

INVESTIGATION INTO HOW TECHNOLOGY CAN OVERCOME LANGUAGE BARRIERS EXPERIENCED BY CONSTRUCTION WORKERS FROM EASTERN EUROPE ON SITES IN LONDON

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Construction sites are dynamic, complex work environments where safety, quality of work and productivity are all key metrics for the success of a project. In a complex environment the ability to communicate and for the communication to be translated into effective and efficient actions is critical, therefore on construction sites in London, the ability to speak and understand English is of paramount importance. With the number of foreign workers in the construction industry on the rise in the United Kingdom (UK) a significant proportion of the construction workforce have very little or no English. These non-English speaking workers face many issues daily, for example the ability to communicate effectively on site and also have problems in the longer term regarding integrating into the workplace. From a Health and Safety (H&S) perspective, of the 16 migrant/foreign workers that suffered fatal injuries in construction in 2016, four died on the first day and 50% died within the first 10 days on site. The research presented in this paper is a pilot study to investigate the impact of poor language skills on site and focuses on a subgroup of foreign workers, namely those from Romania, and looks at the use of a simple assistive technology to help reduce the problem. The researcher, fluent in both Romanian and English conducted interviews with site managers and Romanian workers on 3 London construction sites to establish the level of English-speaking ability and how foreign workers viewed the Site Induction Process (SIP). The responses showed that SIP is seen by the workers as something that has to be done, a tick-box exercise that adds no value since they cannot understand the content. Due to the poor English-speaking ability of workers, instructions are primarily conveyed through demonstrations so a significant amount of time is wasted on site as instructions, comments and signage must be translated constantly, with cultural gatekeepers regularly called upon to translate and interpret. This was shown when workers were instructed to complete simple tasks by an English-speaking manager with and without the use of assistive technology to translate, and workers performance gauged in terms of health and safety, the time taken, the involvement of other people and whether the task was completed. The results from this pilot study indicated the value of Google Translate as an assistive technology on site for workers with a low ability to speak English, potentially adding value to both the SIP and the ability to follow instructions and complete tasks.

Keywords: Assistive technology, foreign workers, H&S, induction, language barriers

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INTRODUCTION

The number of migrant workers has more than doubled in the UK in the last 15 years, with construction having the highest percentage of migrant workers (Office for National Statistics, 2018) Many are unable to speak English. They work and socialise primarily with other foreign workers, so they do not have any incentive to learn the English language.

The lead researcher observed the impact of this during the SIP where Romanian workers who could not speak English were present for the SIP training delivered solely through English. The problem of language is further compounded by lack of experience, no understanding of the UK regulations governing Health and Safety (H&S) on site and cultural differences. New workers are higher risk (Trotto, 2016) but new workers with language difficulties magnify the risk. The key question has to be how would these workers cope on site? For instance, they have no knowledge of the fire safety procedures on site and if they've never worked on site before they will have no idea what to do should a fire break out - despite having gone through the SIP.

Language barriers can impact on H&S, quality and productivity aspects on site and cause frustration when cultural gatekeepers are frequently called upon in order to translate instructions and information. Not only are the cultural gatekeepers disturbed from the task they are carrying out, but the manager and workers are also losing valuable time.

The literature shows that sensing and warning-based technologies are already being used to improve H&S in construction (Antwi-Afari *et al.*, 2019). This led to the research question - could assistive technology be used during the Site Induction Process and also when giving instructions to make sure everybody understands the Site Induction Process and instructions fully? The use of Google Translate as a zero-cost assistive technology (workers all had smart phones but were unaware of the translation apps available) was investigated and the outcome showed a positive effect.

Literature Review

Research published as part of the Secretary of State for Work and Pensions Inquiry into the Underlying Causes of Accidents in Construction in 2017 revealed that Health and Safety Executive (HSE a, b and c, 2018) Inspectors repeatedly identify that foreign or migrant workers are potentially at greater risk than British born workers because of language skills, inexperience, lack of understanding of UK Health and Safety standards and cultural differences.

