

CONSTRUCTION SAFETY THROUGH HOUSEKEEPING: THE HAWTHORNE EFFECT

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ABSTRACT

Clean and tidy sites have often been associated with positive safety cultures in construction. Poor housekeeping can result in the creation of additional hazards and dangers, in the form of protruding objects, which may also be sharp, and may result in situations that can lead to slips, trips, and falls on-site. They also create uneven ground levels, debris, and muddy conditions, which can all lead to an increase in accidents. Housekeeping also contributes to projects being finished in a timely manner, due to fewer distractions being created by what would otherwise be a chaotic situation. However, maintaining good housekeeping practices on-site has been known to be challenging, due to the rapid and complex nature of construction projects. In research that was conducted to explore the question “Why is housekeeping a continuing challenge in Lesotho construction?”, the final outcome of site visits and observations revealed the classic phenomenon of the Hawthorne effect. Without deliberate or intentional “interventionary” measures or demands for regulatory adherence, subsequent visits revealed a transformation in site practices, specifically in housekeeping. The Hawthorne effect refers to a change in behaviour by the subjects of a study due to their awareness of being observed. This effect does not necessarily refer to positive or negative outcomes. In this paper, the transformation that occurred with regard to workers’ practices is discussed critically in the context of this phenomenon. A key outcome of this discussion is whether housekeeping can be encouraged or improved using the notion of awareness of being observed. Finally, the ethicality of carrying out overt or covert observations is deliberated.

Keywords: Hawthorne effect, housekeeping, Lesotho, overt research

1. INTRODUCTION

Worldwide the construction industry has many challenges. One of the major issues that continually receives attention is safety. Safety issues vary considerably, and for this reason, they are very difficult to investigate. Practitioners, policymakers, and academic researchers alike share a keen interest in improving construction project safety. Safety in construction

projects extends to several stakeholders, namely site operatives, clients, and the general public. People less familiar with construction project practices may find it difficult to move around on-site. For example, a client visiting a site will need clear guidance on where and how to move (even after a safety induction). Moving around on-site is further complicated when the environment is not kept tidy, for example if there are obstructed walkways, toolboxes that have been left lying around, and waste materials that have not been carefully disposed of. Testing the premise that untidy sites lead to unsafe conditions, a research project was carried out to investigate housekeeping practices and their effects on overall site safety in Maseru, Lesotho (see Emuze et al., 2016). Observations and interviews were carried out on various sites to study the proposed aim. However, housekeeping practices of site workers were observed to steadily transform with subsequent site visits for observation. The change in behaviour was not as a result of any “interventionary” measures. Thus, this phenomenon was attributed to the Hawthorne effect. This paper explores the behaviour changes that were witnessed while conducting the described research project. This paper does not measure the extent of transformation in housekeeping practices that occurred during the site visits, but instead is based on the premise that behaviour change did indeed occur during the observations. In addition, this research proposes the possibility of using the Hawthorne effect to positively influence site safety with respect to housekeeping.

2. HOUSEKEEPING AND SITE SAFETY

Housekeeping is defined as the day-to-day cleaning and keeping tidy of a construction site (Lingard and Rowlinson, 1994). This is crucial for the prevention of accidents and injuries on-site (Lingard and Rowlinson, 1994). Poor housekeeping has been found to have contributed to almost half of the accidents that have occurred in the United Kingdom (Haslam et al., 2005). Untidy sites and poor housekeeping practices can lead to many types of hazards, such as trip hazards, falling objects, and sharp objects that can cause cuts. Haslam et al. (2005:410) explain that “from the perspective of those familiar with safety in a wide range of other industries, poor site conditions found in construction appear to be a symptom of the weak safety and risk management culture in the industry”. Thus, good site conditions are symptomatic of a positive safety culture.

Site safety is important for all stakeholders, not only site operatives. For a start, when there is a poor safety culture on-site, there can be several implications, ranging from a loss of man-hours to fatal incidents. The term “safety culture” is loosely used to describe a culture in which safety is considered and accepted to be of topmost priority (Cullen, 1990). Cooper (2000:114) describes safety culture as the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation’s health and safety management. Furthermore, organisations with a positive safety culture are characterised by communication founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures (Cooper, 2000:114).

