

## What is broken? Expected lifetime, perception of brokenness and attitude towards maintenance and repair

Salvia G.<sup>(a)</sup>, Cooper T.<sup>(a)</sup>, Fisher T.<sup>(b)</sup>, Harmer L.<sup>(a)</sup> and Barr C.<sup>(a)</sup>

a) School of Architecture, Design and the Built Environment, Nottingham Trent University, Nottingham, UK

b) School of Art and Design, Nottingham Trent University, Nottingham, UK

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**Abstract:** This paper addresses the discrepancy between the expected and actual lifetimes of vacuum cleaners considering perceived 'brokenness' as a driver for replacement. Among electrical products, vacuum cleaners have a high rate of domestic ownership in the UK. They also embody large quantities of greenhouse gases which could be reduced by increasing their longevity and resource efficiency (Schreiber et al., 2012). A focus on energy efficiency has only shown limited or even negative results, therefore to meet recent European Union regulations on durability requirements a focus on product longevity is needed. Around one half of new vacuum cleaner purchasers replace one less than 5 years old, below the expected lifespan, with perceived breakage, poor performance and unreliability as the major reasons for replacement. Their relative simplicity could allow vacuum cleaners to last for significantly longer. The nature of the common causes of failure is known, including stretched cords or blockages, and WRAP has developed guidelines for product improvements. However, many working or repairable machines are disposed of because they are perceived to be 'irremediably' broken.

This paper explores the drivers of perceived brokenness through empirical work that suggested a loss of suction influences replacement decisions. Suction is closely connected to the machine's condition. Regular, minor maintenance preserves suction power for longer but users appear to neglect it, even finding it irritating (Electrolux 2013). Users' lack of interest in maintenance is a major barrier to prolonging the machines' lifespans, and aligns with their view of vacuum cleaners as 'mechanical servants' offering easy, effortless cleaning (Jackson 1992). However, when a tool breaks down or loses efficiency it suddenly demands attention. The paper addresses possible (and concurrent) factors determining 'brokenness' and the mental calculation of the effort required to rectify it, such as perceived difficulty and the cost of replacement or repair. Using Latour's concept of delegation, it proposes a biological analogy for the relationship between user and machine to establish that brokenness is not necessarily an intrinsic condition but, rather, a perception of the machine demanding unwanted effort of the user.

### Introduction

Every year around two million tonnes of electric and electronic equipment (EEE) are discarded by householders and companies in the UK. Vacuum cleaners account for the second largest embodied greenhouse gas emissions of electrical products after televisions, largely due to high sales volumes (Product Sustainability Forum, 2012) and widespread ownership: 87% of the UK population own at least one (MINTEL, 2010).

Two potential areas for reducing the environmental impact of EEE have been set: increased product longevity and resource efficiency (Schreiber et al., 2012). A past focus

on resource - and especially energy - efficiency has shown limited or even negative results, the latter due to the rebound effect (e.g. Hertwich, 2005). Arguably the focus on product longevity may generate a more positive impact.

The longevity of vacuum cleaners also deserves further investigation on the basis of the gap between their actual lifespan and the one expected by users. In the three years prior to November 2012, 44% of UK households bought a vacuum cleaner, the second most frequently bought domestic appliance (MINTEL 2013b). According to WRAP (2013), half of vacuum cleaners purchased in 2012 were bought to replace an existing product under 5

years old. However, vacuum cleaners are expected to last for longer, from 5 to 11 years (WRAP, 2013; Brook Lyndhurst, 2011; Which? 2014). Some potential to work with consumers to extend the lifetimes of such 'workhorse products' has been envisaged, with opportunities for several interventions (Brook Lyndhurst 2011).<sup>1</sup>

This paper addresses the discrepancy between expected and actual lifetimes of vacuum cleaners especially in relation to perceived 'brokenness', as a driver for replacement, on the basis of interim findings from a project currently being undertaken by the authors for Defra. In particular, the arguments are based on the results of a survey with 507 vacuum cleaner users across the UK, completed in August 2014.

### **Replacing because of unreliability**

Many people (55-80%) declare that they would only replace vacuum cleaners when they fail or break down, especially during an economic recession (MINTEL, 2010; WRAP 2013). Consistent with this, and despite general satisfaction with the previous model, our survey respondents who had owned a vacuum cleaner previously (n=449) reported that they discarded their vacuum cleaner because it did not work at all or efficiently (44% and 34% respectively). This sustains the hypothesis that the main reason for replacing a vacuum cleaner is related to a machine break down or loss of performance.