The HSE (b, 2018) has recommendations on dealing with language issues, such as providing English courses for workers who need to improve their English or have no English at all. Although Health and Safety law in the UK doesn't require workers to be able to speak English, learning English reduces communication difficulties and has been shown to lead to higher productivity and retention rates, as well as promoting integration outside work.

Employers have a duty to provide understandable information to workers - this does not have to be in writing, or necessarily in English. Therefore, it would seem to be in the employers' best interest to provide English classes.

Other recommendations from the HSE involve using translators, having a buddy system on site, using pictograms as opposed to text on signs and using clear and simple English in training sessions or when giving instructions.

Communication on-Site Between Migrant Workers and Managers

In a study published by CITB (CITB, 2011), focused on Migrant Construction Workers and Health and Safety Communication showed that extensive research has been carried out in improving the health and safety on a construction site for migrant workers using simple actions such as sign translation. Recognising the role of translators and interpreters is important as most of the communication on site between a non-English speaking and an English-speaking worker or manager is through a cultural gatekeeper, “The terms ‘translate’ and ‘interpret’ are often used interchangeably in everyday, non-technical language, but formal translation (written) and interpretation (oral) work are highly skilled and regulated professions.” (CITB, 2011). Rodrigues (1996) advised that the translators, interpreters or cultural gatekeepers’ job is weighty and almost always without proper training as they are only using their on-site learned English to translate. Even with a professional translator is it is estimated that up to 40% of the intended meaning of the message is lost (Loosemore and Lee, 2002). For example, workers do not understand the terminology encountered on site including basic words such as “‘hazardous’” and “‘risk management’” (Loosemore and Andonakis, 2007). The dangers facing migrant workers who had low English proficiency were highlighted in the study by Trajkovski and Loosemore (Trajkovski and Loosemore, 2006).

Culture

According to Loosemore, and Andonakis (2007), there are many cultural variables that influence inter-cultural communication such as attitudes, social organisation, thought patterns, roles, non-verbal behaviour, and language - the consequence is that messages can often be misinterpreted. Construction sites in London are made up of several different cultures, mostly Eastern European. This leads to a level of isolation and also to a thought process

Technology

The technology presented in the literature currently appears to be focused on wearables designed for sensing or giving warnings from a H&S viewpoint or to enhance communication and productivity (Antwi-Afari *et al.*, 2019). Building Information Modelling (BIM) can be considered as assistive technology in that it allows access to 3D representations of what is to be built and also allows immersive virtual and augmented reality technologies to 'show' what the site locations should look like (Koseoglu and Nurtan-Gunes (2018). The presence of a 'digital skin' as a context aware network of sensors that could make the tracking and tracing of workers, materials and the overall progress of work on the construction site, available in real time, is well accepted as offering huge potential benefits in the management of H&S and productivity (Edirisinghe, 2019).

Throughout the literature reviewed, there was no mention found of how assistive technology could be used to eliminate some of the language barriers on site. As a very basic cost-free assistive technology, Google Translate has the potential to provide a solution to the problem of language difficulties on construction sites. It can translate a picture taken on a mobile phone automatically and with the recent advancements, it can now translate hand writing. Posters and health and safety notices could be translated with ease. A new Conversation feature was introduced recently which allows real-time conversation translation. The challenge is how to move away from the conventional gatekeeper/ foreman translation and introduce the assistive technology on sites.

Site Induction

Research published by CITB, concluded that SIP needs to be redefined (CITB, 2011). There has to be work done on how to make SIP more understandable for foreign workers as there is a suggestion that they will nod their heads when asked if they've understood. In the advice for employers on the HSE website they suggest 'Consider the needs of workers who may not speak English well, if at all, and whether you need translation services' (HSE, 2018).

The HSE states that new workers are as likely to have an accident in the first 6 months of work as they are in the entire remainder of their working career (HSE a, 2018).

