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# JOURNAL OF LITTER AND ENVIRONMENTAL QUALITY

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Keep Britain Tidy has been working to keep the country clean for more than 60 years and has expertise and access to a range of stakeholders in the area of litter and environmental quality. Within Keep Britain Tidy, the Centre for Social Innovation serves as an innovation hub to design and develop new approaches towards changes that benefit society.

The Journal of Litter and Environmental Quality has been created by the Centre for Social Innovation as an open-access, peer-reviewed journal that will share and discuss the latest research carried out by academics, practitioners and wider stakeholders into litter and environmental quality.

Litter refers to waste products that have been disposed of improperly, without consent, at an inappropriate location.

Environmental quality refers to the standard of the local area and includes all/any issues that might affect the appearance of the area and/or how people perceive the area.

The Journal is available for download from the Keep Britain Tidy website [www.keepbritaintidy.org](http://www.keepbritaintidy.org)

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# 2018 REPORT TO READERS

The Journal of Litter and Environmental Quality addresses an important gap in the sector by creating a platform for the publication and discussion of the latest research and thinking on litter and local environmental quality.

Since launching the Journal last year, we have been enthused by the number of individuals and organisations who have come forward to express their shared interest in using quality, peer-reviewed evidence to shape future work. This interest has come not only from across the UK but as far afield as the Netherlands, Israel and Australia.

The growing network of academic stakeholders interested in the Journal comes from a wide range of disciplines including environmental science, geography, psychology, climate change and behavioural science. Other stakeholders include professionals and volunteers working tirelessly on the ground and concerned members of the public. This publication provides space for evidence from both, helping to bridge the gap between academia and practice and providing a space to bring these diverse groups together for critical discussion about the issues.

It is with great pleasure that I present to you our second edition. In it we have an excellent mix of articles by academics and practitioners exploring a range of issues that affect the quality of our local and global environments.

The starting article by Moates provides evidence about the impacts of litter on UK wildlife. In it we see how littered drinks containers threaten populations of small mammals like voles and shrews, not only immediately after they are littered, but sometimes for decades while they remain as litter on our roadsides.

The article by Webb gives us an excellent insight into the work of a voluntary organisation to assess the impact of balloon litter on the coastline of Cornwall and their efforts to change behaviour locally.

Kolodko and Read discuss in their article the role of behavioural science in better understanding and addressing litter. As a *commons dilemma*, they explore the complexity of the issue of litter and provide a thorough review of models and frameworks that can be usefully used in designing effective anti-littering interventions.

The last two articles discuss the critical issue of fly-tipping. The Dickins article provides an analysis of resident engagement in a selection of London estates with a new fly-tipping reduction project, while Ager and Lawrence present in their article the integrated approach that is being rolled out by Croydon Council to tackle fly-tipping.

We look forward to continuing to put together future editions of the Journal, which we hope will become a rich source of evidence for all of those interested in tackling litter and improving local environmental quality. Furthermore, we hope that the Journal will stimulate new research into this important area.

I would like to thank our peer reviewers and our esteemed authors without whom the Journal of Litter and Environmental Quality would not be possible. I would also like to thank the staff at Keep Britain Tidy who helped co-ordinate the publication and editing of this Journal.

I hope that the arguments in this Journal instigate discussion and debate. I welcome you to read, share and enjoy the articles and hope that you will consider contributing your own work and opinions in the future.

**Lizzie Kenyon**

Director, Centre for Social Innovation

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- 05** **Small mammal mortality in discarded bottles and drinks cans: A Norfolk-based field study in a global context**  
Graham Moates

Small mammals occupy an important midpoint in the food chain acting as insectivore, herbivore or omnivore, as well as forming a key prey item for carnivorous mammals and avian predators such as owls and kestrels. This article reports on the results of a study of the impacts of discarded bottles and cans on small mammal mortality and compares these results to those of other national and international studies. 2,174 bottles and cans were collected and examined from sites in south and central Norfolk, particularly roadside lay-bys and verges. Of these, 115 were occupied representing an overall occupancy rate of 5.3% (8.1% of bottles and 4.8% of cans) and, in total, they contained a sum of 230 small mammal casualties. The most frequent number of casualties per container was one, with a maximum of seven casualties found in any single container.

Across all containers examined, the most common casualty was the common shrew (*Sorex araneus*) followed by the bank vole (*Myodes glareolus*). True shrews (*Soricidae*) comprised 52% of the specimens found in bottles and 77% in cans. There is some indication that litter casualties may have local effects in areas of low population size or for pre-breeding/winter populations of small mammals. Pinch-points of high small mammal mortality may also occur at roadside lay-bys with narrow linear verges adjacent to unfavourable habitat such as intensive agriculture with no field margins.

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PAGE TITLE

- 14** **Just a Balloon? A local study of the extent and impacts of balloon litter on beaches**  
Delia M. Webb

This article provides a case study of the work of a voluntary organisation to assess the impact of balloon litter on the coastline of Cornwall and change behaviour locally. Written from the perspective of volunteer beach cleaning and conservation groups, it explores recent citizen science projects that have highlighted the scale of the problem in the Duchy. The article highlights the work of the Cornish Plastic Pollution Coalition to increase awareness of the issue of balloon litter and change behaviour. The group's work has involved approaching a target audience of businesses, schools, charities, organisations and individuals who use and release helium-filled balloons, to engage them on the issue and ask them to consider more environmentally friendly alternatives.

- 20** **Using behavioural science to reduce littering: Understanding, addressing and solving the problem of litter using a commons dilemma approach**  
Julia Kolodko and Daniel Read

The main objective of this article is to provide an overview of decision-making literature relevant to littering and to explain behavioural science as applied to tackling the problem of littering. The article begins by explaining how littering is a *commons dilemma* and why, therefore, it is such a complex problem. This is then used as a framework to show how policy-makers, social entrepreneurs and anyone else who wants to reduce littering can approach the problem. The article then moves on to describe models and frameworks, taken from behavioural science theory and research, that can be helpful in designing effective anti-littering interventions. Finally, this knowledge is applied to outline some ideas of such interventions.

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**36** **Pragmatic considerations and social benefits: An analysis of engagement with a fly-tipping reduction project**  
Tom Dickins

This article reports on survey data collected from residents at five London estates towards the end of a pilot intervention called the Repurpose Project designed to reduce fly-tipping and to increase re-use of items. The intervention focused on developing centres, called Loops, within each estate at which broken and unwanted items could be repaired, improved, sold and bought. Various repurposing and repair skills were also imparted to residents through workshops and other activities (Phillips, 2017).

Attitudes toward recycling and the future were assessed, as well as views on the amount and causes of fly-tipping. Questions about the social benefits of engaging with the project were also pursued. The single predictor of strong engagement with the Loops was a belief that people only fly-tipped when they had no choice. A second model, looking to predict whether residents had heard of the Loops, showed that convenience in conjunction with the view that there was a lot of fly-tipping, as well as age, were significant contributors. Both models strongly suggest that *fly-tipping is thought of pragmatically, and not in the context of broader attitudes about the environment and future*. Residents reported that engagement in the project did cause changes to their recycling and repurposing behaviours and that engagement also conveyed social benefits including increases in size of social networks.

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**47** **Tackling current issues in fly-tipping: a view from a London borough**  
Jacki Ager and Tom Lawrence

The London Borough of Croydon is working to achieve its long-term goal of being the cleanest and greenest London borough. As a key part of this work, Croydon developed and implemented a new integrated approach to specifically tackle the ongoing issue of fly-tipping in the borough. This article presents a case study to outline the approach. This primarily consists of the investment in new street cleansing technologies, improvements to the process for reporting fly-tips, community activity and a renewed emphasis on enforcement. It is hoped that, over time, these initiatives will demonstrate a reduction in fly-tipping rates in the borough.

# JOURNAL OF LITTER AND ENVIRONMENTAL QUALITY

The Journal of Litter and Environmental Quality would not have been possible without the commitment and hard work of our peer reviewers. They provide not only the information needed for publication decisions but also valuable critiques for authors. We offer our sincerest thanks to the following reviewers who served as referees for the journal.

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# SMALL MAMMAL MORTALITY IN DISCARDED BOTTLES AND DRINKS CANS – A NORFOLK-BASED FIELD STUDY IN A GLOBAL CONTEXT<sup>1</sup>

**Graham Moates** is a volunteer for the RSPB, Norwich Bat Group, Suffolk Wildlife Trust and the Little Ouse Headwaters Project and has particular interests in mammals, orthoptera, birds and citizen science generally. His research on the impacts of ‘on the go’ litter on small mammal mortality has been self-led to raise awareness of this particular issue as well as littering in a wider context.

## INTRODUCTION

The ongoing occurrence of ‘on the go’ litter in the built and natural environment has received much attention in recent years (for instance, Keep Britain Tidy, 2015a, 2015b; Brooks and Davoudi, 2017). It is well established that plastics entering the marine ecosystem may be ingested by birds, fish and cetaceans (Marine Conservation Society, 2017) while on land, the littering of transport corridors such as roads can result in the entanglement of medium-sized species in multi-pack plastic rings (RSPCA, 2017) and entrapment of small mammals, such as shrews, mice and voles.

The phenomenon of small mammals becoming trapped in discarded glass bottles was first studied in the UK more than 50 years ago and identified ten affected species of small mammal (Morris & Harper, 1965). However, since this original study, there have been many changes in packaging such as closures to door-step milk deliveries resulting in substitution of milk bottles with carton packaging and the emergence of sports push-pull closures on plastic soft drinks bottles.

