Armchair Auditors: Crowdsourcing Analysis of Government Expenditures

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ABSTRACT: Increasingly, there is interest in using information and communications technology (ICT) to help build a "better world." As an example, the United Kingdom has initiated an "open data" movement to disclose financial information about federal and local governments and other organizations. This has led to the use of a wide range of technologies (Internet, Databases, Web 2.0, etc.) to facilitate disclosure. However, since there is a huge cost of generating and maintaining open data, there also is a concern: "will anyone do anything with the data?"

In a speech in 2009, David Cameron, the Prime Minister of the United Kingdom, used the term "armchair auditor" to describe crowdsourcing analysis of that data. In that speech, Cameron (2009) noted: "Just imagine the effect that an army of armchair auditors is going to have on those expense claims." Accordingly, as more and more countries and organizations generate open data, those "armchair auditors" could play an increasingly important role: to help crowdsource monitoring of government expenditures. This paper investigates a number of potential benefits and a number of emerging concerns associated with armchair auditors.

Keywords: armchair auditing; crowdsourcing; open data; e-government; auditing.

INTRODUCTION

The Internet provides a medium where data and information can be rapidly and thoroughly disseminated to broad groups of people. As a result, it probably is not surprising that there have been calls for governments to make data and information available on the Internet in order to facilitate transparency through open data movements.[1] Although there is substantial interest in open data around the world (Neubauer 2014), at this time, few countries outside of

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[1] See: https://en.wikipedia.org/wiki/Open_data

Canada,[2] the United States,[3] and the United Kingdom[4] make government expense data broadly available. Further, the format of that data varies from expense-level data to financial reports. In any case, with the data's availability, there is now increasing interest in actually using the available data.

Much of the interest and action was initiated at roughly the same time in the United States by President Obama, and in the United Kingdom (U.K.) by David Cameron (2009), Prime Minister of the U.K., who noted:

> Indeed, the promise of public scrutiny is going to have a powerful effect on over-spending of any variety. (we) will put all national spending over £25,000 online . . . And we will extend this principle of transparency to every nook and cranny of politics and public life, because it's one of the quickest and easiest ways to transfer power to the powerless and prevent waste, exploitation and abuse.

Further, in the U.K., local government expenditures over £500 were made publicly available.[5] As a result, as more data have become available on line, government leaders have begun to anticipate some of the benefits. In May 2009, Cameron, as part of a "principle of transparency" in government expenditures, asked citizens to examine and analyze government expense data as they become available, making first use of the term "armchair auditor":

> Just imagine the effect that an army of armchair auditors is going to have on those expense claims. (Cameron 2009)

In October 2009, that phrase "armchair auditor" was reemphasized by Francis Maude, Shadow Minister for the cabinet office in a discussion of government spending on "Information and Communication Technologies":

> The UK Government spends more on ICT than any other government and yet the history of UK government ICT projects is littered with budget overruns, delays and functional failures . . . We need a fundamental rethink . . . We want to unleash an army of "armchair auditors" to crawl over the Government's accounts—ordinary members of the public who will be able to see for themselves whether their government is really delivering value for money for them. (Collins 2009)

Accordingly, politicians are aware that disclosure and analysis of open data could lead to additional scrutiny that could deter politicians and government workers from making expenditures that are inappropriate. Further, analysis of those expenditures could ultimately lead to censure and electoral consequences.

Purpose of this Paper

The purpose of this paper is to explore the notion of "armchair auditors." In particular, this paper examines what it means to be an armchair auditor and analyzes some of the strengths and weaknesses of this innovative crowdsourcing approach to analyze accounting data in order to help guide future open data and armchair auditing efforts. This paper also examines blog information about previous armchair auditor efforts to begin to understand some of the emerging

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[2] See: http://www.open.canada.ca/en
[3] See: https://www.data.gov/open-gov/
[4] See: http://www.data.gov.uk/
[5] See: https://www.gov.uk/government/policies/making-local-councils-more-transparent-and-accountable-to-local-people

implementation concerns. Finally, this paper investigates some of the reasons why it appears that there has been limited armchair auditing to date.

This Paper

This paper proceeds in the following manner. The first section has established the motivation for armchair auditors and summarized some of the development of the notion. The next section provides a brief review of crowdsourcing in general and auditing contexts. The third section examines the relationship between recent open data movements and armchair auditors. The fourth section investigates armchair auditors and other digital movements in the U.K. The fifth and sixth sections provide two different approaches to analyze use of armchair auditing. The fifth section examines blog reports by reported armchair auditors to understand some of the implementation issues of armchair auditors, while the sixth section investigates some of the relationships between armchair auditing and activity theory. The seventh section analyzes some additional potential issues of armchair auditing, using incentives and knowledge-information trade-off. The eighth section investigates the apparent lack of growth of armchair auditors, while the ninth section examines the potential future of armchair auditing. The tenth section briefly summarizes the paper, its contributions, and some extensions.

BACKGROUND: CROWDSOURCING

Crowdsourcing was originally defined by Howe (2006) in contrast to outsourcing. In particular, crowdsourcing is "the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers."[6]

Economic Basis of Crowdsourcing

There is strong economic theory behind using crowdsourcing. For example, Hayek (1945) noted that "knowledge is not given to anyone in its totality." Instead, "the knowledge of circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess." Accordingly, if there is interest in gathering that dispersed knowledge, then those individual bits of knowledge must be somehow gathered, assembled, and used. Crowdsourcing provides one such approach to accomplish that objective.