Reliability and dust pickup are major considerations when buying a vacuum cleaner (Electrolux, 2013; WRAP, 2013), with price and quality and durability a long way behind (Electrolux, 2013).

Strategies for prolonging product lifespan of faulty items have been investigated and proposed, ranging from manufacturing guidelines for more durable vacuum cleaners (WRAP, 2011a) to more effective warranties (Chukova and Shafiee 2013).

Most notably, a European regulation has recently been introduced, implementing the Framework Directive 2009/125/EC by setting ecodesign requirements specifically for vacuum

cleaners and including minimum durability requirements for the motor and the hose (European Commission 2013). From September 2015, operational motor lifetime must be at least 500 hours; considering the testing criteria, it may be inferred that the expectancy of the motor lifetime is around 10 years, thus aiming to at least double current vacuum cleaner lifespans.

Nevertheless, information about the reliability of vacuum cleaners is already available and often easily accessible on the internet. For instance, a Which? report suggests Best Buys ranking vacuum cleaners models on the basis of reliability and consumer satisfaction (Which? 2014); however they do not match the most frequently sold brands (MINTEL 2010).<sup>2</sup>

Furthermore, discarded vacuum cleaners have often been reported to be still in good condition or easily repairable (WRAP 2011b). Therefore other factors, beyond reliability, must determine their premature end-of-life. In the following sections, the relationship between user and vacuum cleaner is explored in order to identify other possible factors for vacuum cleaners having short lifespans, relating to detachment, convenience, commodity and cleanliness.

### **Detachment from vacuum cleaners and disengagement from maintenance**

Vacuuming, and cleaning the house in general, might not be perceived as an enjoyable or engaging task by everyone. In fact, a third of the survey respondents (35%) would like to employ a cleaner but do not for various reasons. It would appear that for UK users the most annoying aspects when using their vacuum cleaner are low suction and noise (Electrolux 2013), and it is unclear to what extent these factors are related.

A recent survey by Which? (2014) identified the most common problems with vacuum cleaners, which included blocked filters and broken belts and brushes in upright models. These factors are mainly related to the attitudes towards proper use and maintenance, according to an interview with a local vacuum cleaner repair specialist.

<sup>1</sup> The term 'workhorse product' is used in Brook Lyndhurst (2011) when referring to products purchased primarily on the basis of their function and expected to do a job reliably.

<sup>2</sup> In a survey by Cooper and Mayers (2000), many respondents (73%) regarded information on expected

product life as very important and more than half (54%) were dissatisfied with currently available information. Half of respondents (55%) in our smaller scale on-street survey (n=114) indicated that they did not know or were unsure about the expected lifetime of VCs.

Lack of maintenance and misuse could be major factors that affect vacuum cleaner lifespans. Regular and proper maintenance is requested by manufacturers' instructions in order to keep the vacuum cleaner in good working condition and thus prolonging the mechanical lifespan.

The vacuum cleaner repair specialist recommended the following fundamental maintenance tasks, generally reported in manufacturers' instructions:

- Dust the outside of the vacuum cleaner and clean the head (i.e. brush bar) at every use
- Change the filter regularly (once a month)
- Change the belt regularly (once a month)
- Do not overfill the bag (up to 2/3 of the capacity).

However, one out of three UK users find it irritating or very irritating to even clean the brush bar (Electrolux 2013), and our survey revealed a generally negative attitude to general maintenance tasks. Half of survey respondents stated that they replace the bag or empty the container of dust when they think it is full, or when the machine does not suck properly (15%), rather than according to manufacturers' instructions (7%) or when indicated by the machine (16%). Similar responses are reported about the frequency of cleaning or changing the filters. 12% do not clean the filters or do not even know if the machine has filters. Similarly, 16% of respondents do not carry out any of the other fundamental maintenance tasks (e.g. checking that the brush bar is free from hair or dirt).

Instructions are provided by the manufacturers and widely available online. However, survey respondents admit that they do not check them or have done so only once (Figure 1). Furthermore, other sources of instructions, beyond manuals, are available on the internet and used in particular by younger population (17-35 years old). Brook Lyndhurst (2011) identified caring for products in use as an opportunity for intervention in attitudes and behaviours, especially amongst lower income consumers, with the aim of lengthening product lifetimes.