Studies have also been undertaken covering this subject in United States, Italy, Poland and Spain (Arrizabalaga *et al.*, 2016; Pagels & French, 1987; Gerard & Feldhamer, 1990; Debernardi *et al.*, 1997; Hamed & Laughlin, 2015; Przybyl *et al.*, 2016). These focus predominantly on the effects of littered bottles and, with the exception of Clinging & Whiteley (1980) and Dodgson (2005), there appears to be little data on small mammal mortality due to discarded drinks cans. Muir & Morris (2013)

suggest that less than one per cent of cans contain casualties although the methodology underlying this result is not stated.

Small mammal mortality is also of interest to mammal recorders and conservationists due to the importance of small mammals in the food chain acting as insectivore, herbivore or omnivore, as well as forming a key prey item for carnivorous mammals and avian predators such as owls and kestrels. There has been an under-recording of many small mammal species in many areas of the UK. For instance, with only 19 pygmy shrew (*Sorex minutus*) records received for Norfolk in 2015, it is conceded that these are probably under-recorded (Farrow, 2015). A similar situation is reported particularly for shrews in other areas of the UK such as Suffolk (Bullion, 2009) and Derbyshire (Derbyshire Mammal Group, 2016). This may be due to lack of observer effort or species-specific issues affecting certain methods – for example, pygmy shrews may be of insufficient weight to trigger a Longworth trap (a small mammal trap) if the trap has been incorrectly adjusted (Morris & Harper, 1965). Przybyl *et al.* (2016) suggest that examination of discarded litter is potentially a quicker route for collecting small mammal distribution records than conventional live trapping.

This study examines current discarded litter in the UK to provide an update on the impact of litter on small mammal species using south and central Norfolk as a study area, and compares this with other national and international studies.

<sup>1</sup> This work includes material which was published in an earlier version as a non-peer reviewed article in Transactions of the Norfolk & Norwich Naturalists’ Society, 2016, 50(2), 205–212 (Moates, 2016).

## METHODOLOGY

The study employed a semi-quantitative methodology in an attempt to quantify the number of small mammal casualties over a measured area spread across a large number of individual sites. However, it is acknowledged that absolute quantification was not possible due to the erratic build-up of litter over time and the potential removal of litter by cleansing operatives or other individuals.

The study involved the collection of discarded bottles and drinks cans from 169 sites mainly in south Norfolk. The sites were predominantly roadside lay-bys and verges of which 14% were on main (A-class) roads, 14% on secondary (B-class) roads, 54% on other roads and 18% on other sites. For comparison with the INCPEN litter composition study for England (INCPEN, 2014), which counts all formal and informal lay-bys as ‘other highways’, 34% were ‘rural roads’ sites, 49% were ‘other highways’ sites and 17% were ‘recreation areas’ with less than one percent of ‘main roads’ sites.

In the case of discarded bottles, the material (glass or plastic) was noted along with the overall bottle length, neck length, body width and internal aperture diameter (i.d.). In the case of cans, the height, diameter and aperture dimensions were recorded. Only uncapped bottles and uncrushed cans were considered as part of this analysis.

The contents of the litter item were poured into a plastic tray and any decaying mammal or skeletal remains were washed leaving skulls and lower jaws – these were identified according to the key of Yalden (2009). The species and numbers present of any small mammals found were recorded along with the presence or absence of water and/or insects in the recovered litter item.

The total area searched (excluding metallised surfaces) was determined using a mapping website and area calculation tool ([www.gridreferencefinder.com](http://www.gridreferencefinder.com)). Each site was

measured in triplicate and the average (mean) calculated. The minimum and maximum areas of the individual sites and the minimum and maximum number of containers collected at an individual site are shown in Table 1.

For a sub-sample of 281 bottles and cans, the product and expiry date were also noted to gain an insight into the type of beverage and length of time that the litter had remained in the environment.

## RESULTS AND DISCUSSION

### Summary of containers collected

2,174 bottles and cans were examined during the course of this study, undertaken between April 2016 and October 2017. These consisted of 310 glass bottles, 16 plastic bottles and 1,848 metal drinks cans.

115 containers (5.3%) were found to contain small mammal remains as detailed in Table 2.

The occupancy rate was in line with Brannon & Bargelt (2013), which found that 4.7% of bottles contained small mammal remains and higher than the 1% reported for cans by Muir & Morris (2013). Discarded glass bottles were found to be more likely to trap small mammals than plastic bottles or metal drinks cans as observed by Hamed & Laughlin (2015). The number of plastic bottles found without caps in place was quite limited and of these, only two were found to contain small mammal remains. The sample size of uncapped plastic bottles was too small to draw any conclusions.

A wide variety of by-catch was observed, particularly in the occupied containers, and included carrion beetles, woodlice, millipedes, slugs and snails although the by-catch was not generally recorded as part of this study. There was a clear association between those containers found to contain mammal remains and the presence of water and insects as observed by Dodgson (2005). However, Gerard & Feldhamer (1990) observed that the

**Table 1: Size of surveyed sites and number of containers collected**

Number of sites surveyed	Total area (ha <sup>-1</sup> ) including repeat visits	Individual site area (ha <sup>-1</sup> )			Total number of containers collected at a single site		
		(min.)	(max.)	Mean ± SD	(min.)	(max.)	Mean ± SD
169	14.844	0.001	0.892	0.064 ± 0.112	1	154	12.2 ± 16.7

NB One hectare (ha) equals 10,000m<sup>2</sup>.

**Table 2: Number, type and material of container and capture rate**

Container type	Material	Number collected	Number occupied	Capture rate (%)
Bottle	Glass	310	25	8.1
Bottle	Plastic	16	2	n.s.
Drinks can	Aluminium/steel	1,848	88	4.8
<b>Total</b>		2,174	115	5.3

*n.s.* = not stated due to small sample size

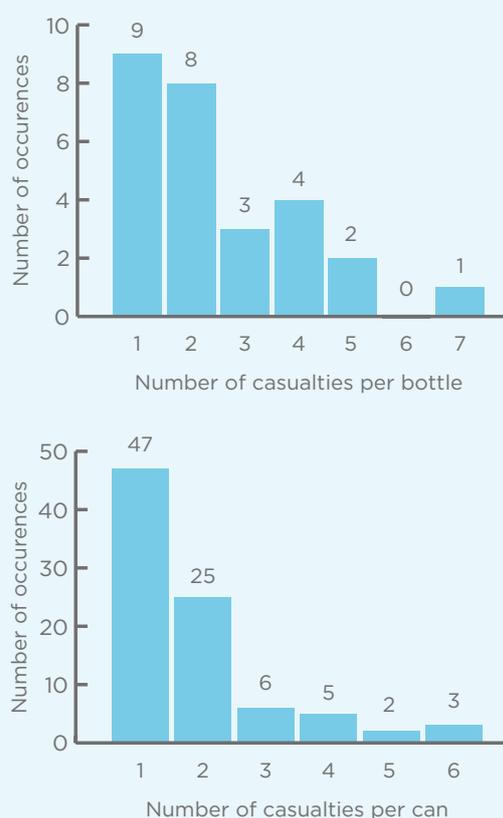
presence of invertebrates in a bottle does not appear to be the sole factor in its functioning as a small mammal trap.

A small number of bottles and cans were found that were full of leaves and had clearly been used by small mammals as nesting chambers. Evidence of nut and seed remains and droppings were also noted in some cases. These bottles and cans were found in a horizontal orientation and so ingress/egress was not impeded. Morris & Harper (1965) suggested that the container

being at an angle of 15° or more is required to prevent free movement of shrews to and from the container.

In total, the 115 occupied bottles and cans examined contained a total of 230 small mammal casualties. The most frequent number of casualties per container was one, with a maximum of seven (Figure 1a and b). This is similar to the findings of Morris & Harper (1965) which report that around half of bottles contain a single specimen up to a maximum of six casualties in their measured sample. Debernardi *et al.* (1997) likewise reported that the most frequent finding was a single casualty although this ranged up to 32 casualties in a single bottle/can. Dodgson (2005) reported a maximum of ten casualties in a single can (six bank voles and four common shrews). The highest reported number of casualties in a single container appears to be in the study of Arrizabalaga *et al.* (2016), which recorded 54 small mammals in a two-litre plastic bottle in Spain.