Crowdsourcing and Emerging Technologies

A number of emerging technologies have been used to facilitate crowdsourcing, including the Internet and different forms of social media and Web 2.0. For example, Wikipedia provides a forum for crowdsourcing content in a wiki environment. As another example, Twitter has been used to provide messages about ongoing events from citizens to other citizens, facilitating a kind of crowdsourcing. All of these technologies and others facilitate interaction and collaboration by large groups of people to help gather knowledge to address an issue or problem.

Crowdsourcing Auditing and Monitoring

There have been only a few "audit-like" uses of crowdsourcing in computer science and information systems. For example, crowdsourcing has been proposed as an approach to auditing biomedical ontologies (Mortensen, Musen, and Noy 2013). In particular, ontological relationships

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[6] See: http://www.merriam-webster.com/dictionary/crowdsourcing

were given to crowd workers to verify. Workers from Amazon's Mechanical Turk,[7] that had passed various qualification tests, manually verified the elements of the ontology. In addition, there have been proposals for systems designed to measure participation and audit crowdsource contributions in an effort to prevent fraud in online crowdsourced events and competitions (Mercuri and Harris 2011). Further, there has been development of so-called "sidewalk auditing" (Hara, Le, and Froehlich 2013). Using mobile devices, the crowd is asked to identify situations that are inappropriate or anomalous. For example, a sidewalk audit might note that there is not accessibility for wheel chairs to a bus stop or similar situations. In a world of increasingly mobile computing and big data, we can expect that there will be a number of other situations in which crowdsourcing is used to gather and audit different situations or data.

These crowdsourcing applications are closely related to the so-called "social audit."[8] Social audits started as analyses of a company's social responsibility activities. However, social audits also were used to audit different aspects of governments, not just companies. In addition, in some settings, these audits have begun to go from strictly formal approaches done by experts to including more informal approaches. For example, social media have been suggested as a means of facilitating social audits, as the crowd performs audit functions for the government.

OPEN DATA, TRANSPARENCY, AND ARMCHAIR AUDITORS

Armchair auditing can be identified with the general notion that *we can build a better world through using information technology and crowdsourcing to facilitate open data and analysis of that data,* to engage the citizens to ensure transparency of government. This section defines armchair auditors and examines some of the advantages of using armchair auditing considering data disclosure, cost savings, and some control characteristics.

Definition

Since there has been limited information about government expenditures available on the Internet, the initial focus of armchair auditing was to make that data available online. As a result, an early definition[9] of an armchair auditor was "a website that uses open spending data provided by councils to dynamically generate reports for users on council spending according to various criteria." This definition roughly equates armchair auditors as "websites," "open data," and/or databases.

Over time, the implications of the term "armchair auditor" have begun to expand, so that rather than limiting the definition to simply providing open data or reports on that data, the notion of an armchair auditor is coming more in line with Cameron's (2009) original call for an army of armchair auditors. In particular, an armchair auditor is a person that is involved in crowdsourcing either data or information availability or analysis of financial or operational data. Armchair auditors typically employ technology, such as databases, web pages, and other devices, to both make data available and to facilitate analysis of the available data. Armchair auditors may have many different purposes, e.g., ensuring that the ICT system creates value, etc., and they may operate in many contexts, but typically in a context where data ultimately are open data, available online. Finally, armchair auditing is based on notions of crowdsourcing from citizens, although analysis could involve others not part of the citizenry.

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[7] Mechanical Turk is an online tool (see: https://www.mturk.com/mturk/welcome) that can be used to get individuals to provide input to a range of questions or concerns.

[8] See: http://www.regionalcentrelac-undp.org/images/stories/DESCENTRALIZACION/herramientas/Practical%20Guide%20to%20Social%20Audit.pdf

[9] See: http://www.data.gov.uk/library/armchair-auditor

FIGURE 1
Data from Windsor and Maidenhead

See: http://www.headlinedata.com/projects/armchair-auditor/

At the heart of armchair auditing is the notion that the analysis is informal and not tied to any specific government group. Because it is informal and voluntary, there are no requirements on armchair auditors. Further, armchair auditors are free to chase those data that interest them for whatever reason. Finally, armchair auditors are not required to issue any formal report or even tell anyone that they have done an armchair audit.

Data Availability

Perhaps the first two U.K. armchair auditor sites were for "Windsor and Maidenhead" (Figure 1) and the "Isle of Wight" (Figure 2). Both were apparently designed to make local government expenditure data available online. Both apparently employed the same basic approach based on the design and software for the "Windsor and Maidenhead" site.

In particular, as one example (Figure 1), transaction information about 115 different service providers and 1936 suppliers are provided in a form listing the different expenses that have been incurred from those service providers and suppliers, which department incurred those expenses, the specific service or good, and the date incurred are provided. In total, 10,439 payments are summarized over the period 2008–2009. Figure 2 illustrates the existence of over 70,000 payments from the Isle of Wight.

FIGURE 2
Isle of Wight Armchair Auditor

See: http://armchairauditor.onthewight.com/

As a more detailed example, the "Windsor and Maidenhead Armchair Auditor" site for "3c Technology Limited" (a supplier), is provided in Figure 3.[10]

Data Format

The initial data format chosen for both websites was "CSV" or "comma separated variables." Thus, the approach is to put the data into a flat file format that is particularly useful for manual analysis or review of the data. Further, the data could be directly downloaded by potential armchair auditors to facilitate their review.

