. Under such a value-system, in which the economic – be that financial, or in the supply-and-demand scarcity principle of impact – is given a high level of precedence, one would expect the academic library to be highly empowered. The academic publishing economy is a market, after all, and through acquisition budgets, the library is the customer. Interestingly, however, this is not the case.

The library is actually disempowered, because it acts under the direction of the researcher. By the same criteria of their output, researchers must also have read the highest-valued material, necessitating a purchase of these materials by the library. Thus, the library finds itself doubly constrained, firstly by researcher activity when it functions as material provider, and secondly by publisher prices (and lengthy contracts, so called 'big deals') when it purchases material. This double-bind does a disservice to researchers; the very system they are using and which they believe they control actually negatively impacts upon their own practice and the zombification demonstrates its first aspects of contagion as it cascades down the chain. This is because the same valorization criteria bestowed upon journals drives the prices of those journals up, thus making it impossible for libraries to afford them. The model of esteem conferred by a researcher upon a publisher within this culture implies the right to charge a higher premium for a title, which then restricts – owing to contracting library budgets – this same researcher's access to material.

To understand how these constraints became so effective and binding, the economic situation of libraries and the emerging models designed to counter this problem must be considered. In recent times, the traditional publishing model has faced its biggest threat to date: open access. In much the same way that the entertainment sector has had to adapt to a digital medium, publishers are increasingly finding, perhaps rightly, that their mode of distribution is being challenged. On a purely ideological plane,

nationalistic interests put aside, there can be little disputing that publicly-funded research should be published under an open access mandate; for citizens to pay a private company to obtain research for which they have already paid through their own taxes would be logically inconsistent. Indeed, in the largest survey on open access to date, 90 per cent of researchers felt that open access was valuable to their discipline, with availability of publicly funded research ranking as the most agreed-upon factor among the 36,507 respondents (Dallmeier-Tiessen et al. 2011: 6), while a separate substantial market research exercise described how 75 per cent of their 'participants said they think it is "very important" or "important" to be able to offer their work free online' (InTech 2011: 7).

In response to this ideological drive, the term 'open access' was put forward in 2002 by the Budapest Open Access Initiative to describe a system under which peer reviewed articles would be available free of charge to the reader, with Green and Gold mechanisms proposed for author self-archiving and pure open access journals respectively (Chan et al. 2002). Furthermore, subsequent thinking on this terminology has sought to distinguish the removal of price barriers from permission barriers as independent components: gratis (instead of purchased) and libre (instead of restricted in terms of reproduction) (Suber 2008). It would be disingenuous, however, to solely credit this provision to a utopian hope. One of the main motivations has been the aforementioned pressure upon university library budgets, alongside ever-increasing journal subscription costs. This is aptly illustrated by William Walters, whose 2007 study of the economics of open access publishing estimated an aggregate annual saving in US higher education library expenditure of almost ninety-eight million dollars in the event of institutions switching to a PLoS or 'Public Library of Science' model (2007: 8) with similarly-scaled predictions repeated in a UK study (Houghton 2011).

Superficially, this all sounds fantastic: research that could be free in both of Richard Stallman's well-known senses: beer and speech (Free Software Foundation 2010). However, regardless of whether funded publicly or privately, institutions are committed for the foreseeable future to reduction of central expenditure while, conversely, the efforts involved in the various stages of open access publication – from server hosting through to copy editing – are not zero cost. To make matters more complicated, competitive frameworks for research assessment such as the upcoming United Kingdom Research Excellence Framework are, despite much criticism, reliant on quantitative metrics to determine the impact weighting of a journal: the Impact Factor, calculated 'by dividing the number of current year citations to the source items published in that journal during the previous two years' (Garfield 1994). Evaluating the Impact Factor of open access journals is a difficult task, but the best estimate at present, based on the 2008 IF, is a 39.43 per cent share in the top fifty (0-50) percentiles, although open access journals counted, respectively, for only 5.38 per cent in the sciences, and 1.52 per cent in the social sciences Journal Citation Reports (Giglia 2010: 34). With this in mind, it becomes possible to fully consider the pressures borne by the library.