Safety culture can be improved by empowering workers and delegating safety activities (Törner and Pousette, 2009). Key components that may be present in a positive safety culture include clear policies, goals, objectives, procedures, manuals, records and audits that are used as tools to aid continual improvement of performance (Emuze et al., 2016). The above components represent the visible (explicit) aspects of a safety culture. By contrast, individual attitudes and personal beliefs of safety cultures are not visible or

explicitly captured (for manifestations of safety cultures at different levels, see Hofstede and Hofstede, 2005:7).

One effective method of improving the non-explicit aspects of safety cultures, e.g. individual attitudes and personal beliefs, is through motivation. A motivated workforce is necessary, as poorly motivated workers could make a workplace untidy, apart from other outcomes, such as rework, poor craftsmanship, fatigue, and poor technical supervision (Loushine et al., 2006). By teaching and empowering new workers to practice safely (including using good housekeeping methods), the general safety culture can improve considerably. Becker (2001) asserts that good housekeeping eliminates many safety problems, it improves morale, and it increases productivity, because workers generally appreciate a clean and orderly workplace where tasks can be completed unhindered.

As discussed in the introduction section, this study aims to explore the behaviour changes that occurred during a research project that investigated housekeeping practices. To further contextualise this study, the origins of the Hawthorne effect are explained next.

3. BACKGROUND OF THE HAWTHORNE STUDIES

The Hawthorne studies were originated in 1924 by the management of the Hawthorne plant of the Western Electric Company in Chicago, Illinois, USA (Ivancevich and Matteson, 1996). A study was set up to investigate the relationship between illumination and productivity, while the main studies, conducted between 1927 and 1933 in collaboration with the Massachusetts Institute of Technology (MIT) and Harvard University, were concerned with the effects of changes in rest pauses and working hours on productivity (Wickström and Bendix, 2000:363). Elton Mayo was the main initiator of the study, which focused on factors affecting productivity. This concept was inspired by the work of Émile Durkheim, who espoused a conflict-free group consciousness that challenged the concept of class conflict (Wickström and Bendix, 2000:363). In the investigation, the illumination was gradually decreased for the experimental subjects, while the control group received constant illumination (Roethlisberger and Dickson, 1939). Both sets of participants were observed to slowly but steadily increase their performance in inspecting parts, assembling relays, or winding coils (Wickström and Bendix, 2000:364). Once the illumination in the experiment room was reduced to a level corresponding to moonlight, the participants began to complain that they could hardly see what they were doing, and thus productivity finally started to decline (Adair, 1984). Overall, the experiment revealed that lighting did not significantly affect the productivity of the workers as long as it was kept at a reasonable level (Wickström and Bendix, 2000). Indeed, factors other than lighting were found to be more important (Ivancevich and Matteson, 1996), and this subsequently led to later studies.

Roethlisberger and Dickson (1939) summarised the findings as follows: the factors that were considered included physical factors causing fatigue and monotony, which were tested by means of four extensive experiments (a first relay assembly, a second relay assembly, mica splitting, and bank wiring). A factor that seemed to be responsible for most of the observed change was the improved personal relations between workers and management. This conclusion was based on transcripts of informally expressed opinions of the workers that participated in the experiment, as well as on the general impressions of the investigators (Wickström and Bendix, 2000:364). This led to the concept of the Hawthorne effect.

3.1 The phenomenon of the Hawthorne effect

The initial conclusion drawn from the Hawthorne studies was that the increase in output was partly caused by the experimental setup and the experimenters themselves (Bryman and Bell, 2003). The Hawthorne effect has now become a household concept in relation to observational research. The term “Hawthorne effect” is mostly used to refer to behaviour-modifying effects on the part of subjects of participant observations (Wickström and Bendix, 2000:363). Although this concept emerged from the Hawthorne plant, its implications today go beyond this context, and, as such, it is used in various fields of investigation (Marshall and Barthel-Bouchier, 1994). What is considered the Hawthorne effect is also referred to as “a nonspecific effect caused by participation in a study”, rather than specific interventional measures taken (Shephard et al., 1981; Wegman and Fine, 1990) in the field of occupational health. In pharmacology, the Hawthorne effect is often compared with the “placebo effect” (Wickström and Bendix, 2000). Fundamentally, most studies that have considered the effects of observation on subjects contend that there were changes in participant behaviour (Wickström and Bendix, 2000).