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[10] See: http://armchairauditor.herokuapp.com/suppliers/

FIGURE 3
Windsor and Maidenhead Armchair Auditor

Windsor and Maidenhead Armchair Auditor

Home   Services   Suppliers   Scoreboard   About

3c Technology Limited (Supplier)

Search Google for 3c Technology Limited

Download data as CSV

Summary for 02 Nov 2009 to 25 Mar 2010

Payments	Total £	Max £	Min £	Average £
2	1,656	908	748	828

Payments from the Council

Date	Ref.	Transaction	Directorate	Service	£
02 Nov 2009	5259		Resources	Business Improvement	908
25 Mar 2010	5589		Resources	Corporate IT	748
			TOTAL		1,656

See: http://armchairauditor.herokuapp.com/suppliers/3c-technology-limited

Controls

As hinted at in Cameron's (2009) speech, armchair auditors can be used to function as controls over spending using classic control theory of preventive and detective controls. Armchair auditors provide a potential detection control if their analysis finds any existing problems. Further, the existence of armchair auditors provides a potential preventive control, as noted in Cameron's (2009) announcement ("Just imagine the effect that an army of armchair auditors is going to have on those expense claims"). However, those controls are informal and may lie largely in the mind of the elected or appointed government officials.

Demand for Armchair Auditors

The notion of an army of armchair auditors is a very appealing and intuitive concept, potentially leading to substantial demand for armchair auditors. People from the crowd, with different levels of expertise, interested in analysis of the data of different entities would provide their analysis to the crowd. Analysis would be contributed, would not be costly, and could help society at the same time. Further, in some settings where the crowd was large, crowdsourcing could effectively generate the ability to continuously monitor government expense information as it became available. Armchair auditors of various levels of expertise would contribute different points of view using different information to "inform the world." In so doing, as noted above, this could increase transparency and potentially eliminate government abuse, exploitation, and waste. In this

setting, ultimately, armchair auditing would be an informal mechanism generated, based on people donating their time and analysis.

ARMCHAIR AUDITOR MOVEMENT AS PART OF OTHER DIGITAL MOVEMENTS IN THE U.K.

The armchair auditor has evolved and emerged as part of and influencing at least two digital movements.

mySociety Movement[11]

The Armchair Auditor movement has been identified as part of the "mySociety" movement, which "aims to help people become more powerful in the civic and democratic parts of their lives, through digital means." Providing citizens with digital information potentially provides improved transparency and helps create a "better world" through information technology.

Open Data Movement

In the United Kingdom, the open data movement has led to placing substantial data on the Internet for public consumption and potential review. For example, the U.K. recently determined to make information about a broad range of government expenditures available. In particular, it was determined that all of the expenses of public servants paid more than £150,000 a year would be put online—as would all public spending at the federal level over £25,000 (BBC 2009).

After the initial websites aimed at sharing data, starting roughly with 2010 data, U.K. government began publishing government financial data. At that time, the development of Armchair Auditor data apparently was at least partially taken over by the Open Data Movement, including, for example, the Open Data Users Group (ODUG).[12]

Open data can come in a number of formats and in different degrees of depth or structure. The Open Data Movement rate data as having one to five stars: One star for unstructured data (e.g., pdf); two stars for data in a proprietary format, such as Excel; three stars for data structured in an open format, such as CSV; four stars for "linkable data"; and five stars for data that were linked to other data, for example, to URLs.

In any case, the Open Data Movement has led to disclosure of increasingly large quantities of data. Further, such data disclosures can be considered part of the emerging "big data" movement that has garnered increasing attention. Big data, since providing government expenditures over £25,000 pounds and local expenditures over £500 pounds, will result in substantial data available to analyze.

EMERGING IMPLEMENTATION ISSUES OF ARMCHAIR AUDITORS

The issue facing anyone interested in crowdsourcing analysis of government expenses is how to implement armchair auditing, in order to fully leverage the digital environment in which openly available government data are based, and to organize crowdsourced citizen participation and analysis of that open data. After the initial steps of generating data and capabilities to search those data, as people began to analyze data and adopt the role of armchair auditors, they encountered some emerging concerns. This section analyzes concerns raised as part of the implementation of armchair auditing as discussed in blogs.

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[11] See: http://www.mysociety.org/about-tom-steinberg/
[12] See: http://www.data.gov.uk/odug

Data or Information or Both

One of the first analyses of the limitations of armchair auditors was posted as part of a blog, suggesting that there was ambiguity in the role of armchair auditors and that armchair auditors had little access to critical context information (Butler 2010a).

> For a start I think the mission for armchair auditors needs to be much better defined. It is not just about data, it is also about what does the data buy? (Higgerson 2012)

Similarly, another commentator who apparently tried doing armchair auditor analysis noted:

> For this to work in the way envisaged, councils must put out a lot more information and in a format that can be used by anyone. There has to be sufficient context to enable anyone reading the information to understand what is being bought and why. Then you can have a sensible discussion about whether the spending makes sense or is value for money. We can then deal with the material figures not the trivial ones which cause most of the negative publicity. (Butler 2010b)

Unfortunately, with just a list of expenses, there is limited context information. Further, because, typically, armchair auditors are "outside" crowdsourced participants, armchair auditors are not in a position to gather much additional information about context of the expenditures within the organizations. In addition, these two comments illustrate that the primary concern of those armchair auditors does not appear to be with the "quality of the numbers," but instead is more concerned about value.