Libraries: the locus of subversion

Academic libraries are not the culprits responsible for a self-sabotaging researcher paradigm; they did not build the botnet. They are, however, the focal point of all

relations as they currently stand, and the black-box which renders these interrelations opaque. Were the costs exposed directly to the researcher, rather than through the non-transparent medium of the library, it would be possible for competition on price to play an active role in researcher selection of publication outlet. This considered, could elimination of the library as a gateway, or custodian, constitute a viable means of identifying the Trojan malware in the system? Could open access provide this?

When speaking of economic savings, there is always a free-market flip-side for the provider: loss of revenue. It is clear that on the topic of library budgets, the movement towards open access systems benefits the library at the expense of the publisher. Likewise, on first inspection, the positives for the researcher, over the publisher, appear clear: instant gratis access. From this appraisal, it seems that the researcher and the library both stand to benefit while the publisher must wholesale lose out. This assumption, however, is short-sighted.

Traditionally the custodians of material, the library needs to rapidly rethink its status in a world where there are no physical guardians beyond fail-safe archives. Instead, it is redefining itself as a provider of 'research tools' whose purpose is to educate users on new technologies and assist with the sifting of vast quantities of metadata (Bosc and Harnad 2005). The problem here is that this encroaches upon the role of IT Services who may well argue that they, or perhaps an external contractor such as Google, are better placed to undertake this role. Also less frequently considered are the implications for the power relations that sit atop this financial substructure. As Walters puts it: 'Open access pricing is likely to shift journal costs from libraries to other parts of the university, thereby shifting authority from those who make decisions about particular journals (chiefly librarians) to those who evaluate the apparent value of particular research projects (chiefly departmental faculty and funding agencies)' (2007: 12). Certainly, in this cession to external budget pressure through an embrace of open access, it is clear that the library both disempowers itself financially, and begins to erode its rationale for existence, as with all compromised zombies within a botnet.

It could be argued, however, that within an institutionally devolved funding model, the library performs a mediating role vital for academic freedom. This is because, in order to maintain profitability in open access, publishers are implementing a system of author payment for each article. In this case, the academic wishing to publish in an outlet will have their work peer reviewed and is then expected to pay the journal the publication fee. Should central management hold these funds, it could be posited that a conflict of interest arises between marketeers and academics. On the other hand, allowing departments unlimited sovereignty in their spending removes many of the aspects of accountability of funds that open access is supposed to mitigate. The library as the centre of funding allocation for publishing could function as a go-between, a mechanism of accountability towards management, but also as a guarantor of academic freedom. The rationale for this being a library, rather than a funding committee, is that this mediation process would require longer term interaction and understanding of a researcher's project than a snap-decision funding committee could hope to achieve. The library can, perhaps, make a case for its existence in this way.

Publishers: an evil? A necessary evil?

On the other side of the debate there has been, in light of open access developments, much discussion as to whether there is a continuing need for academic publishers. As is common knowledge, much of the editorial process for publishers – peer review, copy-editing and authorship – is performed by academics free of charge to the publisher, as an expected part of their employment at the university. A materialistic view of the current situation would see, in this, that the publisher contributes little more than a transcription of academic work into physical format and then sells it, with extremely small financial return for the author. For an ideally self-critical institution, it seems that an absolute extreme of alienation and commodity fetishism is inscribed directly within the academy; a disconnect between surface motivation and underlying action exists in the compromised zombie.

This, of course, in no way encapsulates the full scope of the academic publishing environment. As has already been touched upon, publishers are the gatekeepers of reputation, the self-admitted key to academic success, in terms of both tenure and audit. In many ways, then, researchers are directly responsible for their own circumstance here. However, publishers have obtained this position only by the now-shifting sands of tradition upon which they are founded; their head start will not last forever. Secondly, again, the activities are not zero-cost. However, a transition to open access brings these costs down to a level which could almost certainly be managed institutionally. Furthermore, at this crucial stage where open access is only beginning to emerge, particularly in the humanities, it is unlikely that early career researchers would be able to secure institutional funding for the up-front costs publishers are demanding. In short: the current model of publishing is unsustainable from the library's (and therefore, the researcher's) perspective, while the move to open access is financially untenable, or at least uncertain, for publishers. As a final hurdle, attempting to make this profitable through up-front payment renders it impossible for some of the keenest advocates of open access, the early-career researchers, to publish. Indeed, it is this subset who realize, more than any other that, as Thomas HP Gould puts it: 'Print academic research journals are dead' (2009: 232-235).