Site Induction is critical because according to statistics from the HSE (HSE c, 2018) of the 16 foreign construction workers killed in incidents at work in the UK in 2015, four died on their first day on site and 50% of the fatalities occurred during the first 10 days on site. To reduce this figure, one possible approach could be should be to focus on CSCS cards provision and SIP as they are the two requirements to be able to work on any site in the UK.

CSCS cards

A CSCS card is necessary to be able to access any construction site in the UK. The test for a CSCS card can be done in English or by getting a voice over or have an interpreter in the following languages: Bulgarian, Czech, French, German, Hungarian, Lithuanian, Polish, Portuguese, Punjabi, Romanian, Russian and Spanish (Construction Helpline, 2018). These languages cover most foreign workers in the construction industry which allows workers using the languages as listed to walk onto construction sites with no English-speaking capabilities.

Even though there is no English level requirement when completing the exam to obtain a CSCS card, once the worker has a CSCS card most employers take it that he/she is aware of the basic health and safety risks on a site. "Many admitted to pretending to understand English in case it stopped them getting work, or of losing their jobs if their lack of English became known" Health and Safety Executive (2018). This nullifies the benefit of the CSCS card that should be acting as a screening method to ensure those on site had basic knowledge and so puts the holder and their work colleagues at risk.

RESEARCH DESIGN

This pilot study was built on undertaking qualitative research to explore the impact to of language barriers on three London construction sites, with 30 semi-structured interviews, to gain the subjective viewpoints of non-English speaking workers and their managers. The interviews were all conducted in an open-ended format, face-to-face and focused on Romanian and Albanian workers as the lead researcher is fluent in Romanian and as such could directly interact with the people interviewed. All pre-determined questions or relevant probes were tabled in the same style and order with responses noted accordingly, to improve replicability of results. The interview subjects were two Contracts Managers, three Project Managers, one Site Manager, one Health and Safety Manager and two Site Engineers, four Foremen and 17 site workers. The managers were targeted because they have to deal with language barriers daily. The workers selected were mainly Romanian or Albanian. The focus of the interview was to establish the level of English comprehension that the workers had, its impact on their productivity and safety and on how to use the newly available technology of Google Translate to deal with language barriers in critical areas such as SIP.

On-site, tests (as outlined below) were carried out to see if an assistive technology, in this case Google Translate, could be of benefit as a translation tool on site and its effect observed. As already stated, these tasks were used to show the effect of the translation app as a means of reducing the language barrier for relatively inexperienced workers. More complex tasks would involve training and support or more experienced workers and so fall outside the scope of this work. The tests used involved simple tasks that required little or no experience or training and had negligible risk from the H&S perspective and could be monitored in terms of time taken, number of people involved, the actual completion of the job and whether there were any unforeseen H&S implications. The focus was solely on the impact of the translation technology on the ability to do the simple task.

As controls, the two tests were done without any assistive technology and involved an English-speaking manager giving a task to a non-English speaking worker verbally or in writing. Tests that involved similar tasks were then given to the same workers but this time they utilised Google Translate Photo and Conversation. The data from the tests was gathered by observing the worker's performance and the quality of the completed task.

Test 1: Task instructions given with and without Google Translate Picture;

- As a control, an English-speaking manager gives a non-English speaker a task to carry out which is typed out on a page in English with no diagrams or pictures. The task was to collect all the steel rubbish around a small area on site and to ensure it was placed into the 'Metal Only' skip
- The researcher monitors the worker to see how he manages the task in terms of how long it takes him, are there any Health and Safety implications, and was there an intervention by any other worker and whether the task was completed.
- The same worker is then given a similar task by the same manager in the same way. The task was to go to another area of the site and collect all the waste timber that had to be placed in the 'Timber Only' skip. This time, the worker also receives a data sheet showing him how to use the Google Translate Picture feature on his smart-phone to translate the document.
- The researcher monitors the worker to see how he performs the task after using the Google Translate Picture technology to translate the instruction.