Access to Previous Audit Work

Recently, it also was recognized that if "armchair auditors" are to be effective, they need access to the actual auditors' work, suggesting that not just data be made available, but also information and other analyses of those data. As noted in recent legislation:[13]

> Currently, the Commission summarises the results of local audit work in our annual "Auditing the Accounts" publications. These provide "armchair auditors" and other key stakeholders with easily accessible answers to questions such as:

- which authorities failed to produce their accounts on time?
- which authorities have had their accounts qualified, and why?
- which authorities have had their value for money conclusion qualified, and why? and
- where did auditors issue public interest reports during the year?

Access to Additional Information

Armchair auditors face limitations in getting further information about the actual disclosed information. In the U.K., citizens can request to inspect and make copies of local government accounts' information at particular times of the year; however, what can be copied might be edited by the time the armchair auditors get to the material. As a result, there has been controversy about the amount of information that government officials have redacted and the corresponding ability of an armchair auditor to get additional depth into their analysis of particular issues (e.g., see Figure 4).

Apparently, as armchair auditors pursue issues and concerns, they have limited ability to press government information sources, e.g., city personnel, for additional detailed information. Based on

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[13] Local Audit and Accountability Bill (October 2013). Bill 101 of 2013–14. See: http://researchbriefings.files. parliament.uk/documents/RP13-56/RP13-56.pdf

FIGURE 4
On the Rights of Armchair Auditors to Additional Information

Pages

· Parking Ticket Appeal Guide

May 2014 Elections

May 2014 elections
London
62 Day
12 Hr
27 Min
19 Sec

MR MUSTARD

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Email address...   Submit
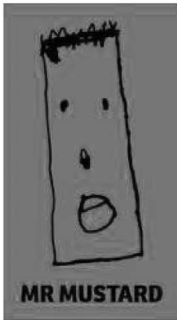
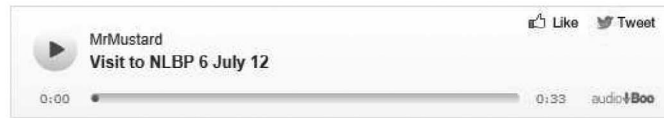The Famous Four Barnet Bloggers (- me)

· Broken Barnet (Mrs Angry)
· Future Shape (One Barnet)
· Mr Reasonable
· The Barnet Eye

Twitter

Total Pageviews

20 July 2012

Obstructing the Armchair Auditors - the evidence

MrMustard
Visit to NLBP 6 July 12

0:00   0:33   audio♦Boo

👍 Like   🐦 Tweet

As readers will know any resident can pop along to the council during a set time in the year, usually in July, and inspect the Accounts for the council tax year that just ended in March.

This right is conferred under the Audit Commission Act which includes the following within S14

A person who has the custody of any such document and—
(a) obstructs a person in the exercise of a right under this section to inspect or make copies of the document, or
(b) refuses to give copies of the document to a person entitled under this section to obtain them, is guilty of an offence and liable on summary conviction to a fine...

Let us look at the evidence to see if obstruction has taken place.

Mr Reasonable, Mrs Angry and Mr Mustard went to North London Business Park. We were there for hours and didn't achieve much in the way of an armchair audit because the documents that we wanted to audit were so heavily redacted as to make the task impossible. Now listen to the 30 second extract of the meeting, the first voice you hear is Mr Reasonable, then Mrs Angry and then a senior lady officer telling us why the documents had been redacted (when they shouldn't have been). Mr Mustard often tapes council meetings so that he can accurately transcribe what was said and to avoid those "he said, she said" arguments

So what did the senior lady officer say about the suppliers' invoices we were looking at "on the redaction that's what they've asked us to do" and other words confirming that suppliers have been approached and redaction has followed.

See: http://www.lbbspending.blogspot.com/2012/07/obstructing-armchair-auditors-evidence.html

armchair auditor queries, it appears that government entities may need to provide only limited or partial information, as seen in the example, which can limit effectiveness, but also limit the cost to government of spending time discussing information with armchair auditors.

ANALYSIS OF ARMCHAIR AUDITING: AN ACTIVITY THEORY APPROACH

Armchair auditing is an "activity" aimed at the analysis of openly available financial data. Accordingly, the purpose of this section is to use activity theory to analyze armchair auditing. Using the components of activity theory can provide additional insights into armchair auditing. Although