In this mode, then, the publisher is pitched against the library. In their bid to stick to traditional publication methods and make themselves financially viable, publishers weaken the library in the view of the researcher, who becomes frustrated at the lack of available material. This is a far more appealing prospect for publishers than the upfront charges of open access that impact directly upon the researcher. If the publisher can use the library as a shield to mask the financial transactions underpinning the economics of academic publishing, then it appears to be in their interest to do so. On the flip-side, though, libraries are increasingly 'declaring war' on publishers over the unaffordable and unsustainable rates of subscription costs and big-deal lock-ins, while also attempting to make this relation perspicuous to researchers (Shubber 2011). It is here, then, that publishers begin to exhibit self-subversive behaviour. As they are manipulated by financial motivations and the incompatibility of researcher demands with a for-profit schema, they are pushing for a strategy that can only jeopardize the library acquisition-budget and could lead to their own extinction. When this has been achieved, who will pay the subscription costs if not the institutions? Is it a repetition of the Cree proverb: 'Only when the last tree has died, the last river has been poisoned and the last fish has been caught, will we realize that we cannot eat money'?

Finally for this section, then: what do academic publishers actually add? Stephen Mooney, in a barefaced attempt to identify the threats to publishers' traditional models of marketing and offer countermeasures, suggests that the three saving graces of the industry are marketing, editorial and reputational (2001). Mooney posits that the role of the publisher is self-marketing, so that they are identified as the provider of reputable information, distinct from the 'bad information' on the web. This is fallacious and dangerous; it is the role of education to develop the knowledge and critical faculties to independently evaluate material, regardless of its source. Relying on source of publication as evidence of quality is not the way forward, regardless of whether this provides an easy solution for publishers and researchers. Secondly, Mooney lambasts the peer review system on the grounds of its inability to select content that will sell; hardly a criterion that should be the foremost aspect of selection, over academic merit. Mooney suggests that editorial direction is actually a form of marketing, and is about understanding what will sell, rather than what is well received by peers: 'Only you can provide … review *targeted toward your market*' he declares (2001: 27, emphasis in original). The final of this triad, reputation, is clearly predicated upon the former two. If the marketing machine of the academic publisher promotes itself as absolute quality and the better arbiter of what material should be published, then of course, were this to be accepted, it would be the ultimate accolade to have one's work published there, heralded as The Truth. Clearly, these recommendations will do little to endear academics to publishers, particularly when couched in this vein; we will return to what can be done about it later.

From the picture painted here, the self-subverting nature of all three parties can be clearly canvassed. Researchers, in their blindness to the processes driving acquisition, limit their own access to material by the very criteria of prestige to which they cling. Libraries, in pushing for the open access solutions to their budgetary woes, put themselves at the mercy of a reconfigured power structure within the institution, threatening their own existence. Publishers, in their nostalgia for an impossible future, either hide financial relations behind libraries, resulting in the extinction of their own customers, or alienate early-career researchers by locking them out of the publishing cycle, deferring the problem until a later date. Attempting to trace back from this situation to an origin seems to yield no clear result. Any one of these parties could be held responsible for the current situation, the fine mess into which we have been led.

Command and control

Botnets, such as Conficker and Storm, with their millions of zombie machines, sit idle most of the time, awaiting a request for action through their respective communication channels. These channels are known as command and control systems, for obvious reasons. There is only one fundamental requirement of these systems: that they are resilient. This is achieved through a variety of methods: by obscurity (making it difficult for information security researchers to find, understand and thereby disrupt); re-use of existing infrastructures (for instance, running the mechanism through Twitter or Internet Relay Chat so that disabling this will also disable its legitimate uses, a sort of 'Betamax court case' ruling for malware); and distribution (making it harder to bring down the mechanism by distributing it across the network). Academic publishing has managed to build, autosubversively, a resilient

command and control mechanism to relay and amplify the destructive signals from each zombie to the other. It is to the parallels with this typology that I will now turn.