Test 2: Task instructions given with or without Google Translate Conversation;

- As a control, an English-speaking manager communicates a task that is required to be completed verbally to a different non-English speaking worker to the best of his ability. The manager verbally gave instructions about a task to the worker. He used short sentences and as simplistic a language as he possibly could. The task was to place a Fire Point Unit on the 1st level of the slip-form which included 2 fire extinguishers, an eye cleaning toolkit etc.
- The researcher monitors the worker to see how he manages the task in terms of how long it takes him, are there any Health and Safety implications, and was there an intervention by any other worker and whether the task was completed.
- The manager then communicates a similar task to the same worker but this time the Conversation feature on Google Translate is used, which allows instant real-time translations.
- The researcher monitors the worker to see how he performs the task using the Google Translate Conversation technology.

RESULTS

In this pilot study, a total of 30 people were interviewed and when asked about their English speaking ability, six spoke English as their first language and 19 of the remaining 24 stated that they had or would lie about their English-speaking abilities in case they wouldn't get or would lose a job. There were eight people who stated that their English is below poor and five of these stated that they would not be interested in taking English classes. All had a smartphone with access to the internet, yet only one out of these 30 people had previous knowledge of the Google Translate feature and that it was available for free. This is a missed opportunity for improving communication on site as it shows that the construction workers aren't being made aware of free assistive technologies that are available to them.

It was found that 85% of the people interviewed strongly agree and 10% somewhat agree that the SIP used on site was ineffective, rating it as either very poor or poor. Most people interviewed considered the SIP as something that must be done to get on site. It was not seen as being a source of vital health and safety information, such as fire escape routes and site-specific rules. The construction workforce on the sites surveyed, clearly had no belief in the effectiveness of the induction process in its current format. When asked what recommendations they had on how to change the current SIP, 18 responses indicated there should be a translator in every induction room with 15 responses stating that there should at least be a video of the SIP in every language.

At the end of the interview, the researcher showed the workers and managers the features available on Google Translate - both Picture and Conversation. 100% of the people interviewed, including the one person that knew about the features when asked, stated that they would find Google Translate very useful to translate during the Induction process, putting it ahead of the solutions they previously suggested as outlined above.

Of the 30 people interviewed, 14 believed it was too easy to obtain a CSCS card, especially as they can do it in their own language (apart from Albanian) and therefore have no need to speak English to obtain their CSCS card. When asked about how they currently communicate with other workers that do not speak the same language or don't have good English-speaking capabilities, 21 people said that they do it through demonstration i.e. they ask someone to show them how to perform the task. Skilled workers that have good English must show low skilled workers with poor English how to do tasks using minimal and simple English. However, people doing translations and interpreting on site are neither recognised or qualified. They are simply picked out from the workers on site because they have a higher level of English-speaking capability than the other foreign nationals on site. The use of the Google Translate technology may lead to these 'unofficial' translators being able to concentrate on their own job and experience less interruptions.

Test Results

The control aspect of the first test to show the effect of the assistive technology involved an English-speaking manager giving a Romanian non-English speaking worker written instructions on a task - to collect all the steel rubbish around a small area on site and to ensure it was placed into the 'Metal Only' skip. The worker could not understand the written instructions detailing what he was to do. The worker sought out on site the storeman who he knew had good English and got him to

translate. This added time to his completion of the task and involved taking up another worker's time.

The next part of the first test involved the same two people but a slightly different task. This time the task was to go to another area of the site and collect all the waste timber that had to be placed in the 'Timber Only' skip. Before the manager gave the worker the task the researcher showed the worker the Google Translate Picture feature on their smartphone. Once the worker received the written instructions detailing the task, he was able to translate it instantly on his smartphone and proceed immediately with the task. He did not require any help from anyone so there was no time wasted. The area was cleared in half the time that it took the same worker to clear a similar area of a similar material. Since the worker spent less time doing the task, his exposure to any risk was also reduced.