Interventions to encourage longevity might therefore aim at increasing consumers' ability to take basic care of products.

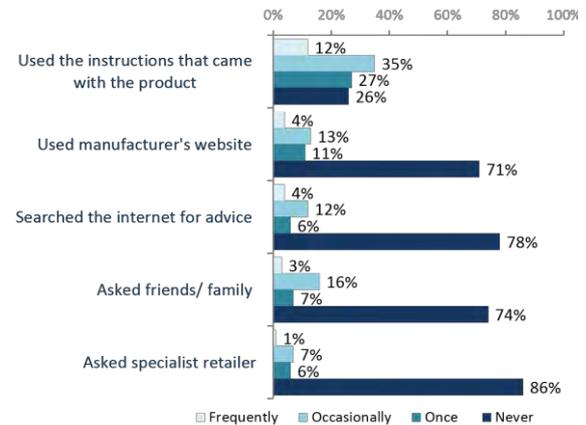


Figure 1. Sources of information and frequency of use when maintaining and repairing vacuum cleaner.

### Convenience of replacement and repair

The generally negative attitudes to maintenance was also reflected when a breakdown of the vacuum cleaner is experienced. In our survey, almost 8 in 10 respondents stated that they would consider repairing their vacuum cleaner in the hypothetical case of loss of suction or if the machine did not switch on. However, only a fifth of respondents (18%) reported that their vacuum cleaner had been repaired, while 14% stated that they did not think that vacuum cleaners are worth repairing.

Rising repair costs in conjunction with falling prices of newly manufactured goods makes it increasingly difficult for consumers to justify repairs (Cooper, 1994, 2004; Downes et al. 2011; McCollough, 2007, 2010).

The first vacuum cleaners imported to Britain cost £25, roughly equivalent to a maid's annual salary (Jackson 1992). Nowadays prices are considerably lower.<sup>3</sup> According to the White Goods Trade Association (WGTA, 2010), over the last two decades appliance prices have dropped in real terms, with significant implications for the industry and for product lifetimes.

<sup>3</sup> According to Which? (2014a), the average cost of a new vacuum cleaner is £184, raising up to £279 for a Best Buy.

Although it can represent a significant service industry (Department for Professional Employees, cit. in Graham & Thrift, 2007), the repair market has significantly declined over past decades. The Professional Service Association, a New York-based trade group, reports that over the 15 years preceding 2007 the number of appliance and electronic goods service centres decreased by about 40% and 70% respectively (McCollough, 2010).<sup>4</sup>

The UK Government's waste prevention programme aims at promoting greater reuse and repair through the development of a tool to enable householders to find local reuse and repair services (HM Government, 2013). However, several barriers undermine the spreading of the repair market including:

- willingness to pay more than a small fraction<sup>5</sup> of the replacement cost to have an appliance repaired (Brook Lyndhurst 2011; Hlavacek, cit. in McCollough, 2009)
- dissatisfaction or detachment from the product (Clarke & Bridgwater, 2012; Cooper, 2004)
- consumer's confidence and trust in repairers (Darby and Karni, cit. in McCollough, 2009)
- frustration and annoyance between breakdown and completion of the repair service (Lee Woolf et al., 2012; Ziebarth 1992)
- foreclosed possibilities of maintenance and repair that might be deliberately designed in the product (Verbeek, cit. in Graham & Thrift, 2007)
- aggressive marketing strategies for buying new products that reduce demand for repair services (McCollough, 2009).

This last barrier, in combination with the previous ones, not only challenges the feasibility of the repair option (and therefore the extension of vacuum cleaners lifespans) but also contributes to shape the perception of vacuum cleaners as commodity products, as addressed in the next section.

## Vacuum cleaners as commodities

16% of our survey respondents indicated that they replaced their vacuum cleaner because they wanted a new one, despite their existing one still working. Maybe surprisingly, vacuum cleaners can be subjected to a 'desire for new' (Campbell, 1992) and as for other products there could be several underpinning triggers for the acquisition of new vacuum cleaners (e.g. Shove and Warde, 2002).