Obscurity: as has been noted, the library creates a blind-spot in the network. For-profit publishers' prices are translated, through the library, into a straightforward negative imperative: 'access denied'. It appears, to the researcher, that the message originated from the library and blame is thus incorrectly apportioned to this corner. Conversely, the supposed free-market competition that should feed back from researchers' demand to publishers' supply can be masked by limited library budgets. This competition is evaluated on the basis of usage metrics. However, it is clear that the metrics currently deployed – most of which are citation-side – do not adequately capture a usage picture of inter-library loans. It would only be possible to get a true picture of demand were price to be totally removed from the scenario so that researchers were not limited in their access to material. Of course, this would negate the need to measure such use.

Infrastructure: there is a clear parallel with the use of public channels for command and control relay at work here. This is because the problematic features of the system are inherently structural: it has appeared, for a long time, that it would be impossible to remove the autosubversive aspects without also losing the research output. For researchers, open access provides the solution to this dilemma but, clearly, from the logic already outlined, the other actors have strong motivations to keep this from emerging.

Distribution: in many ways attributable to the previous points, there are always two demands made upon any actor within the network, but usually with their own actions as a root cause. Researchers experience twofold pressure from libraries (in terms of access) and publishers (in terms of submission prestige). Libraries are pressured for access to material by researchers and placed under financial strain by publisher prices. Publishers face a commercial pressure from customers (libraries) and suppliers (researchers) while also having to maintain reputation in the eyes of the latter. This constant pressure from multiple angles renders the system resilient, in library-publisher relations, to a single point of failure. For instance, the inability of libraries to pay will not mean the demise of publishers so long as researchers continue to value the journals, it will merely result in already financially strained institutions having to find the money demanded, most likely through human resource cuts. Again: the inability of libraries to supply material to researchers will not impact the entire system, it will merely result in an exodus of academics into the institutions that can meet demand – the dreaded brain drain.

However, the system is not fault-tolerant in respect of the researcher. Should researchers, en masse, decide to trash the currently accepted metrics and journal valuation system, publishers' business models would collapse but – with open access software packages now widely available – research publication would not cease. There are, of course, strong mechanisms in place to check this and it is unlikely that the required unity could be mustered. From funding mandates down to personal egotism, the prestige barrier is a factor that can only be eroded by time, not obliterated in the present, by which time the system could well have adapted to preserve its commoditized nature in unforeseeable ways.

Dismantling the network

So what, then, can be done? The procedure for dismantling a botnet varies as technologies shift but, at present, there are several successful tactics. The first is technological in nature. It consists of analysing the behaviour of the malware, reverse engineering the command and control protocol, crafting a client that emulates the behaviour of a current zombie (but is actually autonomous) and then using this client to disrupt the command and control channel. Likewise, developing effective anti-virus signatures for the malware in question can help, although more cleverly crafted botnet entities function at the lowest level, called rootkits, and are thus extremely hard to detect. The next generation of malware will likely employ hypervisor virtualization (for instance, Rutkowska 2006 and King et al. 2006), wherein the entire operating system runs as a guest within the malignant entity and is therefore almost completely at the mercy of its invisible hand. The other recourse for dismantling botnets is an appeal to legal authority. If one can firmly ascertain the identity of the botmaster, arresting this individual or group under computer misuse provisions will result in the shutdown of the network. If it were desirable to eliminate zombie entities from the academy's publishing cycle, might not these models also have their analogies within this typology?

Technological: many researchers do not consider it important to query the mechanisms of dissemination for their work. When this is the case, these researchers have been virtualized, in the sense of one operating system on a computer running inside and under the authority of another, as with rootkits. They are zombies, whose ostensible autonomy is hosted by the botnet and predicated upon their blindness to the controlling concepts sitting beyond their grasp. In this sense, they have already reached the level of a hypervisor rootkit; a system of malware that fools all software running beneath it into believing that it has been given direct access to the hardware, while in reality all channels in and out are monitored and can, at will, be controlled by the rootkit. Such researchers are as unlikely to accept knowledge of their constricted agency in academic publishing as Plato's cave-dwellers: the system seems to serve their interests, it is the reality of academia. As is clear, however, it is also shadow-like.