The control aspect of the second test involved a different Romanian worker, chosen because he had very poor English, and the same manager. The manager verbally gave instructions about a task to the worker. He used short sentences and as simplistic a language as he possibly could. The task was to place a Fire Point Unit on the 1st level of the slipform which included 2 fire extinguishers, an eye cleaning toolkit etc. The worker nodded like he knew what he had to do but in fact, he had no idea as he returned 10 minutes later with a foreman to ask again. The task remained incomplete.

The next part of the second test involved the same worker and manager as above. The task remained the same as the worker didn't have any knowledge of what he had to do. The researcher showed the worker how to use Google Translate Conversation before the manager proceeded to instruct him on the task. The manager used short sentences and spoke slowly so Google Translate could pick up everything he was saying. The worker was able to understand all the information about the task. No other site personnel got involved and the task was completed quickly and safely by the worker.

It should be pointed out that the tasks involved in the test were very simple and required little or no experience to complete so any problems with completion were down to the workers inability to speak English. Other more complex tasks would require more than the translation of the instructions, but as a pilot study, the usefulness of Google Translate was demonstrated.

CONCLUSIONS

It needs to be stated that this pilot study showed the potential benefit of using Google Translate as a simple assistive technology on site, helping with the translation of instructions or training such as SIP. The functionality of this assistive technology is also recognised as being dependent upon the availability of Wi-Fi, the quality of the Smartphone and of course the reliability and accuracy of the translation. It is also recognised that, on site performance and H&S compliance are dependent on more than just translation. The influence of management style, level of pressure on the site, experience and cultural viewpoint of both the workforce and their supervisors also have a huge part to play in the interpretation of what has been translated. However, with the advent of highly sophisticated, and expensive assistive technologies coming on site as tools to facilitate BIM, the introduction of a simple 'first step' cost-free technology to assist with translation on site seemed interesting and timely.

The research reported here, focused primarily on the Romanian sub-group of foreign workers, found that even though 85% of foreign workers interviewed on the sites face

language barriers daily, 50% of them have no interest in learning English. The areas most affected by the language barrier were found to be SIP and the basic on-site communication between managers and workers. As the workers could not understand the simplest of instructions, basic communication of tasks usually involved the workers going to get the assistance of workers who had better English. Suggestions by those interviewed to overcome the language barrier included the availability of a translator and the provision of safety / site videos in foreign languages, both of which would have both logistical and financial implications for the contractor. The availability and use of, Google translate as an assistive technology, despite some limitations, could reduce the negative impact of the lack of English-speaking ability, as a cost-free first step in reducing language barriers on site.

To investigate the effect, simple tests were carried out where the instructions were given in written format or verbally, with and without access to the Google Translate app on a smartphone. The findings indicate that the use of the Google Translate app, available free on both Android and Apple platforms, allowed the workers receiving instruction to understand the instruction and complete the task correctly and promptly, without any need to seek help with the English. This meant that the workers were not only more productive but were also safer when they understood the task. Thus, despite its limitations as listed earlier, Google Translate could be a useful tool for communication with non-English-speaking foreign nationals when giving instructions or during induction. The barriers to implementation of Google Translate as an assistive technology are minimal as everyone on site has a smartphone and the application is free to download.

The possible future research for this topic would be analysing in detail: how much time could be saved on site, the difference in the number of accidents/fatalities on site if Google Translate is used effectively and measuring the reduction in the amount of rework done by reducing the language barrier.

More work would need to be done in terms of how technologies associated with BIM such as augmented reality through the use of helmets with visors that present workers with translated instructions, could influence productivity, quality and H&S on site. This is of course dependent upon having the system tuned to the translation process, managers and professionals who can structure the instructions or information in the correct way, the availability of the technology for workers who have sufficient experience to understand the instruction and the skill be able to implement it.

In conclusion, the positive effects of using Google Translate on-site could go some way in making foreign workers more effective and productive while enhancing site safety for themselves and everyone else on site.

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