**Figure 1. – Frequency distribution graphs showing number of small mammal casualties found per (a) occupied bottle and (b) occupied drinks can**

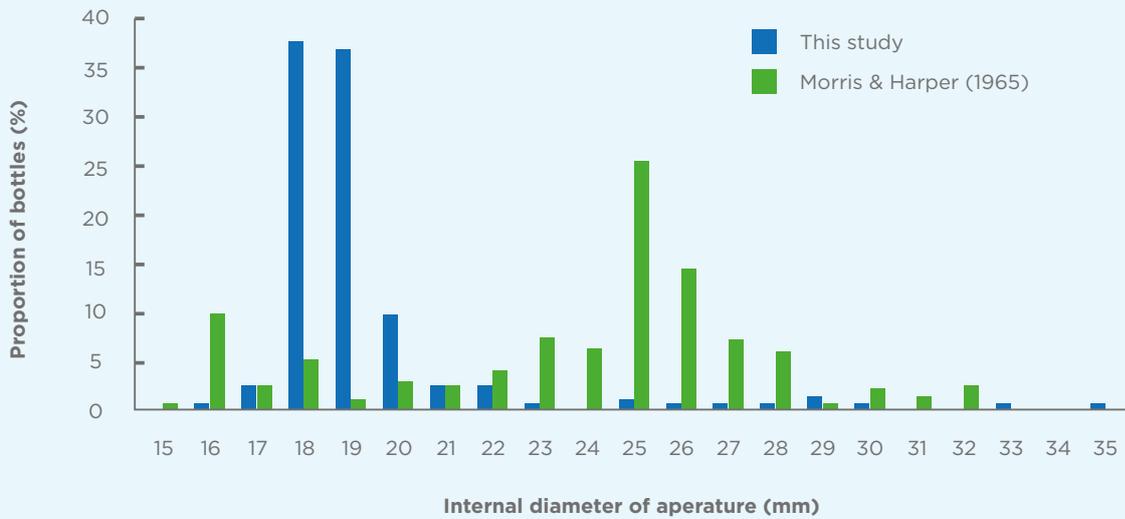


### **Discarded bottles**

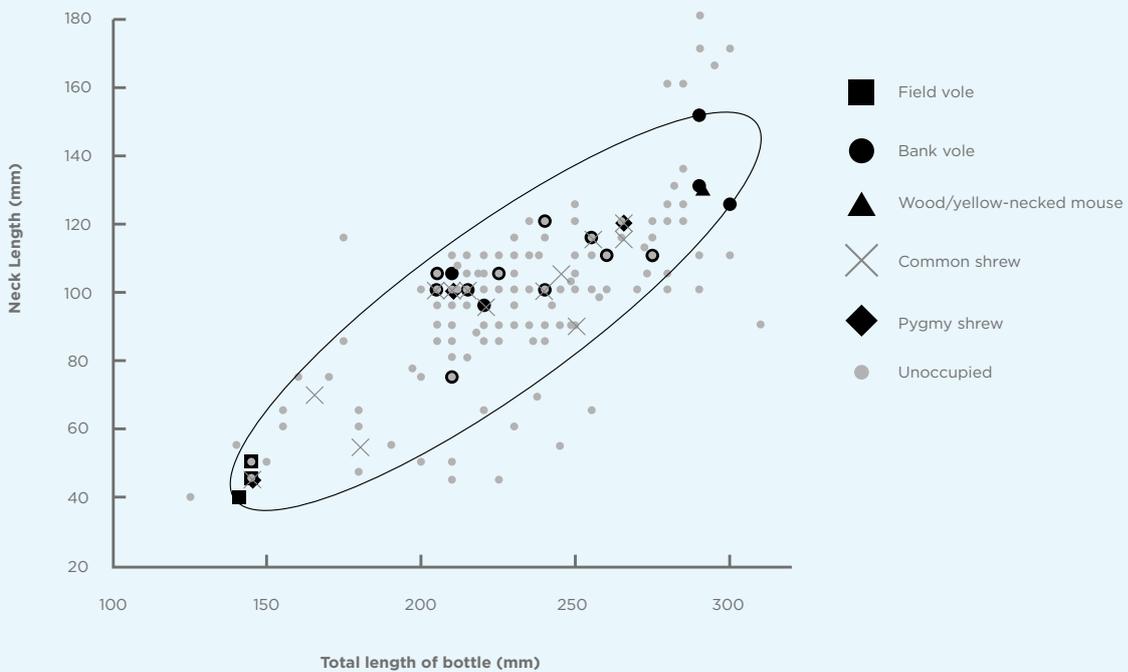
The aperture size of open drinks bottles has decreased markedly since the study of Morris & Harper (1965), falling from predominantly 23-28mm i.d. to 18-20mm for the bottles found during this study (Figure 2 overleaf). The aperture size would also appear to be much more tightly clustered than previously. As discussed by Morris & Harper, an aperture size of less than 19mm i.d. will be highly selective in favouring shrew mortality compared to rodent mortality.

It can be seen from Figure 3 (overleaf) that small mammals become trapped in a wide range of bottle sizes but would appear to avoid bottles having the very longest neck lengths and possibly some of those having proportionately short neck lengths relative to their total length.

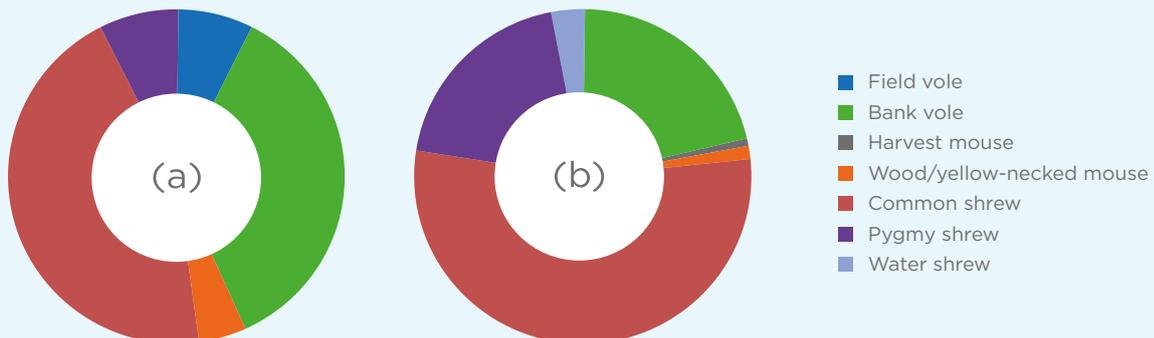
**Figure 2 - Comparison of aperture size of bottles found in the current study and in the Morris & Harper (1965) study**



**Figure 3 - Graph of bottle dimensions and species of small mammal captured**



**Figure 4 - Charts showing species and relative proportions of small mammal casualties found in (a) occupied bottles and (b) occupied drinks cans**



Of the 27 occupied bottles found, seven were milk bottles containing skeletal remains indicating the persistence of litter in the environment. However, the majority of the sample consisted of more recently deceased specimens.

Five species of small mammal were observed as casualties in discarded bottles ( $n = 67$ ) during the course of this study. The most common casualty was the common shrew (*Sorex araneus*,  $n = 30$ ) followed by bank vole (*Myodes glareolus*,  $n = 24$ ), field vole (*Microtus agrestis*,  $n = 5$ ), pygmy shrew (*Sorex minutus*,  $n = 5$ ) and wood/yellow-necked mouse (*Apodemus sp.*  $n = 3$ ), with true shrews (*Soricidae*) comprising 52% of the specimens found (Figure 4a).

### **Discarded cans**

The widest distance across the aperture in the drinks cans examined was generally 23 to 25mm and the narrowest distance was usually 10 to 12mm. The narrowest dimension was slightly larger if the closure remained in the upright position rather than being returned to the flat position, if the closure had become detached or if the can had been otherwise modified. However, no relationship was observed between the size of the aperture and the species found trapped.

Six species of small mammal were observed as casualties in discarded drinks cans ( $n = 163$ ) during the course of this study. The most common casualty was the common shrew (*Sorex araneus*,  $n = 88$ ) followed by the bank vole (*Myodes glareolus*,  $n = 35$ ) and then the pygmy shrew (*Sorex minutus*,  $n = 32$ ). In addition, five water shrews (*Neomys fodiens*) were found in four cans from sites within 250 metres of water, two wood/yellow-necked mice (*Apodemus sp.*) were found in cans from wooded locations and a harvest mouse (*Micromys minutus*) from common land. True shrews (*Soricidae*) comprised 77% of the specimens found (Figure 4b).

This coincides with the findings of Debernardi (1997) which found true shrews (*Soricidae*) to be the most represented family in an Italian sample (73.5% of specimens found) and Pagels & French (1987) who also found soricids to be the most abundant small mammal found. Dodgson (2005) found bank voles (*Myodes glareolus*) to be the most common small mammal casualty in terms of percentage of surveyed 1km<sup>2</sup>, although information on the number of casualties found is not given. The results will be highly dependent on the habitat of the surveyed areas and species known to

be present. Surprisingly, Przybyl *et al.* (2016) found only bottles and no cans that contained small mammal remains in a survey of two sites where several species of shrew were found to be present. The same authors found water shrew (*Neomys fodiens*) through live-trapping only, with no specimens found in discarded bottles and cans - this study, along with that of Dodgson (2005), suggests that they will be trapped albeit at a lower rate and favouring habitat relatively close to water.

No field voles (*Microtus agrestis*) were found in discarded cans in this study suggesting that they may be to some extent trap-shy. This was also concluded by Clinging & Whiteley (1980), which noted that the frequency of field voles found in discarded litter and live traps did not correlate with the frequency found in owl and kestrel pellets.

Pygmy shrews appeared to be much more readily trapped in discarded cans (one pygmy shrew per 2.8 common shrews) compared to discarded bottles (one pygmy shrew for every six common shrews). Despite the number of discarded bottles being much lower than the number of discarded cans found, the abundance of pygmy shrews relative to common shrews observed in discarded bottles is close to other UK bottle studies as listed in Harris *et al.* (1995). The relative abundance of pygmy shrews found in discarded cans is also higher than the figure of one pygmy shrew per 5.4 common shrews given for England by Harris *et al.* (1995). Further scale-up and combining with other records from Norfolk would indicate whether pygmy shrews were relatively more common in Norfolk than in the wider UK or whether this was due to discarded cans functioning as a more effective trap for pygmy shrews than bottles.

### **Overall effect on small mammal populations**

The effect of litter on populations of small mammals remains elusive due to the uneven spread of litter tending to be present at highest densities close to towns and cities, near picnic sites, along roadside verges or adjacent to traffic lay-bys. In order to quantify the effect on small mammal populations in the surveyed locations, the total area surveyed including repeat visits (14.844ha<sup>-1</sup>) was determined and compared with the indicative population size (e.g. from Harris *et al.*, 1995) (Table 3 overleaf).