It seems, therefore, that as with the technological solution of the anti-virus, beyond a certain level of 'complicity', or depth of malware, this method will be of limited efficacy. Instead, it becomes necessary to adopt the more extreme approach of 'emulate and subvert'; the very technique that a rootkit would use. This is, essentially, the phased transition approach whereby established researchers who understand the high stakes at play commit to publishing a certain percentage of their work in open access journals. This could even be extended a step further to the suggestion of publishing this quota in specifically non-commercial open access outlets: university presses. In such a system the researcher appears to be continuing along traditional lines, while concurrently tipping the balance in favour of open access.

Legal: writing computer viruses and gaining unauthorized access to computer systems are criminal activities in most jurisdictions. The most effective means of bringing down a botnet is to physically apprehend the individual or group responsible; the gatekeeper who can be compelled to divulge the encryption keys and passwords for the network. Could this find a parallel in the world of academic publishing, in the simple ousting of one party or more?

Would it be possible and desirable to remove publishers from the system? This is certainly a theoretical possibility. When analyses such as that of Stephen Mooney make it clear that publishers are seeking profit first and foremost, rather than providing material to the scholarly community, perhaps it is naïve to hope that business practices could be predicated upon such altruism. On the other hand, researchers have the power to substantially erode these profits should they so choose. If an entire upcoming generation of scholars is aware of this, publishers must – if they wish to survive in this brave new world – re-conceive and re-present the value they bring as existing for the other.

It must also be considered that such a removal would have a huge knock-on effect on libraries for, as has already been explored, what would their role be? This can perhaps finally be answered through another question: do academics have the technical skills and time to embark on publishing enterprises of their own? I would suggest not. It might, in the end, be that knocking publishers off the top spot will result in a simple slide in which their place is taken, in the new open access world, by the library-as-publisher.

Repercussions

Even as open access holds out this possibility, there are strong incentives for publishers to ensure that they are not wiped off the map, and libraries also are not keen on their change of role. Indeed, to coin an unfortunate acronym, the library becomes the Research Output Team. The potential mass decentralization of publication will of course also impact upon researcher activity. For too long, research has been valued for its location rather than its content. The advent of easily available technical solutions should lead to a proliferation of increasingly niche e-journals to the point where location is chosen less on prestige, but rather that the publication is of relevance to the work. This is not to suggest that peer review and quality control should be abandoned, but rather that ranking journals according to their rejection rate is elitist nonsense that does not help researchers find and evaluate scholarly material from their field. Publishers must not be allowed to keep their place merely because of conservatism in the academy and it is certainly not the role of universities to prop up an outmoded business model.

While measures of assessment, such as the United Kingdom's Research Excellence Framework, are designed to perpetuate the botnet by linking funding to a researcher's performance within that very system, such metrics are merely the second edge of a Damoclean sword. If the system is allowed to continue as it stands, researchers will no longer be able to afford access to material as the library heads to extinction; they will no longer be able to carry out their work. If researchers buck the trend and fare poorly in the assessment frameworks they will, likewise, find themselves unable to work as their funding will be slashed. It is perhaps only fitting to conclude by noting that this practice of autosubversion is clearly not unique to publishing, as evidenced in this final example of assessment metrics, but rather seems to pervade the whole academy. Researchers must become aware of the constraints placed upon them by external systems with which they are complicit and work to stem the tide of colonization. Soon it should be possible to banish to history the days when researchers could feign ignorance of the impact their choices make. As the American novelist

Thomas Pynchon put it, although not in reference to his later zombie-like beings the Thanatoids: 'we do know what's going on, and we let it go on' (1995: 713). We must all work to know better the mechanisms through which we disseminate our research, so as to break free of the botnet, so as to not act against our own interests, to not let it go on, so as to not be, in this typology of technology, infection and auto-destruction, zombies spun within a hegemonic web.

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