As stated in the introduction, this research aimed to explore the behaviour changes that occurred during observations of site practices with regard to housekeeping and site safety. The next section discusses the data-collection methods employed, and subsequent analysis of the data.

4. RESEARCH METHODS

The initial research project adopted a multiple case study approach using field observations, which were supported with follow-up focus group interviews (see Emuze et al., 2016). All the project sites were located in Maseru, Lesotho. A total of four projects were considered in this study. The research was designed to capture the complexity of housekeeping on the multiple project sites, and also to attend to contextual conditions. The observations were specifically conducted to understand human housekeeping activities, and the physical settings in which these housekeeping and other safety activities occur. The observations took a structured format, that is, specific practices, such as equipment arrangement and scheduling of site cleaning, were studied. The structure of the observations was informed by the reviewed literature on housekeeping and site safety. Although the observations undertaken had a structured format, the observers made allowance for “unexpected occurrences”. Much existing construction management research (e.g. Rubrich, 2012; Forbes and Ahmed, 2011) and non-construction management research (e.g. Yin, 2013; Thomas, 2015) was considered when developing the data-collection instrument.

As part of the studied literature, the “5 Whys” technique was used as a tool to aid compilation of the discussion section of the initial research project (see Emuze et al., 2016 for data-collection and data-analysis details of the initial study). Site managers and other operatives were interviewed after the site observations. This paper does not focus on the subsequent interviews and the analysis of that data. The paper specifically focuses on the “Hawthorne effects” during the observations of housekeeping activities. This is because the observed behaviour modifications occurred before the interviews took place, hence the decision to exclude the interviews.

4.1 Ethical considerations

Data collection was conducted by students who had undergone research and data-gathering training. An “overt” approach was used during fieldwork. Site visits were regularly conducted for a few weeks, as the researchers intended to capture general practices of the workers with respect to housekeeping. The site operatives were briefed about the purpose of the study, namely to explore site safety practices. General consents for the empirical work were approved by the various site managers. In addition, the workers were informed in their morning briefings of the photographs that would be taken of site works. They were also informed that they had the right to decline participation without incurring any penalty. It was further explained that the study was for academic purposes, and that the findings would be used to teach prospective construction professionals.

5. FINDINGS

Many similarities were observed during the initial observations, particularly with regard to poor housekeeping practices. These similarities are explained in this section. The changes that followed during the subsequent visits are discussed later.

5.1 Site A

Excess materials, including construction waste, were observed in many areas of the site. Notable issues that were observed on the site included

- Poor waste segregation,
- Poor storage of materials,
- Walkways that had been obstructed by reinforcement bars from demolished walls,
- Lack of proper working methods, which had created trip hazards,
- Poor tidying-up practices, which had led to electrical cables coming into close contact with flammable liquids, and
- Wasteful use of materials, due to defects, rework, and poor workmanship.

Following the initial visit, workers’ practices in relation to housekeeping began to show improvement. Workers began sorting their waste into different categories. Trip hazards were observed to be considerably fewer, and workers were showing signs of reducing waste. More importantly, the observers noted that a waste-disposal area, which was initially situated along the walkway to the site, and excess materials had been eliminated.

Before

After



Figure 1: Site A images

5.2 Site B

On this site, there were similar poor practices with respect to housekeeping. Some of the recorded observations are as follows:

- Walkways that had been obstructed by construction waste,
- Lack of appropriate cleaning instructions from the site foreman,
- Poor signage to alert workers and other stakeholders to potential hazards,
- External authorities (the municipality) in charge of intervening were ignoring poor site conditions,
- Interchanging scheduled work sequences, which led to confusion and increased risks,
- and
- Construction materials not being stored properly, e.g. storing valuable materials yet to be used in the same location as waste materials.

There was a visible transformation in the appearance of the site in subsequent site visits. For example, proper signage indicating potential hazards was erected on the site. In addition, a designated storage area for construction waste became evident on the site.