FIGURE 5
Activity Theory
(Engestrom 1987)
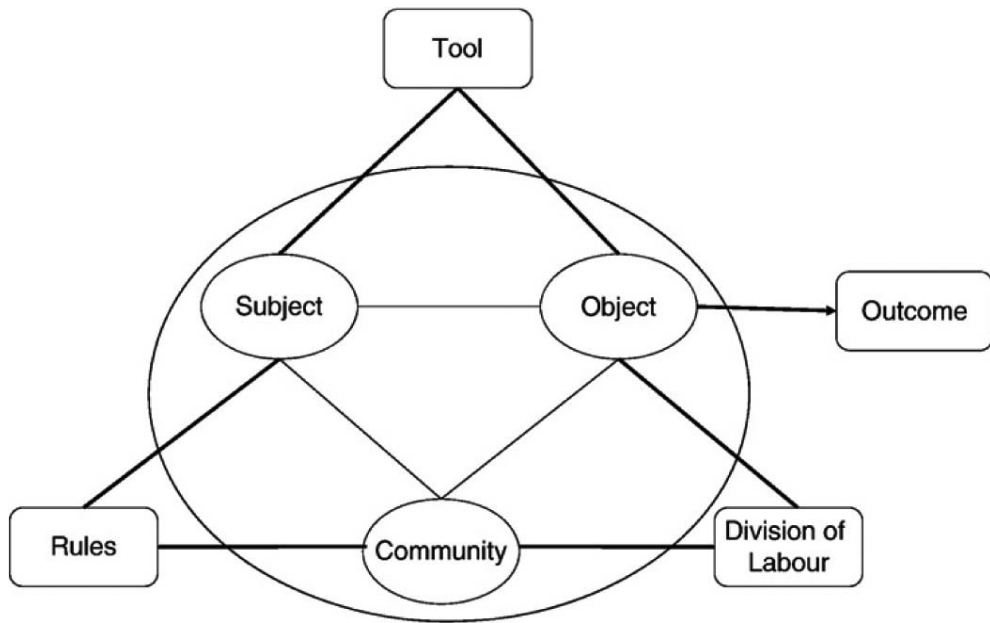
activity theory has received only limited use in accounting (e.g., O'Leary 2010), it has a substantial history, generated from the efforts of Russian psychologists trying to develop a psychological theory based on Marxist philosophy and thinking, and has been used in human-computer interaction research (e.g., Collins, Shukla, and Redmiles 2002; and others).

Russian psychologists developed activity theory for use in psychology based on Marxist thinking and philosophy. Activity theory has been used in human-computer interaction research (e.g., Collins, Shukla, and Redmiles 2002; and others). Lev Vygotsky, a Russian psychologist, initiated activity theory in the 1920s and 1930s (as summarized in Vygotsky [1978]). Others, including Leont'ev (1978), have extended that research. Rubenstein first formulated the notion of human action as a unit of psychological analysis. As noted by Mintz (1958), Leont'ev and Rubenstein were leaders in the development of Russian psychology research.

One of the key sets of structures used to explain activity theory was developed by Engestrom (1987). In particular, activity theory (e.g., Engestrom 1987) provides a template-based approach based on seven components (see Figure 5): tool, rules, division of labor, subject, object, community, and outcome. In particular, activity theory indicates that human activity uses tools; rules or knowledge about how to perform the activity; different tasks are performed by different actors with division of labor; the subject is a person who works on the activity, who can take different roles, e.g., armchair auditor; the object is what is modified or explored by the subject(s); the community is the group of people involved in the activity being analyzed; and the outcome may or may not be one that accomplishes the object, e.g., audit financial statements.

This section investigates its use to analyze crowdsourcing in general and armchair auditing in particular, using activity theory as a framework to elicit potential issues.

Tools: No Built-In Tools

Activity theory emphasizes the importance of tools to facilitate activity processes. In the case of armchair auditing, some commentators have made proposals for tools (Hirst 2013). As an example, visualization has found use in a number of disciplines and provides a vehicle to help understand patterns in data: Peng, Feng, and Rozenblit (2006) used visualization as a means of auditing intrusion-detection data. Accordingly, visualization might be used to generate context diagrams or other visualization approaches using available data to guide armchair auditors (Hirst 2012). Other approaches could employ statistical analysis to help armchair auditors analyze the data. Still other approaches might allow the linking or comparison of information in multiple databases, e.g., to provide a comparison of costs from similar vendors. Unfortunately, there are no tools generally available for armchair auditors.

The need for tools to facilitate armchair auditing could be met from multiple sources. As noted at a recent presentation of this paper, educational institutions could use this as an opportunity to get and analyze data, with students performing analysis as a supplement to their classroom tasks. Still another source could be entrepreneurs who develop applications to facilitate that analysis, meeting a potential worldwide market need. As an example, recently Dai, Li, and Vasarhelyi (2015) have proposed the development and use of "apps" for specific armchair auditing activities.

Rules: No Promulgated Rules or Methodologies for Analysis

Activity theory recognizes the importance of rules for performing activities. Unfortunately, armchair auditors have little guidance to facilitate and support their analysis. For example, to date, there are few (if any) promulgated methodologies for analysis of financial data by armchair auditors. Government or educational institutions could generate such approaches. Further, because armchair auditing is an informal activity, if armchair auditors did not want to follow those rules, then there would be limited recourse against them. Finally, it is arguable whether there should even be promulgated methodologies. If the crowd is to bring their unique views to the analysis of the data, then a promulgated methodology or a set of rules could potentially do more harm than good.

Division of Labor: No Clear *A Priori* Structure

Activity theory also indicates the importance of the role of division of labor in activities. Unfortunately, armchair auditing, as with most crowdsourcing activities, has no structure or *a priori* plan to divide the work into discernable pieces, without formal coordination. As a result, potentially, armchair auditors may only examine portions of the available data while ignoring other parts. In addition, armchair auditors might do only partial analyses of data, e.g., a ratio analysis, while ignoring other parts of the analysis, such as comparing the data to other entities. Further, armchair auditors could focus on data that they specialize in, neglecting other potential critical issues. In addition, different geographic areas could have different numbers of armchair auditors for various reasons, including population, education levels, and interest.