While the capture rate does not suggest that the levels of litter found are likely to cause catastrophic effects to the overall post-breeding small mammal populations, there may be local effects in areas of low

**Table 3: Comparison of the mortality rate from this study with indicative population estimates**

Species	Mortality rate (number ha <sup>-1</sup> )	Indicative population size (number ha <sup>-1</sup> )
Bank vole	4.0	5-130 (depending on season and habitat) <sup>[1]</sup>
Common shrew	8.0	42-59 (summer, deciduous woodland and grassland) <sup>[2]</sup> 5 -27 (winter, deciduous woodland and grassland) <sup>[2]</sup>
Pygmy shrew	2.5	12 (summer, grassland) <sup>[3]</sup> 5 (winter, grassland) <sup>[3]</sup>

<sup>[1]</sup>Harris et al. (1995), <sup>[2]</sup>Churchfield (1995), <sup>[3]</sup>Pernetta (1977)

population density or for pre-breeding/winter populations. Roads may act as a barrier for small mammals (Underhill, 2003; De Redon *et al.*, 2015) and, as such, roadside lay-bys with narrow linear verges adjacent to unfavourable habitat such as intensive agriculture with no field margins may result in pinch-points of high small mammal mortality and subsequent habitat fragmentation. This is especially the case during the winter months when small mammals may tend to avoid the cropped areas. For instance, in the case of pygmy shrew, a localised capture rate equivalent to 2.5 specimen ha<sup>-1</sup> was observed in this study compared with an indicative winter grassland population of 5 per ha<sup>-1</sup>. It should be noted that there is wide variation in the population estimates given although the importance of roadside verges for small mammals is well-known (Bellamy *et al.*, 2000; Underhill, 2003). There will also be some over-estimation of the mortality rate with respect to time that discarded containers will remain in the environment until removed. Hamed & Laughlin (2015) attempted to account for this possible over-estimation by noting the likely age of the discarded item by reference to the bottling date marked on the container. In the UK, the usual date marked is the ‘best before’ date enabling an estimate to be calculated using the typical retail shelf-life.

**Product type and estimated age of litter sampled**

For the sub-sample of containers where the product and expiry date were noted, it can be seen that there is a relatively high percentage of containers arising from alcoholic drinks, mainly beer and lager (Table 4). This is consistent with the author’s observations on the total sample and perhaps surprising in a roadside location. Carbonated soft drinks and sports/energy drinks were the next most numerous container types collected.

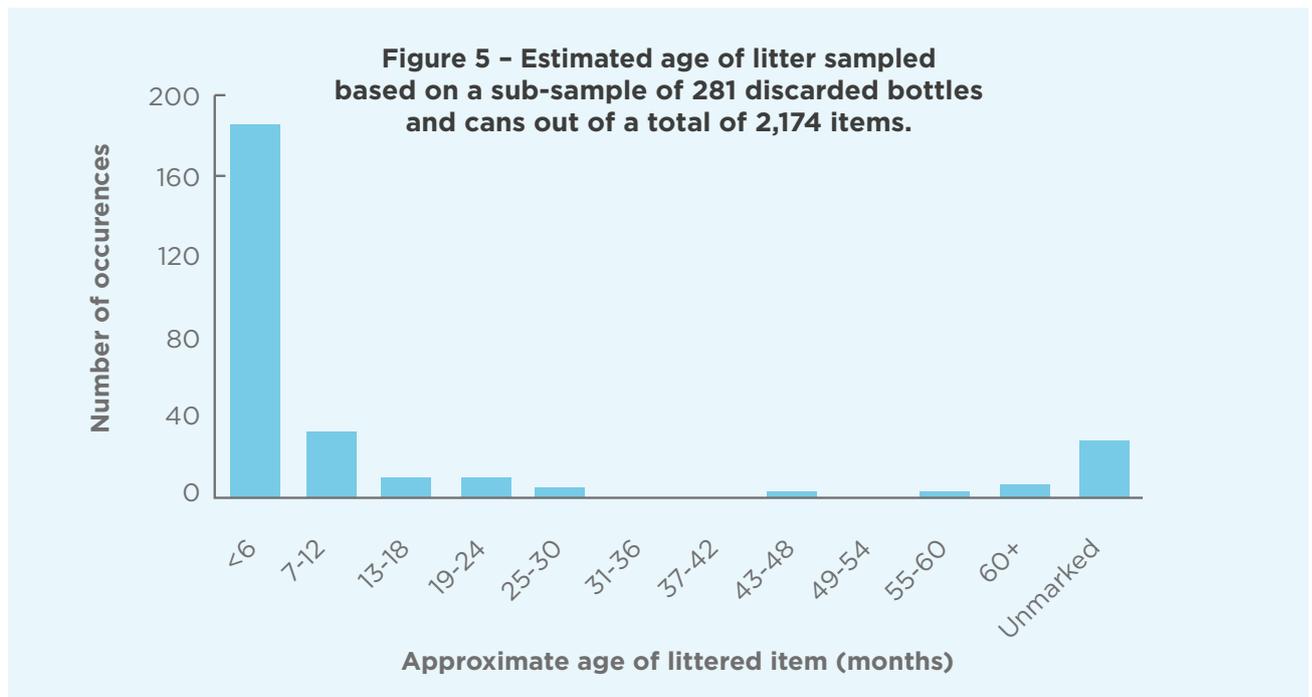
**Table 4: Product type**

Product type*		Percentage
Alcoholic drinks	Beer/lager	48%
	Cider	4%
	Wines and spirits	1%
Non-alcoholic drinks	Carbonated soft drinks	22%
	Sports/energy drinks	20%
	Juice and juice drinks	<1%
Unmarked		5%

\* Based on a sub-sample of 281 discarded bottles and cans out of a total of 2,174 items.

The age of the litter was estimated by calculating the estimated purchase date by subtracting the retail shelf-life from the marked ‘best before’ date (where shown). For beers, lagers and cider, the shelf-life was found to be typically eight to ten months; for carbonated soft drinks (with sugar), typically 11 months; for low-calorie carbonated soft drinks, typically four to five months; and for sports/energy drinks, typically 16 to 23 months. It is assumed that these ‘on the go’ products are consumed soon after purchase and not stored at home.

While around ten per cent of the litter was unmarked presumably due to weathering, it is still clear that the majority of litter found was very recent at the time of collection with approximately two-thirds of the littered items less than six months old (Figure 5). Around two per cent of the littered items were over five years old with the oldest item found being a carbonated fruit drink only made between 1983 and 1986 (more than 30 years old), again demonstrating the persistence of litter in the environment.



### Scale of littering in the UK

Only 69% of the 9,591 billion aluminium drinks cans produced in the UK are recycled each year ([www.recycle-more.co.uk](http://www.recycle-more.co.uk); [www.alupro.org.uk](http://www.alupro.org.uk)), leaving the remaining 31% (2.973 billion p.a.) being disposed of as general waste or littered. Also, the total numbers of metal drinks cans and glass bottles picked up from the ground annually in the UK have been estimated to be 346,889,238 and 55,136,888 respectively (Hogg *et al.*, 2017). The number remaining in the environment is not readily measurable although it is estimated that, of all the litter that is *genuinely littered* on the ground (i.e. not placed correctly in bins) over a certain period, 88% is picked up, and that of the remaining 12%, half remains in the terrestrial environment (6% of all litter dropped on the ground) and half enters the marine environment (6% of all litter dropped on the ground) (Eunomia, 2018). Using this estimate leads to a figure of 27.4 million metal drinks cans and glass bottles which may, in turn, lead to 1.4 million occupied containers containing 2.9 million deceased small mammals each year based on the results of this study. There will be considerable uncertainty in this number due to extrapolation errors, but the occurrence of small mammal casualties in discarded litter was very prevalent in the study area and observed at similar occupancy rates in the various scientific studies referred to in this article, although these tend to be in rural areas. There is a risk of over-estimation if containers are crushed prior and subsequent to littering. However, no consideration has been given to small mammal casualties occurring in plastic

bottles or other tubular containers. Further research is recommended to increase the sample size, especially for plastic bottles and other containers, and to study the effect of a range of habitats (e.g. urban, suburban, rural) as well as to provide a clearer knowledge of small mammal populations and their distribution.

One positive, very recent development is a new drink can with a resealable closure and narrow (4mm wide) aperture. Although this does not tackle the litter problem, it could certainly prevent small mammal mortality by stopping small mammals entering the cans. However, despite these apparently being rolled out in the UK in February 2015 (Anon, 2015), only two were found during the course of the study.

### Conclusions

Despite changes in packaging over the past 50 years, litter remains a serious problem in the wider countryside, often buried in the undergrowth acting as a lethal trap for small mammals and small invertebrates. Approximately eight per cent of all bottles and five per cent of all cans were found to be occupied. Across all containers examined, the most common casualty was the common shrew (*Sorex araneus*) followed by the bank vole (*Myodes glareolus*), with true shrews (*Soricidae*) comprising 52% of the specimens found in bottles and 77% in cans. The mortality rate cannot be gauged without a complete clearance over a measured area and, indeed, the mammal population density and occurrence of litter will vary considerably. However, there is some indication that litter

casualties may have local effects in areas of low population size or for pre-breeding/winter populations of small mammals. Pinch-points of high small mammal mortality may also occur at roadside lay-bys with narrow linear verges adjacent to unfavourable habitat such as intensive agriculture with no field margins. Checking and clearing bottles and cans provides a relatively quick source of small mammal records, particularly shrews, often close to inaccessible areas where conventional Longworth trapping would not be possible. This may lead to an improved understanding of small mammal distribution as well as providing the benefit of preventing further unnecessary small mammal fatalities through removal of the litter from the countryside.