Before



After



Figure 2: Site B images

5.3 Site C

This site had the least poor housekeeping practices at the initial visit. However, this site also had its challenges:

- A lack of storage facilities,
- Workers' toolboxes were littered all over the site, unattended, which created trip hazards, and
- Overcrowding of workers, due to lack of adequate working space.

Due to limited space on this site, most of the project materials were stored off-site. Although this was considered good practice, the logistics of transportation and delivery of the materials stored off-site were improperly handled. The site workers seemed unprepared each time deliveries were made, thereby increasing the risk of accidents.

Before



After



Figure 3: Site C images

5.4 Site D

Similar to Site C, this site was relatively small, and this increased the problems of creating and maintaining a tidy site. Some of the observed issues are as follows:

Lack of adequate storage facilities,

Workers appeared incompetent, e.g. they forgot to install service ducts, and they had to rectify this omission, and so ended up doing double work,

Extra (waste) materials littered the site, e.g. the service ducts mentioned above,

Overcrowding of workers in a confined space, leading to activities not being completed, and

Dangerous placement of electrical cables and water pipes, creating trip hazards.

Initial improvements observed during follow-up visits included no overcrowding issues, due to efficient use of available workers. Other issues related to space management seemed to have been handled effectively during the follow-up visits.

Before



After



Figure 4: Site D images

6. DISCUSSION

During the visits for the empirical work, there were noticeable improvements on the sites, and these observations formed the basis for the development of this paper. It is important to note that the focus of this paper is not to quantify the extent of change or safety improvements that occurred on the sites, but only to acknowledge that change had occurred

during the time of observation. From the findings, it is evident that behaviour changes had occurred in housekeeping and site safety practices (see the figures above).

Since the study was overt, it is assumed that most workers knew they were being observed. Consent for the observations was sought from the site managers. Two observers visited the sites. The observers did not have the appearance of individuals in positions of authority, e.g. local authorities, or safety inspectors. This was part of the research design, so that workers could feel at ease and not become distracted or feel threatened by the possibility of being reprimanded for any wrongdoing that might be observed.

6.1 Benefiting from the Hawthorne effect

In this particular research, the behaviour modification observed was definitely positive as far as housekeeping and tidying up is concerned. This change possibly brought about a safer site. Choudhry (2014) asserts that one of the main types of safety controls is good housekeeping practices, i.e. day-to-day cleaning and keeping tidy of all parts of the site. Proper use of personal protective equipment (PPE) is considered to go hand in hand with good housekeeping (Choudhry, 2014), but this was not a behaviour change observed on any of the sites described in this paper. This is because PPE usage was not found to be problematic on the sites visited.

As explained in the methods section, intervention in housekeeping practices was not part of the research objectives. The changes in such practices that became apparent during subsequent site visits were spontaneously made by the site workers. Furthermore, on all four sites there was no record of regulatory authority interventions, or any issues in relation to housekeeping practices. The only common denominator present on all four sites was the presence of the observers, and hence it can be concluded that their presence played a role in the improvement in housekeeping and safety practices.

6.2 Conviction by conscience

Site managers, foremen, and operatives were all aware of the presence of the researchers. The change in practices could be argued to have occurred as a result of fear of being reported for poor practices, but this has been ruled out based on the empirical approach adopted, i.e. using research students that did not have the appearance of authority figures. Furthermore, the potential research outcomes were explained clearly, i.e. academic work that would lead to learning and promotion of site safety practices.

Experienced workers are often knowledgeable about good safety practices, as they have learnt them and practised them for many years (Nicolini et al., 2013). They have “learnt by doing”, and this is the same approach they use to transfer knowledge to workers with less experience (Aboagye-Nimo et al., 2015). This type of safety knowledge is mainly tacit, and, as such, workers may not be conscious of learning or teaching it (Kamoche and Maguire, 2011). This would lead to improvement in personal beliefs and individual attitudes, i.e. aspects of a safety culture that are not explicit.