Subject: No Required Knowledge

The subject's knowledge can be a critical variable to making crowdsourcing work. In the auditing community, before engaging in auditing activities, potential auditors undergo a rigorous education program. In addition, there are certification programs for auditors. For example, in the U.K., accounting and auditing knowledge accomplishment is measured by becoming a "Chartered Accountant." Further, associated with every audit engagement, there are teams of auditors with varying expertise, including experts. Accordingly, it is probably not a surprise that the U.K. parliament recently noted that the armchair auditor "needs to be a particular type of person: engaged

and interested in local government, with a good grasp of how government works and motivation and skills to dedicate time to it. To have all these traits in combination is rare."[14] However, armchair auditing is an informal mechanism and there are no guarantees as to knowledge of the participants.

Object: Limitations in the Data and Information

In activity theory, the object is what is being analyzed by the subjects. Unfortunately, there are at least five limitations of the data available to armchair auditors. First, some of the early data presented for armchair auditors had no related date information, indicating when the event was recorded. Second, much of the early data are available only in pdf formats or flat files. Information in pdf format is not easily manipulated in a computer-based environment. Flat file formats limit the ability to query the data, to link data on different tables. Third, although CSV data provide a format that can be loaded into most spreadsheets, such as Excel, rather than a single format, CSV provides a family of formats that differ in a number of ways.[15] Fourth, although armchair auditors ultimately may have access to open financial information, that does not mean that there is "information" about comparative costs or even what was purchased for the amounts in the transactions. As a result, analysis of the data may have limited ability to address issues such as "value for money" or cost-benefit analysis. In addition, access to transactions would not provide the ability to know if a transaction was fraudulent or involved collusion, only that it occurred.

Community: No Clear Community

Community refers to virtually all of the people directly involved in the particular activity being analyzed. In the case of armchair auditors, there seems to be limited, if any, community design to support or facilitate armchair auditing. The blog information suggests, at most, a loosely linked informal group. Unfortunately, such a group provides limited ability to exchange information, tools, etc., that could facilitate armchair auditing.

In addition, although there is constant pressure to ensure that professional auditors remain at arm's-length from their clients (e.g., Eden, Dacin, and Wan 2001), with crowdsourcing, there are no constraints in place to guard against armchair auditors having direct relationships with the people that are the source of the data under review. To the contrary, with crowdsourcing, those that are not at arm's-length might have the greatest interest in being armchair auditors, as discussed below.

Outcome: Link Findings to Changes

Crowdsourcing is by its very nature informal. Armchair auditors have no formal mechanism or channels to report their concerns, other than blogs or other social media. Unfortunately, such approaches provide limited public forums. As a result, if there is an analysis of the data that leads to determination of actual audit concerns, then the current armchair auditor approach has no formal mechanism for reporting or addressing any questionable spending: The current approach has no formal mechanism for members of the public to get answers about why the money was spent.[16]

Further, if there are "actual" auditors, then the existence of actual auditor work begs another question: what would we expect that armchair auditors would be able to generate beyond the findings of the actual auditor? If real auditors do their job, then what is the role of the armchair auditor?

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[14] See: http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpubadm/564/56405.htm
[15] See: https://en.wikipedia.org/wiki/Comma-separated_values
[16] See: http://www.edemocracyblog.com/tag/armchair-auditors/ (last accessed February 26, 2014).

ADDITIONAL ISSUES

In addition to the issues brought to light by implementers and an activity theory-based approach, there are other potential limitations deriving from incentives and a knowledge-information trade-off.

Incentives

Principal-agency theory suggests that incentives are a critical concern (e.g., Eisenhardt 1989). Armchair auditors are likely to perform tasks for the public good, for economic benefit, or for political benefit. Although arguments can be made for the armchair auditor being a principal (e.g., a taxpayer) or an agent (doing an analysis of expenses), a key concern is what their incentives are for being an armchair auditor.

Armchair auditors interested in doing "public good" likely have some intrinsic payoffs. However, such payoffs may occur only if negative results are found, e.g., finding an overpayment for some expense. Accordingly, there may be no payoff if the agent does not find issues of concern.

If the armchair auditor is a competitor of some agent that does business with the government entity, then there can be direct economic payoffs if the armchair auditor finds some anomalous expenses in the data, whether real or convenient. In addition, if the armchair auditor is a competitor, then simply finding that some competitor does business with the government entity can provide information that could lead the armchair auditor to be able to compete with that competitor. As a result, open data could provide business intelligence to the armchair auditors that might facilitate their competition against another firm.

Further, the armchair auditor could be affiliated with a competitor of the politician responsible for the particular expenses. In this setting, there likely are substantial political incentives for the armchair auditor to try to find inappropriate expenses.

Information and Knowledge

Two critical issues for armchair auditors to be able to identify important issues are their level of *knowledge* about auditing and the events that governments participate in and the extent of *information* available to the armchair auditor. In general, if an armchair auditor has more knowledge and more information about the situations in a particular government entity, then they are more likely to be able to find and cogently report on anomalous events in the data.

Level of Knowledge

Armchair auditors' knowledge is likely to be on a continuum somewhere between substantial accounting and auditing knowledge and little to no accounting knowledge. However, it is also likely that to generate effective armchair auditing requires more knowledge rather than less. Further, organizational knowledge, such as how the entity functions, also is likely to be of interest and help to armchair analysis, as noted above.

Level of Information

Armchair auditors can come from all types of backgrounds, including government. As a result, some armchair auditors may have "inside information." For example, imagine that an accountant or manager that works for some part of the government is concerned about a particular set of transactions that they have seen conducted. Such inside information could be coupled with published financial information in order to provide real insights. As an armchair auditor, that accountant or manager would be in a position to provide insight and context to what might appear to be innocuous transactions. Armchair auditing could potentially provide the ability to bring information to the attention of others without being recognized as a "whistle-blower."