The trend of replacing vacuum cleaners rather than keeping them for longer could be related to users' perceptions of their machines. The majority of our respondents (80%) keep their vacuum cleaner out of view, usually in a cupboard, perhaps due to the unpleasant appearance of vacuum cleaners. As vacuum cleaners are used and their materials deteriorate, they show scratches and grazes from use. Alongside mechanical damage, the clear shiny plastic becomes 'milky' and very fine dust collects in the complex shapes and contours of many vacuum cleaners. These qualities are liable to lead to disaffection with plastic products, even to the extent of encouraging disposal of products that still function. This is particularly the case for products associated with hygiene (Fisher 2004, Fisher and Shipton 2009), as addressed in the next section.

## Attitudes toward cleanliness

Individual attitudes towards cleanliness at home have implications for the lifespan of vacuum cleaners.

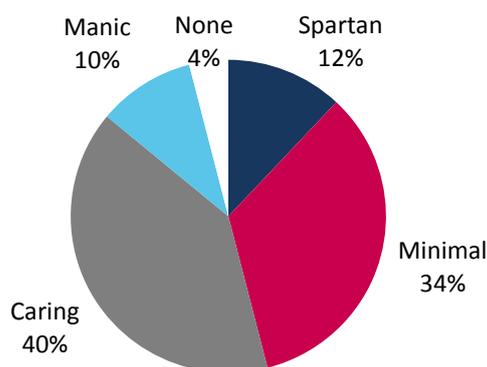
Nearly three quarters of adults in the UK 'really care' about their house being clean, taking pride in maintaining a clean home (MINTEL 2013a).<sup>6</sup> In fact, when cleaning "we are not mainly trying to avoid disease. We are [...] making visible statements about the home that we are intending to create out of the material house" (Douglas, cit. in Shove 2003, p.82).

Vacuum cleaning the floor is the third-highest priority cleaning task reported by householders (MINTEL 2013a) and a third of vacuum cleaner users in the UK feel satisfied after vacuuming (Electrolux 2013). On the other hand, our survey revealed how variable is the

<sup>4</sup> Contrasting findings have been gathered about trends in repair over recession periods that might increase for some studies (Adler & Hlavacek, 1976) or fall for others (McCollough, 2009).

<sup>5</sup> Up to a third according to the local repair specialist.

<sup>6</sup> In our survey, 31% of the interviewees consider the cleanliness of the house a *high* priority in their life, while the 57% consider it a *medium* one.



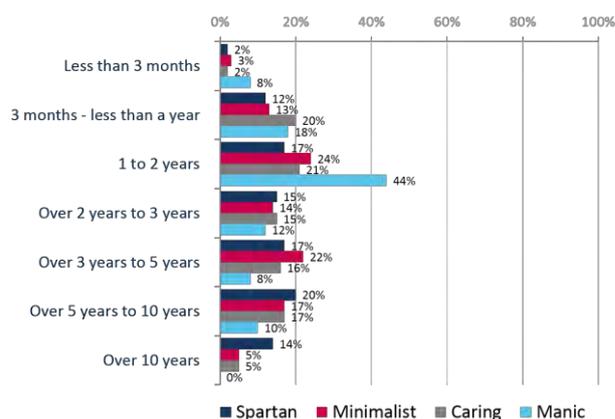
**Figure 2. Clusters of attitudes towards cleanliness.**

homeowner's interpretation of cleanliness and vacuum cleaning at home, as "there is no such thing as absolute dirt: it exists in the eye of the beholder" (Douglas, cit. in Shove 2003, p.82).

To this end, the results from the survey have been clustered according to attitudes towards cleanliness and vacuuming, adapting typologies from a previous study (Vaussard et al. 2014):

1. **Spartan cleaners** vacuum less than once a week and cleanliness of their house is a medium or low priority
2. **Minimalist cleaners** vacuum once a week or, if less often, cleanliness of their house is considered a high priority
3. **Caring cleaners** vacuum at least 2-5 times a week and cleanliness of the house is a high or medium priority
4. **Manic cleaners** vacuum daily.

There appears some correlation between these clusters and their attitudes towards vacuum cleaners lifespans. Manic cleaners replace the machine faster than people in the other clusters, perhaps suggesting more intensive use or their perceived need for a vacuum cleaner that always performs (Figure 3). For Manic and Caring cleaners the latter is supported by their more positive attitude towards maintenance and repair, and also by their interest in having the vacuum cleaner serviced for a convenient price (an option considered, on average, unrealistic by Spartan and Minimalist cleaners).