Since the workers knew that the observers were on-site to learn about good safety practices (which obviously includes good housekeeping), they could have been compelled to work safely. Psychologists explain that one’s conscience will compel one to delineate what is right from what is wrong, what is proper from what is improper (Hitlin, 2008:1). In this case, there were already experienced workers on all the sites, and hence it can be argued

that they were encouraged to work safely as a result of the presence of the observers. Knowing that the observers on-site were there to learn, the workers would have had to use good practices. Rowlinson et al. (1993) explain that experienced workers take on father-figure roles when they are teaching less experienced workers on-site. In addition, they tend to ensure that these newcomers (who have less experience) are protected when working in this high-risk environment. For this reason, the workers on-site may have unconsciously led by example by using good housekeeping practices.

6.3 A new approach to effective housekeeping?

Involving apprentices or students who are on-site to study could be a useful way to get workers to improve their practices. One key factor is to let the experienced workers know that they are being observed by learners. By showing the workers that the observers are not on-site to report or reprimand them, the workers may be more inclined to work comfortably and safely without pressure.

From this study, it was acknowledged that workers generally worked more safely when they were being observed by less experienced workers. Furthermore, by teaching or transferring safety knowledge, the experienced workers continually transform and review their existing knowledge. Gherardi and Nicolini (2000) explain that safety (in this case housekeeping practices) is a situated practice, and, as such, site operatives will always have to reassess their safety practices with respect to new situations, in order to be able to teach less experienced workers.

If less experienced workers or learners are included in projects, the more experienced workers would thus be compelled to use safer methods overall. Although formal-setting (explicit) knowledge transfer is important in construction safety, on-the-job training has been described to be more effective in many situations, especially when workers have to identify risks and dangers on-site (Bartholomew, 2008). Learning of this type of practical and invaluable knowledge may be taken for granted, as it is mainly implicit. On-the-job learning as a method of safety knowledge transfer offers the learner an opportunity to acquire practical wisdom that would have been missed in many other situations (Gherardi and Nicolini, 2002).

Placing a learner on-site in order to compel workers to work safely is not the only factor that needs to be considered to ensure safer practices. There are several factors that need to be considered when ensuring site safety, and it may need to be considered as part of a whole. Sawacha et al. (1999) suggest many areas that need to be considered to help improve site safety, such as eliminating time and financial constraints.

7. CONCLUSIONS

This paper has focused on workers' behaviour changes that occurred during an exploratory study on construction site housekeeping in Lesotho. These behaviour changes, also known as the Hawthorne effect, were found to be as a result of workers being observed by academic researchers. Housekeeping on-site improved considerably as the observers visited the sites over a given period. These behaviour changes were not the result of specific interventionary measures. The workers were clearly informed of the presence of the observers, as well as of the aim and scope of the research.

The improvement in housekeeping practices as a result of workers being observed by individuals who are on-site to learn about good practices could be used as an approach to enhance site safety. The behaviour changes may stimulate changes in thinking among the site operatives. Experienced workers are known to play father-figure roles on-site, and, as such, tend to teach less experienced workers how to stay safe at work.

As explored in the literature, the behaviour changes when people are being observed do not necessarily have to be positive or negative. For this study, the changes observed on all four sites were positive with respect to housekeeping. In future, this method could be tested on different projects, with the sole purpose of identifying whether behaviour changes are always positive with respect to housekeeping and site safety.