FIGURE 6
Armchair Auditor Knowledge and Information Trade-Off

Information and Knowledge Trade-Off

This discussion is summarized in Figure 6, with the four different boxes suggesting different situations. The lower left-hand corner (Box 1) likely is the setting where armchair auditors can generate their greatest contribution. If some members of the crowd have knowledge about auditing and inside information about potential anomalous events, then those armchair auditors are likely to be able to generate real insights.

Recourse?

At a recent symposium,[17] it was suggested that there could be recourse against armchair auditors that use inside information. An example was proposed regarding police expenditure information, which the discussant felt had resulted in recourse after the value of the expense was questioned. Since using inside information could result in recourse against the insider, there may need to be a way to either signal concerns or engage others as vehicles to help act on inside information. Armchair auditing may provide the ability to send those signals based on inside information, without recourse, by coordinating analyses within the community, i.e., get someone else, not directly affected, to analyze the data.

Malicious Armchair Auditors[18]

As noted earlier, people could have many motives for being an armchair auditor (e.g., doing public good or being a competitor). However, in some cases, armchair auditors simply could be malicious. Potentially, armchair auditors could write a blog making assertions that are negative and not true. However, ultimately, if the data are widely available, then such assertions could be

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[17] 33rd World Continuous Auditing and Reporting Symposium, Rutgers, The State University of New Jersey, Newark (November 8, 2014).

[18] This idea was suggested by one of the anonymous referees.

American Accounting Association

TABLE 1

Number of Tweets and Re-Tweets from @Armchairauditor

Date	Number of Tweets or Retweets
Calendar 2013	0
Calendar 2012	1
Calendar 2011	2
September 2010	4
August 2010	17
July 2010	21
June 2010	6

analyzed and potentially rejected. Unfortunately, such malicious behavior could have a substantial impact on the target, even if it is not true.

LACK OF GROWTH OF ARMCHAIR AUDITORS—NO CROWD?

Unfortunately, although there are increasing amounts of open data and a formal program for open data for governments and other institutions in the U.K., the United States, and other countries, it appears as though the armchair auditor movement is not expanding as rapidly as would be hoped. There has not been an "army" of armchair auditors yet. As a result, some commentators have argued that the "armchair auditors (have) yet to emerge" (Dunton 2011), while others have asked "Where are all those armchair auditors Francis Maude talks about?" (Ballard 2012). Further, it appears as if the notion of armchair auditor may be getting less attention over time, as the emphasis has switched more to notions of "open data" rather than "open analysis," perhaps because of the difficulty of doing such analysis. Although armchair auditing calls for crowdsourcing, it appears that there is limited crowd participation: Where are the armchair auditors?

Accordingly, the purpose of this section is to try and find ways of identifying trends in the number of armchair auditors. Although there is limited formal public data about the numbers of armchair auditors, there are at least three potential ways to assess the growth or lack of growth of interest in the issue of armchair auditors.

Twitter

One measure of interest in the concept is the Twitter page with the name "@armchairauditor." A summary of the number of Tweets is given in Table 1. Analysis of that table indicates a substantial drop in interest after roughly August 2010, with the development of open data.[19]

Another approach is to search Twitter for the hashtag "#armchairauditor." Unfortunately, a search using that hashtag in November 2014 found only two tweets.

Google Trends

As another example, the website www.armchairauditor.co.uk was not active at the time of this analysis. Perhaps this is just an indication that one of the original implementers of the concept is no

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[19] Apparently, 2010 initiated the availability of a number of open data sets; e.g., see: http://www.data.gov.uk/dataset/uk-civil-service-high-earners/resource/e9d53257-9eb9-43f7-911f-99173a0acfca

longer participating as an armchair auditor. Another measure of interest can be obtained from Google Trends. Unfortunately, that analysis finds that there is "not enough search volume to show graphs."

Google Blog Search

A third approach is to investigate the number of blogs that investigate armchair auditor concepts. Thus far, it appears that blogs seem to provide the primary forum for discussion of armchair auditor results. A Google Blog search found 14,700 results with the term "armchair auditor," suggesting that there is substantial potential interest.

Since armchair auditing is informal and there is no formal registration, it is possible to potentially underestimate the number of armchair auditors. In particular, with the disclosure of results limited to Twitter and blogs, the actual number of armchair auditors may be "hidden."

In addition, the nature of armchair auditor findings might be limiting what we think is the number of armchair auditors. In particular, armchair auditors may find positive, negative, or no results. However, if the results confirm no problem or suggest that government is doing its job, then there is not likely to be much interest by external sources. After all, the focus of the original discussions about armchair auditing by Cameron and Maude, above, suggested that armchair auditors would find events that were negative. Accordingly, it would seem that disclosing findings that led to negative publicity would gather greater attention. In actuality, there may be many people doing analyses of the open data, but if their analyses do not result in negative findings, then their concerns may not bubble up to garner public attention. In general, when it comes to analysis of government expenses, there probably is limited interest in finding no problems.