**Figure 3. Lifespan of currently owned vacuum cleaners.**

### Meaning of vacuuming and vacuum cleaners

The investigation carried out so far reveals several factors contributing to faster replacement of vacuum cleaners, classified in this paper as unreliability, detachment, convenience, commodity and cleanliness. As mentioned above several policy interventions have attempted to address these, ranging from international regulations for component durability to manufacturing guidelines. These actions target specific issues but other possibly relevant causes of faster replacement are at risk of remaining untapped.

In fact, the EU regulation limiting the wattage of vacuum cleaners and including the minimum lifespan for certain components (European Commission, 2013) generated contrasting reactions, not only by manufacturers – who might feel undermined in the way they design and produce<sup>7</sup> - but also by users who bought a higher wattage vacuum cleaner before they were banned.<sup>8</sup>

Users may worry that such a regulation will reduce performance and therefore reduce the attainable level of hygiene or time saving that only high wattage machines are considered capable of providing. It is plausible that the introduction of higher wattage machines over time has been influencing the perception of minimum technical specification required to reach acceptable levels of hygiene. As stressed by Shove, "as cleaning technologies are enmeshed in a landscape of moral and social distinction, their development has the further

<sup>7</sup> <http://www.telegraph.co.uk/technology/news/11075490/James-Dyson-suggests-leaving-the-EU-over-vacuum-cleaners.html>

<sup>8</sup> <http://www.dailymail.co.uk/news/article-2740197/Power-surge-Fourfold-rise-sales-super-vacuums-Some-customers-buying-two-models-beat-new-EU-regulations.html>

effect of reconfiguring that terrain” (Shove 2003, p.83).

Our hypothesis is that factors leading to faster replacement reflect the type of interaction that is established between the user and the machine, or in other words with the human and non-human subjects. vacuum cleaner users appear resistant to following the instructions of optimal maintenance required for a durable and high performing machine. Regular and effective maintenance is essential to those machines. However, the human component of this ‘team’ is not aware of or engaged with it.

Vacuum cleaners could be envisaged as almost ‘magic’ machines for cleaning, as advertised on 1920s advertisements promoting the first vacuum cleaners imported to Britain: they offer “easy, effortless cleaning of every nook and corner” and provide “leisure and freedom” (Jackson 1992, p.166). Jackson (1992, p.166) concludes that “this reveals something of the mythology of the ‘mechanical servant’: it is as if the vacuum cleaner steers itself around the house unaided.”

Using Latour’s concept of delegation (1992), vacuum cleaning is the kind of practice constituted by a human-non-human hybrid involving a distribution of competences between user and machine. Although the latter is in charge of the core activity of cleaning the floors, the former is supposed to oversee the latter by ‘feeding’ it (i.e. keep un/plugging to the mains while in use), steering and maintaining it. Feeding the vacuum cleaner has been partly delegated to rechargeable batteries, and steering may be delegated to robotic vacuum cleaners.

However, the user still holds responsibility for the most fundamental task for product longevity, maintaining the vacuum cleaner. Unwilling users or those unsuccessful at carrying out maintenance effectively make this hybrid system ineffective. It may be inferred that as with the delegation of feeding and steering, humans have wished to delegate maintenance tasks to the machines themselves, expecting performance and longevity with limited effort. This expectation is not met, and when the vacuum cleaner breaks it demands attention that the human has tried to avoid by means of delegation to the machine. From this perspective, the first factor leading to the perceived brokenness, unreliability, is confirmed. vacuum cleaners are not reliable for

contemporary users as they break due to their (current) inability for self-maintenance.

## Conclusions

This paper addressed the factors influencing actual and perceived brokenness of vacuum cleaners. The analysis of the results of a country-wide survey revealed insights about users’ reluctance to carry out maintenance and repair that can be related to the interaction between user and product. In particular, we argue that brokenness is not necessarily an intrinsic condition of the machine but rather a perceived state in which unwanted effort is required of the user by the item.

The failure of the vacuum cleaner to reach its potential lifespan relates to users’ expectations of their performance - as if users expect the machines to maintain themselves and thereby minimise their involvement and effort. However, this is not achievable with current technologies; future interventions should perhaps target this relationship between product and user.

The design element of this project attempts to engage the user in maintenance tasks by improving the experience of use and maintenance. Enhancing the enjoyment of vacuum cleaning and the associated maintenance tasks of the vacuum cleaner is a major objective and a possible strategy to change attitudes and reactions to (perceived) brokenness. Through co-design and action-based research approaches, design-driven strategies will be investigated in future stages of the project.

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