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9. REFERENCES

- Aboagye-Nimo, E., Raiden, A., King, A. and Tietze, S. (2015). Using tacit knowledge in training and accident prevention. *Proceedings of Institution of Civil Engineers: Management, Procurement and Law*, 168(5), 232–240.
- Adair, J. G. (1984). The Hawthorne effect: A reconsideration of the methodological artifact. *Journal of Applied Psychology*, 69(2), 334–345.
- Bartholomew, D. (2008). *Building on knowledge: Developing expertise, creativity & intellectual capital in the construction professions*. Chichester, UK: Wiley-Blackwell.
- Becker, J. E. (2001). Implementing 5S: To promote safety & housekeeping. *Professional Safety*, 46(8), 29–31.
- Bryman, A. and Bell, E. (2003). *Business research methods*. New York: Oxford University Press.
- Choudhry, R. M. (2014). Behavior-based safety on construction sites: A case study. *Accident Analysis & Prevention*, 70, 14–23.
- Cooper, M. D. (2000). Towards a model of safety culture. *Safety Science*, 36(2), 111–136.
- Cullen, W. (1990). *The public inquiry into the Piper Alpha disaster*. London: HMSO.
- Emuze, F., Linake, M. and Seboka, L. (2016). Construction work and the housekeeping challenge in Lesotho. In: P. W. Chan and C. J. Neilson (eds). *Proceedings of the 32nd Annual Association of Researchers in Construction Management (ARCOM) Conference*, 5–7 September, Manchester, UK: ARCOM, Vol. 1, pp. 497–506.
- Forbes, L. H. and Ahmed, S. M. (2011). *Modern construction: Lean project delivery and integrated practices*. Boca Raton, FL: CRC Press.
- Gherardi, S. and Nicolini, D. (2000). To transfer is to transform: The circulation of safety knowledge. *Organization*, 7(2), 329–348.

- Gherardi, S. and Nicolini, D. (2002). Learning the trade: A culture of safety in practice. *Organization*, 9(2), 191–223.
- Haslam, R. A., Hide, S. A., Gibb, A. G. F., Gyi, D. E., Pavitt, T., Atkinson, S. and Duff, A. R. (2005). Contributing factors in construction accidents. *Applied Ergonomics*, 36(4), 401–415.
- Hitlin, S. (2008). *Moral selves, evil selves: The social psychology of conscience*. New York: Palgrave Macmillan.
- Hofstede, G. and Hofstede, G. J. (2005). *Cultures and organizations: Software of the mind*. 2nd ed. New York: McGraw-Hill.
- Ivancevich, J. M. and Matteson, M. T. (1996). *Organizational behavior and management*. 4th ed. Chicago: Irwin.
- Kamoche, K. and Maguire, K. (2011). Pit sense: Appropriation of practice-based knowledge in a UK coalmine. *Human Relations*, 64(5), 725–744.
- Lingard, H. and Rowlinson, S. (1994). Construction site safety in Hong Kong. *Construction Management and Economics*, 12(6), 501–510.
- Loushine, T. W., Hoonakker, P. L. T., Carayon, P. and Smith, M. J. (2006). Quality and safety management in construction. *Total Quality Management & Business Excellence*, 17(9), 1171–1212.
- Marshall, G. and Barthel-Bouchier, D. L. (1994). *The concise Oxford dictionary of sociology*. Oxford: Oxford University Press.
- Nicolini, D., Gherardi, S. and Yanow, D. (eds). (2003). *Knowing in organizations: A practice-based approach*. Armonk, NY: M. E. Sharpe.
- Roethlisberger, F. and Dickson, W. (1939). *Management and the worker*. Cambridge, MA: Harvard University Press.
- Rowlinson, S., Ho, T. K. K. and Po-Hung, Y. (1993). Leadership style of construction managers in Hong Kong. *Construction Management and Economics*, 11(6), 455–465.
- Rubrich, L. (2012). *An introduction to lean construction: Applying lean to construction organizations and processes*. Fort Wayne, IN: WCM Associates LLC.
- Sawacha, E., Naoum, S. and Fong, D. (1999). Factors affecting safety performance on construction sites. *International Journal of Project Management*, 17(5), 309–315.
- Shephard, R. J., Cox, M. and Corey, P. (1981). Fitness program participation: Its effect on worker performance. *Journal of Occupational Medicine*, 23(5), 359–363.
- Thomas, G. (2015). *How to do your case study*. London: Sage.
- Törner, M. and Pousette, A. (2009). Safety in construction: A comprehensive description of the characteristics of high safety standards in construction work, from the combined perspective of supervisors and experienced workers. *Journal of Safety Research*, 40(6), 399–409.

- Wegman, D. H. and Fine, L. J. (1990). Occupational health in the 1990s. *Annual Review of Public Health*, 11, 89–103.
- Wickström, G. and Bendix, T. (2000). The “Hawthorne effect”—what did the original Hawthorne studies actually show? *Scandinavian Journal of Work, Environment & Health*, 26(4), 363–367.