## REFERENCES

- Anon. (2015), "Resealable Mega Monster 'can with a cap' to roll out mid-Feb", available at [thegrocer.co.uk/buying-and-supplying/categories/soft-drinks/resealable-mega-monster-can-with-a-cap-to-roll-out-mid-feb/512766.article](http://thegrocer.co.uk/buying-and-supplying/categories/soft-drinks/resealable-mega-monster-can-with-a-cap-to-roll-out-mid-feb/512766.article) (accessed 7 October 2017).
- 
- Arrizabalaga, A., Gonzáles, L.M. and Torre, I. (2016), "Small mammals in discarded bottles: a new world record", *Galemys*, 22, 63-65.
- 
- Bellamy, P.E., Shore, R.F., Ardeshir, D., Treweek, J.R. and Sparks, T.H. (2000), "Road verges as habitat for small mammals in Britain", *Mammal Review*, 30, 131-139.
- 
- Brannon, M.P. and Bargelt, L.B. (2013), "Discarded Bottles as a Mortality Threat to Shrews and Other Small Mammals in the Southern Appalachian Mountains", *Journal of North Carolina Academy of Science*, 129, 126-129.
- 
- Brooks, L. and Davoudi, S. (2017), "Litter and social practices", *Journal of Litter and Environmental Quality*, 1, 16-25.
- 
- Bullion, S. (2009). *The Mammals of Suffolk*. Suffolk Wildlife Trust & Suffolk Naturalists' Society, Ipswich, Suffolk.
- 
- Churchfield, S. (1995), "Common shrew *Sorex araneus*", in: Corbet, G.B & S. Harris (Eds.), *The Handbook of British Mammals*, Blackwell Scientific Publications, Oxford.
- 
- Clinging, V. and Whiteley, D. (1980), *Mammals of the Sheffield area*. Sorby Record – Special Series No. 3, 5-6.
- 
- De Redon L., Le Voil I., Jiguet F., Machon N., Scher O. and Kerbiriou C. (2015), "Road network in an agrarian landscape: Potential habitat, corridor or barrier for small mammals?", *Acta Oecologica*, 62, 58-65.
- 
- Debernardi, P., Patriarca, E., Perrone, A., Cantini, M. and Chiarenzi, B. (1997), "Small mammals found in discarded bottles in Alpine and pre-Alpine areas of NW-Italy", *Hystrix*, 9, 51-55.
- 
- Derbyshire Mammal Group (2016), "Mammal Status - Pygmy shrew", available at: [derbyshiremammalgroup.org.uk](http://derbyshiremammalgroup.org.uk) (accessed 16 December 2016).
- 
- Dodgson, J. (2005), "Small mammals in drink cans", *Worcestershire Record* No.18, April 2005, 28, available at: [wbrc.org.uk](http://wbrc.org.uk) (accessed 5 December 2016).
- 
- Eunomia (2018), estimate – personal communication with Chris Sherrington.
- 
- Farrow, F. (2015), "Norfolk Mammal Report – 2015", *Transactions of the Norfolk & Norwich Naturalists' Society*, 49(2), 194-211.
- 
- Gerard, A.S. and Feldhamer, G.A. (1990), "A Comparison of Two Survey Methods for Shrews: Pitfalls and Discarded Bottles", *The American Midland Naturalist*, 124, 191-194.
- 
- Hamed, M.K. and Laughlin, T.F. (2015), "Small-Mammal Mortality Caused by Discarded Bottles and Cans along a US Forest Service Road in the Cherokee National Forest", *Southeastern Naturalist*, 14, 506-516.
- 
- Harris, S., Morris, P., Wray, S. and Yalden, D. (1995), *A review of British mammals: population estimates and conservation concern of British mammals other than cetaceans*, Joint Nature Conservation Committee, Peterborough, available at [jncc.defra.gov.uk](http://jncc.defra.gov.uk) (accessed 17 December 2016).
-

Hogg, D., Elliott, T., Gibbs, A., Grant, A. and Sherrington C. (2017), "Impacts of a Deposit Refund System for One-way Beverage Packaging on Local Authority Waste Services", October available at [eunomia.co.uk](http://eunomia.co.uk) (accessed 13 October 2017).

---

INCPEN (2014), Litter composition survey of England. Keep Britain Tidy, London, available at [incpen.org/docs/KBTINCPENLitterComposition2014.pdf](http://incpen.org/docs/KBTINCPENLitterComposition2014.pdf) (accessed 7 October 2017).

---

Keep Britain Tidy (2015a), "How clean is England?", The Local Environmental Quality Survey of England 2014/15, available at [keepbritaintidy.org](http://keepbritaintidy.org) (accessed 26 November 2017).

---

Keep Britain Tidy (2015b), "Soft drinks littering", available at [keepbritaintidy.org](http://keepbritaintidy.org) (accessed 26 November 2017).

---

Marine Conservation Society (2017), "Clean seas", available at: [mcsuk.org/clean-seas](http://mcsuk.org/clean-seas) (accessed 26 November 2017).

---

Moates, G. (2016), "A study of small mammal remains found in discarded bottles and drinks cans across south and central Norfolk", *Transactions of the Norfolk & Norwich Naturalists' Society*, 50(2), 205-212.

---

Morris, P.A. and Harper, J.F. (1965), "The occurrence of small mammals in discarded bottles", *Proc. Zoological Society of London*, 145, 148-153.

---

Muir, G. and Morris, P. (2013), *How to Find and Identify Mammals*, The Mammal Society, Southampton.

---

Pagels, J.F. and French, T.W. (1987), "Discarded Bottles as a Source of Small Mammal Distribution Data", *The American Midland Naturalist*, 118, 217-219.

---

Pernetta, J.C. (1977), "Population ecology of British shrews in grassland", *Acta Theriologica*, 21, 241-256.

---

Przybyl M., Kolenda K., Pilñacińska B. and Rychlik L. (2016), "Survey of discarded bottles more effective than short-term trapping in detection of the diversity of shrews and rodents", poster presented at International Colloquium Biology of the Soricidae IV, 11-14 September 2016, Poznań, Poland, abstract book available at [shrews4.home.amu.edu.pl](http://shrews4.home.amu.edu.pl) (accessed 5 December 2016).

---

RSPCA (2017), "Litter costs lives", available at: [rspca.org.uk/adviceandwelfare/litter](http://rspca.org.uk/adviceandwelfare/litter) (accessed 26 November 2017).

---

Underhill, J.E. (2003), PhD thesis, Roads and wildlife: A study of the effects of roads on mammals in roadside habitats, University of Birmingham.

---

Yalden, D.W. (2009), *The Analysis of Owl Pellets*, 4th edition, The Mammal Society, Southampton.

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# JUST A BALLOON? A LOCAL STUDY OF THE EXTENT AND IMPACTS OF BALLOON LITTER ON BEACHES

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## INTRODUCTION

In recent years, there has been a growing trend of using 'balloon releases' to mark memorial, celebratory, sports or fundraising events. Brightly coloured latex or shimmering foil balloons (often made from mylar, a type of polyester sheet) are let go in their hundreds, or even thousands, by people who watch them 'disappear' into the skies. Many businesses and other organisations have branded balloons as advertising and promotional giveaways. Essentially, these items are 'single-use', with many ending as litter and marine debris. This plastic and latex pollution then poses a real threat to wildlife and the environment. In Cornwall the problem seems to be more evident with balloon debris regularly found during beach cleans.

Other single-use items such as plastic bags and cotton bud sticks have been the subject of successful campaigns to reduce their use and so reduce the amount of associated pollution. This article outlines the work of the Cornish Plastic Pollution Coalition to campaign locally on the issue of balloon litter.

## THE CORNISH PLASTIC POLLUTION COALITION

Cornwall has a thriving network of local marine conservation volunteer groups who promote and protect the marine environment on their local patch. This network of local marine conservation groups has been encouraged and supported through the Cornwall Wildlife Trust's Your Shore project, and has led to the formation of the Cornwall Plastic Pollution Coalition (CPPC). This network now comprises more than 30 environmental organisations, local marine conservation groups, beach

cleaning groups and marine science experts. It is recognised that together this network is a powerful voice for our marine environment.

The CPPC work towards the following of key objectives:

- To raise awareness of the issue of marine litter and plastic pollution around the coastline by working with community groups, interested schools and other organisations who wish to engage with the CPPC.
- To informally improve information exchange and coordination between organisations and volunteers involved in marine litter and plastic pollution in Cornwall.
- To specifically highlight the issue of balloon debris in Cornwall.
- To raise the issue of marine litter and plastic pollution with identified businesses and organisations and try to persuade them to change their practices to more environmentally friendly methods/products.

## THE SCALE OF THE PROBLEM

There has been conflicting scientific research for the past three decades about the actual percentages of released, helium-filled balloons that reach the upper atmosphere and then burst into small pieces. The Marine Conservation Society (2006) states that approximately ten per cent of such balloons do not reach a sufficient height, and may remain inflated, while research by Stephan Irwin (2012) suggests that at least 80% of released balloons come down intact. These can float many miles as they descend back to the land or sea.

Even air-filled balloons on sticks can travel long distances when blown by winds that carry them into watercourses and streams, and then into the sea. Figure 1 shows the type of balloon debris from one beach clean at Poldhu.



Figure 1 – Balloon debris from one beach clean at Poldhu

In Cornwall, many balloons are washed up on beaches with local volunteers anecdotally reporting picking up this debris, which includes intact balloons, balloon fragments, nozzles, sticks, weights and ribbons, on a daily basis.