Technological Divide

Finally, Norris (2001) noted the potential development of a "digital divide." Technology or lack of an understanding of or access to technology can limit the ability of a person to contribute to settings based in technology. In the case of armchair auditors, typically, a person needs to be digitally savvy. In particular, data must first be accessed and then analyzed, both generally requiring an understanding of technology and analytics. As a result, the set of potential armchair auditors is necessarily limited.[20]

FUTURE OF ARMCHAIR AUDITING

As the United States and other countries begin to provide open data, potentially, this will increase the need for armchair auditors to review those increasing disclosures. As a result, that suggests an environment with increasing demand for armchair auditors.

Extension to Other Environments

In addition to other countries disclosing more data, in the United Kingdom, there have been pushes for letting armchair auditors have access to additional types of data, expanding their reach. For example, Keeling (2012) called for access and analysis of trade union data. Further, in the United States, a number of cities have begun to disclose financial data as part of open data movements, for example, in California.[21]

Hopeful Growth?

There have been some signals of hopeful growth of armchair auditors. In particular, others around the world have asked for armchair auditors. For example, on October 13, 2013, the New

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[20] The discussion on digital divide was suggested by Miklos Vasarhelyi.

[21] See: http://www.ballotpedia.org/wiki/index.php/Los_Angeles_County_employee_salaries

Zealand Taxpayer Union Incorporated was established to give New Zealand taxpayers a "strong voice" (New Zealand Taxpayers Union Incorporated [NZTUI] 2013). At the time, Chairman John Bishop noted, "we've come together to promote sensible fiscal management, to expose government waste and to promote policies to make public spending work better. Government, politicians and taxpayer funded groups are on notice that we are looking to expose waste or rorts" (NZTUI 2013). Further, as noted by David Farrar, a member of the Union Board, "the concern for our members is that vast amounts of public money are being spent by government on our behalf and we don't get value for that money. Our aims aren't just to cut government spending, but to make public spending work better" (NZTUI 2013). As part of these efforts, David Farrar also noted that one of the initial projects to help rein in spending would be to promote a New Zealand version of an "Armchair Auditor Act." However, there has been limited analysis and discussion of the notion of "armchair auditors" outside of the United Kingdom.

"Open Data" as "Big Data"

As open data moves to other countries and multiple organizations across those countries, the amount and types of data will rapidly move toward becoming "big data." In addition, using armchair auditors is consistent with notions on how to process the large quantities of open data being generated. With the development of such "big data," potentially seeking out multiple parallel (human) processors can be an effective approach to process that data. Ideally, each of the armchair auditors can choose some chunk of transactions and analyze those transactions. As a result, armchair auditing is consistent with classic computer-based approaches to big data.

Alternative Solution: Pay the Crowd

If there are not enough armchair auditors, then perhaps paying the crowd would be an alternative approach that could generate analysts. For example, Amazon Turk has been used to study a number of crowdsourcing activities (e.g., Kittur, Chi, and Soh 2008). Perhaps armchair auditors could be gathered for relatively small payments. If Amazon Turk is inappropriate, then perhaps crowds from other settings that have the appropriate skills could be engaged. Developing another site that specializes in armchair auditing might even result in a new business model, effectively outsourcing a consulting activity.

SUMMARY, CONTRIBUTIONS, AND EXTENSIONS

The notion of an "armchair auditor" was first suggested by David Cameron, Prime Minister of the U.K., as a term to describe crowdsourcing analysis of digitally available open data. This paper has examined the development and evolution of the concept of armchair auditors. As part of that analysis, this investigation couched armchair auditors into digital movements, including the open data movement. This paper also examined some of the emerging concerns associated with armchair auditing and speculated about the future of armchair auditing. In addition, this paper analyzed some of the strengths and limitations of the armchair auditor approach. Finally, although conditions seem to suggest that armchair auditors should prosper, there seems to be a question as to "Where are the armchair auditors?"

Contributions

There has been limited discussion of crowdsourcing auditing and armchair auditor efforts in the academic literature. This paper initiates a dialogue about the use of armchair auditing. In so doing, this paper provides a historical context for armchair auditing. This paper gathered information from blogs about how armchair auditors were implementing the concept. In addition, this paper applied activity theory, incentive analysis, and the knowledge-information trade-off to armchair auditing in

order to gauge some of the strengths and weaknesses of the concept. Further, the use of those theories provides a context for some potential changes in open data to facilitate armchair auditing. Finally, although this paper has investigated issues at the nexus of crowdsourcing and open data, it is clear that substantial political forces have invested in this approach and it is likely that others will continue in the future. Perhaps this paper will provide a basis for implementing some of those future efforts.

Extensions

This paper can be extended in a number of directions.[22] First, as other countries begin to push for open government data, perhaps the limitations identified in this paper can be considered in the nature of the data that they ultimately have disclosed. Second, this paper applied activity theory, incentives, and knowledge-information trade-off to armchair auditing. Similarly, these approaches could be extended to crowdsourcing in general. Third, if armchair auditing begins to garner more attention, then that growth can be chronicled and contrasted with the historic context provided in this paper. Fourth, this paper has focused on financial data disclosures; however, the open data movement has led to a number of other disclosures that could be analyzed. For example, maintenance data or departmental response data regarding infrastructure complaints and other data have been disclosed and could be analyzed. Such data likely would require a shift from accounting and auditing information to operations information (O'Leary 2016). Fifth, additional theories beyond those such as activity theory could be used. For example, systems theory could provide an alternative approach. Sixth, perhaps future researchers would like to formalize some of these notions. Seventh, future research could examine how informal armchair auditing could be integrated with existing formal audits.

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[22] Some of these extensions were suggested by the anonymous referees.

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