While latex balloons are often marketed as ‘100% biodegradable’, these still take

months or even years to break down in the cold, oxygen-poor, high-salinity marine environment. They certainly persist in the sea and coastal environment for sufficient time to cause real harm.

According to Marine Conservation Society (2014), a long list of autopsied marine creatures – dolphins, whales, turtles, fish and seabirds – have been reported with balloons in their stomachs. It is believed that they mistake balloons and other buoyant plastics for their natural prey, e.g. jellyfish and squid, and eat them. The Marine Conservation Society’s Great British Beach Clean Report 2016 (Marine Conservation Society 2016) stated that balloon debris on the UK’s beaches increased by 53% from the previous year.

### GATHERING THE CORNISH EVIDENCE

In autumn 2015, Cornwall Council joined a growing number of local authorities who voted to ban balloon and Chinese/sky lantern releases from land in their ownership. Much of the evidence submitted to the Council to persuade them to make this decision came from the many community-led marine conservation and litter-picking groups across Cornwall. Following the ban, the CPPC decided to run a short-term, non-scientific monitoring exercise to gather data in respect of balloon debris around the coastline.

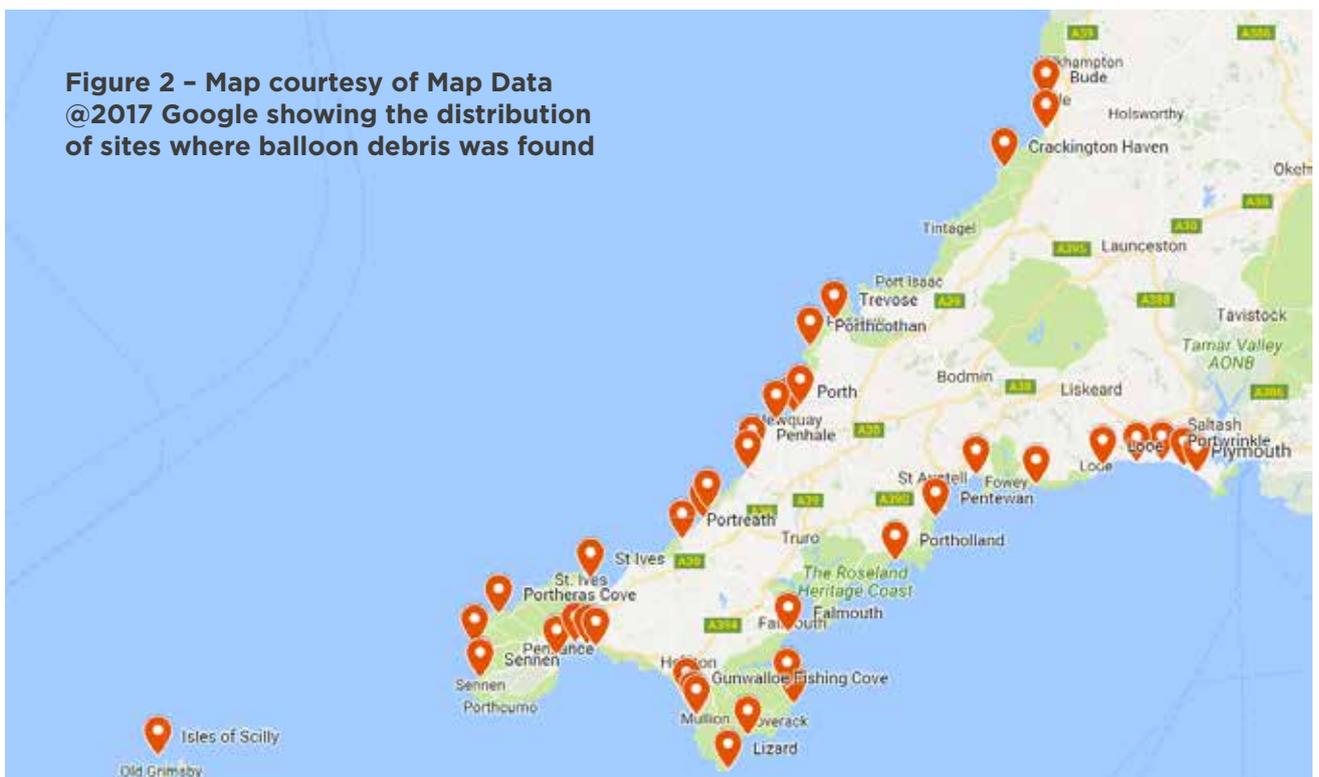


Figure 2 – Map courtesy of Map Data @2017 Google showing the distribution of sites where balloon debris was found

During the period July to December 2016, balloon debris was found and recorded during beach cleans at 39 locations across Cornwall (north and south coasts) and the Isles of Scilly (see Figure 2). This evidence came directly to the coalition from its members who took part in beach cleans or litter-picks, and was accepted in a variety of formats varying from photographic evidence to numerical data.

There was no standardised approach to data collection with varying sizes of monitoring sites and varying regularity of beach cleans. Each piece of separate balloon debris was logged, and if a balloon was found still attached to its cord or plastic end, it was recorded as a single piece of debris.

A total of 2,223 separate pieces were recorded. Table 1 provides a breakdown of these results per site.

Cornwall has an extensive network of volunteer beach cleaners and beach cleaning groups. Many of these are active on a weekly or even daily basis, and so some of the locations were cleaned on more than one occasion during the period, while others only once. Where groups/individuals did multiple beach cleans before counting or photographing the resulting number of balloon pieces collected, a retrospective estimate was made (from the actual total picked up) as to the amount found at each separate location. It is important therefore to look at the total number of pieces of balloon debris recorded, rather than focus on the amount at each individual location.

The recorded balloon debris included single balloons (latex and mylar), multiple ‘bundles’ of balloons, weather balloons, branded and non-branded items, nylon cords and plastic ends/weights/sticks (see Figures 3-5 for examples).

Some of the balloons found on Cornish beaches had travelled from other parts of the UK, Ireland and Europe.

Table 1 - Table to show individual results from each location		
	Location	No of pieces of balloon debris
1	Portwrinkle	25
2	Looe	19
3	Bude	64
4	Crackington Haven	4
5	Widemouth Bay	15
6	Porthcothan	1
7	Trevose	1
8	Porth	98
9	Watergate Bay	115
10	Fistral	27
11	Penhale	355
12	Perranporth	281
13	Portreath	15
14	Porthtowan	9
15	Chapel Porth	65
16	St Ives	5
17	Portheras Cove	52
18	Cape Cornwall	4
19	Sennen	37
20	Wherrytown	45
21	Long Rock	59
22	Marazion	283
23	Stoney Beach Marazion	160
24	Gunwalloe Fishing Cove	27
25	Gunwalloe	48
26	Poldhu	59
27	Lizard	2
28	Kennack Sands	1
29	Godrevy (Lizard)	1
30	Porthallow	2
31	Falmouth	1
32	Portholland	1
33	Pentewan	7
34	Par	2
35	Llansallos	4
36	Downderry	21
37	Tregantle	277
38	Freathy	19
39	Isles of Scilly	12
	<b>TOTAL</b>	<b>2,223</b>



Figure 3 - Branded balloons found at Portheras Cove



Figure 4 - Assorted balloon debris found at Penhale

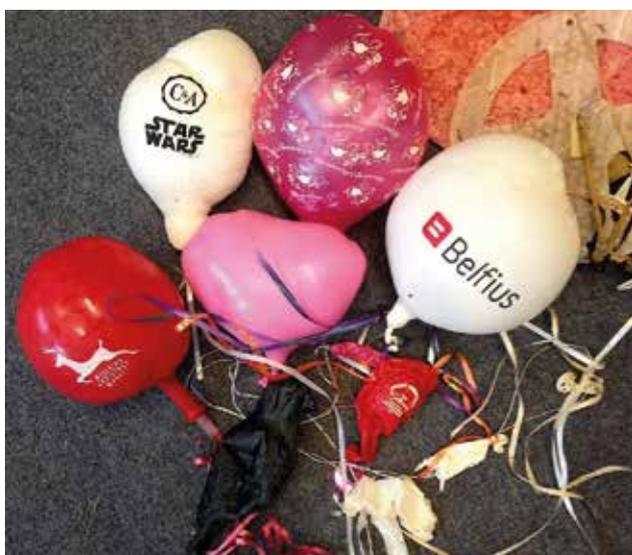


Figure 5 - Assortment of branded balloons found on the Isles of Scilly



Figure 6 - Branded balloons that have spent 18 months in a jar of seawater

### BALLOON IN A JAR: A CITIZEN SCIENCE EXPERIMENT

Many balloons are sold to individuals and organisations as being 100% biodegradable. In the experience of many Cornish beach cleaners, the balloon debris picked up from beach cleans seems to have persisted in the environment for quite some time. Whole balloons, or fragments, are often pulled out of decaying seaweed and other associated flotsam, which has been lying on the high tide lines of some isolated beaches for several months since the previous high spring tides.

To demonstrate the time taken for balloons to biodegrade, one of the CPPC member groups devised a simple citizen science-type experiment. They placed several branded balloons that had been found during beach cleans into a jar of sea water, open to the air, and placed them in direct sunlight. These balloons have now been in this jar for over 18 months and show no signs of degradation whatsoever (see Figure 6). While this simple jar of seawater is clearly not representative of the dynamic ecosystem that exists in the ocean (lacking wind and wave movement and interaction with marine plankton) - it does indicate that more research into the biodegradability of balloons in the marine environment is needed.

## IMPACT ON MARINE ENVIRONMENT

The CPPC also took photos of balloon debris side-by-side the local wildlife, which proved useful in communicating locally (see Figures 7-9).



Figure 7 - Guillemot (*Uria aalge*) with balloon debris tangled around its legs (Picture from Rame Peninsula Beach Care)



Figure 8 - Grey seal pup (*Halichoerus grypus*) and balloon at Portheras Cove (Picture from Friends of Portheras Cove)

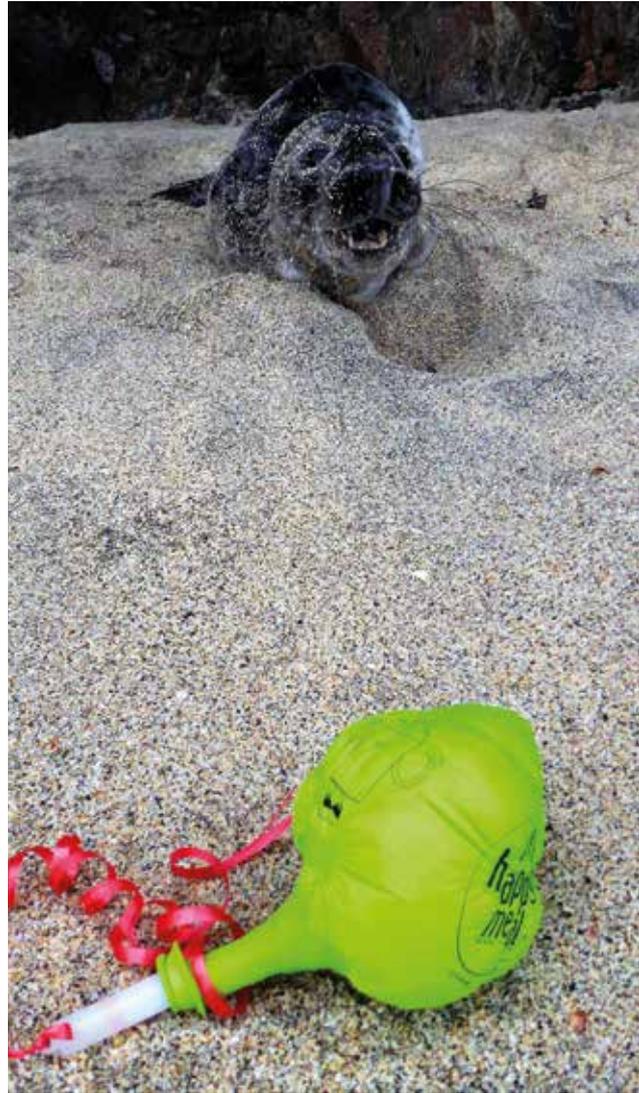


Figure 9 - Balloon among Portuguese-Man-of-War stranded at Portheras Cove (Picture from the Friends of Portheras Cove)

## CHANGING ATTITUDES AND BEHAVIOURS

### **Workshops and exhibitions**

The intention of gathering the evidence above was for use in raising awareness and changing behaviours. The evidence gathered by the CPPC has been presented to many different audiences in a variety of differing formats.

At the beginning of 2017, a report was submitted to Cornwall Council to further on-going consideration of a Public Space Protection Order which would extend the current balloon and lantern release ban across the whole of Cornwall, not just council-owned land.

Face-to-face workshops, activities and exhibitions have been carried out at schools, community centres, conferences and public events. Anecdotally, these events appear to be an effective way of getting the message across, with attendees reporting their surprise at the scale of the problem and how balloon pollution impacts their local environment. The format of the school workshops is made as relevant as possible by using volunteers from 'local' community conservation groups and large-scale displays of items found on beaches close to the school's location. Although the content of each workshop is tailored to the individual group, the basic structure includes:

- short input using visual images;
- examination of examples of beach-cleaned items;
- discussion about age and origins of marine litter (vintage plastics, container spill items, degradation times, ocean gyres and currents);
- experiments to test the differing buoyancy properties of the plastics in salt water; and
- art and creative writing activities using recycled plastics from beach cleans.

Pupils are given the opportunity to handle the items (which are carefully cleaned and sterilised beforehand), looking for any clues as to their age, country of origin and possible reasons for being found as litter on the coastline. This 'beach archaeology' approach enables the children to think through the consequences of a simple action such as letting a balloon go. They begin to understand the impact of that action and how it can be felt much later and much further away than they realise. The final creative activity in each workshop not only provides a lighter 'fun' element, but also carries a serious message about recycling and reusing items in order to prevent more rubbish going to landfill (see Figure 10 and 11).

One young primary school student was so motivated by what he learned during an exhibition event organised by members of the CPPC in the summer of 2017 that, within 24 hours, he (unaided) managed to instigate, and take part in, two live interviews on BBC Radio 2 discussing the topic of marine plastic pollution.



Figure 10 - Cornish Brownie pack during one of the workshops



Figure 11 - Children at a community workshop with their recycled beach art

Much of the balloon debris collected during the CPPC's six-month recording exercise was fashioned into the 'Appalling Multi-Coloured Balloon Coat' - a strikingly real and visual aid to getting the point across at various conferences, exhibitions and events (see Figure 12).



Figure 12 - The Appalling Multi-Coloured Balloon Coat

## CPCC'S WORK WITH STAKEHOLDERS THAT USE BALLOONS

Volunteers from the CPPC also make direct contact with businesses, companies, charities and organisations whose branded balloons and other materials are found during Cornish beach cleans. The aim is to try and persuade them to consider more environmentally friendly alternatives. Items that are themselves made from recycled materials, e.g. plastic/paper/cloth, and that are designed to be reused again and again (as opposed to 'single-use items') would help reduce marine pollution. Social media has proved to be a very useful tool for lobbying and communicating about the subject of balloon releases. This is particularly so when timescales between finding out about a planned release and its actual date are relatively short.

Communications with organisers of balloon releases being planned for memorial events, however, need to be handled with more sensitivity. It is important to be non-judgemental, and often a personal, direct approach works better than a formal, written communication.

Many alternative, environmentally friendly ways of celebrating someone's life can be found. These include:

- blowing giant bubbles
- wildflower 'bombs' and gardens
- planting trees
- using kites and streamers
- releasing paper prayers/wishes into a bonfire or candle flames
- floating flowers in water.

But there are many, many more ways that can be organised to suit each person's life, personality and family circumstances.

## CONCLUSION

This article has intended to provide a case study of how a coalition of community organisations has aimed to build an evidence base on balloon litter locally and use this to inform and change behaviour.

Additionally, progress is being made to tackle the issue of balloon litter with an increasing number of councils/local authorities instigating balloon and Chinese/sky lantern release bans, an increasing number of companies and organisations ceasing to use balloons for advertising and promotion, and a growing number of individuals who are choosing a more sustainable lifestyle and refusing 'single-use' items.

However, there are still huge sections of society including some schools, charities, businesses, fundraisers and event organisers who are still unaware of the true impact of letting a balloon go. One option to change behaviour in the UK would be through the use of existing legislation within the Environmental Protection Act 1990 and the Clean Neighborhoods & Environment Act 2005. This act could be used to designate balloon and Chinese/sky lantern releases as illegal mass littering events.

## REFERENCES

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Irwin, S. (2012), Mass Latex Balloon Releases and the Potential Effects on Wildlife. Clemson University USA, All Dissertations. Available at [tigerprints.clemson.edu/cgi/viewcontent.cgi?article=1959&context=all\\_dissertations](http://tigerprints.clemson.edu/cgi/viewcontent.cgi?article=1959&context=all_dissertations) (accessed November 2017).

---

Marine Conservation Society (2006), Don't Let Go. Leaflet available at [mcsuk.org/downloads/pollution/dont%20let%20go.pdf](http://mcsuk.org/downloads/pollution/dont%20let%20go.pdf) (accessed October 2017).

---

Marine Conservation Society (2014), The Intentional Outdoor Release of Balloons and Chinese/Sky Lanterns Pollution. Policy and Position Statement. [mcsuk.org/downloads/pollution/beachwatch/MCS\\_balloons\\_and\\_chinese\\_lanterns\\_policy.pdf](http://mcsuk.org/downloads/pollution/beachwatch/MCS_balloons_and_chinese_lanterns_policy.pdf) (accessed November 2017).

---

Marine Conservation Society (2016), Great British Beach Clean Report. Available at [mcsuk.org/downloads/gbbc/2016/GBBC\\_2016\\_Report.pdf](http://mcsuk.org/downloads/gbbc/2016/GBBC_2016_Report.pdf) (accessed October 2017).

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# USING BEHAVIOURAL SCIENCE TO REDUCE LITTERING: UNDERSTANDING, ADDRESSING AND SOLVING THE PROBLEM OF LITTER USING A COMMONS DILEMMA APPROACH

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## INTRODUCTION

It is easy to imagine a world inhabited by rational people, who act in a way that serves the common good, whose preferences are stable and predictable and whose decisions are based on pure logic. But this is not the world we live in. People are guided by emotions (Bagozzi & Moore, 1994); they rely on their often inaccurate perceptions; their preferences depend greatly on decision context and arbitrary cues (Lichtenstein, 2006; Thaler & Sunstein, 2008); they put too much weight on present gratification, which results in weak will (Baumeister *et al.*, 1998); Frederick *et al.*, 2002; Mischel *et al.*, 1996; Read, 2004). These all too human characteristics are some of the reasons (see structure/agency debate, e.g. Archer, 1995) why, as a society, we are obese, in debt, struggle with global warming and have litter.

In this article, we draw on behavioural science theories and insights and apply them to the problem of littering. The main objective of this article is to provide an overview of some decision-making models, behavioural change insights and frameworks, which we deemed relevant to, and useful in, tackling the problem of littering. Our aim was to bring together relevant research and use these insights to make recommendations for understanding and changing the behaviour of litterers.

The article is divided into two parts. We begin by describing the impact of littering in the UK and the importance of tackling this issue. We then move on to describe *commons dilemmas* and explain how littering is an example of this class of behaviour. We provide an overview of some behavioural science research showing what can promote cooperation in *commons dilemmas*, and explain how these insights

from laboratory experiments are applicable to littering. Next, we provide an overview of relevant models and frameworks, including the dual processing systems analogy and diffusion models of collective behaviour, which explains decision-making on an individual level. We finish the first part of the article by describing the stages and elements of behavioural change intervention design. In the second part, we suggest some anti-littering interventions, approaches and nudges.

### WHY TACKLE LITTER?

Litter, apart from being aesthetically unappealing, has direct financial, environmental and health consequences to individuals, organisations and societies alike. The annual cost of picking up litter across the UK, for example, is close to £1bn (Keep Britain Tidy, 2014), an amount that would be much higher if one were to clean up the country entirely and which does not include the indirect social and environmental costs incurred as a result of litter.

Recently, countries have been shifting from assessing the prosperity of their nations in exclusively financial terms, to incorporating measures of national wellbeing (e.g. Gross National Happiness [Jones, 2005]), on which litter also has a negative impact. Eighty-one per cent of British people say that seeing litter on the streets makes them frustrated and angry (Populus, 2015). More generally, spending time in places that appear uncared for may result in damage to community spirit and wellbeing, while appealing landscapes increase positive emotions and encourage physical activity and social integration (Abraham *et al.*, 2010; Humpel *et al.* 2002; Seresinhe *et al.*, 2015).

Litter can also have a direct harmful effect on health. For example, beach-goers are exposed to paint cans and chemical drums, which can leach toxic materials; nappies and medical waste, which spread bacteria and germs; and sharp items, which can cut their skin (International Coastal Cleanup, 2010). Overall, we can expect that the more littered the environment, the lower the wellbeing and health of people who live in that area, especially if the litter is a permanent part of the surrounding.

Litter is, at the same time, a financial burden on corporations from which litter is being dropped. Many organisations do not consider themselves responsible for social issues, unless they can directly link their corporate social responsibility (CSR) activities to profit. In the case of litter, many organisations put

all liability on consumers, implicitly denying their own role on its production (Meikle, 2009). Yet companies should expect to see the impact of litter on brand image, sales and revenues. As Roper and Parker (2013) showed, seeing branded litter significantly lowered attitudes towards a brand and consumers' intention to buy products of the brand. Research participants who saw litter around the studied location were willing to pay 4p less for a product than those who did not see litter (£1.92 and £1.96, respectively). Such a decrease could mean a two per cent drop in yearly turnover of a company and, of course, a much higher fall in profits, especially in low-margin industries.

Finally, we can't forget the impact on the natural environment itself. First, there are the straightforward implications on domestic and wild animals, which can get trapped in or hurt by litter. PETA (2016) describes many examples of such instances, such as: cats entangled in soft drink can rings; birds having their beaks wrapped or wings tangled up in discarded fishing lines; or small animals unable to move after they step in gum.

The scale of the problem is possibly even greater for marine wildlife. It is estimated that 60-80% of land debris ends up in oceans, carried by lakes, streams and rivers, often across continents (Ocean Conservancy, 2010). Eventually, this litter gets trapped in ocean currents, ending in one of the floating gyres. The biggest of these gyres, the North Pacific Gyre, is the largest ecosystem on Earth, comprising approximately 8 million square miles (Marine Debris Program, 2017), with some areas containing as much as 200,000 pieces of litter per square kilometre (Law, *et al.*, 2010).

Ebbesmeyer and Scigliano (2009) describe two examples of how far litter can travel and how long it can stay in the oceans. In 1990, during a storm, 78,932 pairs of sneakers were lost at sea, by a cargo ship en route from Korea to Los Angeles. Nearly a year later, they were washing up on Canadian and Oregon shores, 2,000 miles away. In 1992, another cargo ship, on its way from Korea to Washington State, lost 28,800 plastic bath toys. Sixteen years later many of the rubber ducks, turtles, beavers and frogs were found, some as many as 34,000 miles away from the crash site.

The immediate threat to marine animals is straightforward – they get tangled in the litter, ingest it, can suffocate on it; all this while the plastics decompose in the salty water, polluting it and creating further problems, including becoming a global hazard to shipping and

fishing industries (Gregory, 2009; Laist, 1987; Roper & Parker, 2013), and a potential threat to human health (Seltenrich, 2015). A recent analysis estimated that the scale of the ocean litter problem will only keep increasing and that, by 2050, plastic will outweigh fish in oceans (Williams, 2016).

## LITTERING AND OTHER COMMONS DILEMMAS

If littering has so many negative consequences, why do people do it in the first place? The decision to litter is a classic response to a *commons dilemma* (Lloyd, 1833), which is simply a many-person version of the *prisoner's dilemma* (Poundstone, 1992). A commons dilemma arises when people choose options that are personally beneficial, yet which incur costs to others. Added up, these costs exceed the personal benefits. If everyone takes the “selfish” action, everyone is worse off than if they had chosen to do something else. Robert Frank (2010) calls this “smart for one, but dumb for all”. Commons dilemmas are at the heart of a vast range of social problems, including littering.

Littering produces a commons dilemma when litterers find the benefits (to themselves) of littering exceed the costs (to themselves) of not littering, but society finds the benefits (in aggregate) of littering to be less than the costs (in aggregate). A fly-tipper, for instance, can get a personal benefit from conveniently offloading a car-boot full of rubbish and incurs little personal cost. Meanwhile, everyone in the affected area finds their life a little less pleasant. Some people may even incur great direct costs as a result, such as farmers whose land can get contaminated, and who need to instantly remove the fly-tipped items from their land to be able to work. If the fly-tipper had to “pay” for this, they might not have found it the more worthwhile option.

The first key feature of a commons dilemma is a shared resource, such as a park or streets, which people can choose to maintain or exploit, and where maintenance costs more than exploitation. The second characteristic is that the benefits to the individual from a single act of exploitation exceed the costs of maintenance. Dropping a single piece of litter has a small effect on the environment (especially if it is already littered) and, from an individual perspective, does not justify the cost of finding a bin. If a typical litterer drops just a few, usually small, pieces of litter in a day, the impact may not even be noticeable. The problem arises when these small pieces add up – but people don't appreciate the

effect of these small increments on the overall outcome. Just like few people understand the effect of compound interest rates on their retirement savings, few acknowledge that throwing out small pieces of litter adds up to piles of litter lying on the streets at a later time. In other words, in commons dilemmas, individual and collective interests are at odds: each individual is better off littering than not, even if society is worse off if people litter.

There is no single solution to commons dilemmas. The “classic solution” offered for litter is based on property rights – people don't want to litter in their backyard. But most of the littering is done in “other people's gardens” and so the personal benefit (not having to carry litter around) exceeds the cost of littering (an unsightly environment that one will probably never see). However, sometimes these problems can be successfully overcome without the need to assign property rights.

A recent example is dog owners picking up after their pets. In a relatively short period, the public perception and expectations have changed enough so that nowadays many dog owners clean up streets and lawns after their pets, even when they know no one can see them. A report by the BBC (2015) states that complaints about dog fouling dropped from approximately 83,000 in 2013/2014 to fewer than 74,000 in 2014/2015, suggesting a visible drop in dog fouling rates. This change can be traced back to “pooper scooper” law (officially known as the Canine Waste Law), passed in New York City in 1978, imposing a \$50 fine on dog owners who don't clean up after their pets. Yet, as Dubner and Levitt (2005) point out, due to limited enforcement, a simple law introduction wouldn't have been as effective if it wasn't supported by social incentives – the hard glares of passers-by and the offenders' feelings of guilt (Grasmick *et al.*, 1991).

## THE “WHAT” OF SOLVING COMMONS DILEMMAS

If littering is a pure commons dilemma and arises simply from an unfavourable cost-benefit analysis, there are two approaches to reducing it: increase the perceived costs of littering or increase the perceived benefits of not littering. The word “perceived” is important here. Because of limited cognitive resources, impulsivity and the influence of emotions, people typically will not conduct an explicit cost-benefit analysis when deciding whether to litter. They will choose based on personal rules, norms or arbitrary clues that come from the situation context, through which they perceive a benefit, or a cost, to themselves.

Consequently, minor alterations in choice design can result in significant changes in behaviour, and can help solve the commons dilemma.

### SITUATION CONTEXT

Small changes to the environment, even ones that appear innocuous, can have a big effect on behaviour. These small changes are often called *nudges* (Thaler and Sunstein, 2008). It is no coincidence, for example, that supermarkets place high-profit items in highly noticeable and easy-to-reach places on their shelves. Nudging has become a widely used method by which policy-makers promote social change (Behavioural Insights Team, 2015; Behavioural Insights Team, 2016; Martin et al., 2014; OECD, 2017; Thaler & Sunstein, 2008; World Bank, 2015). It is, therefore, important to assess and address the impact and role the physical environment – such as the availability and accessibility of litter bins – has on littering behaviour.

### SOCIAL CONTEXT

Just as the physical environment influences what we do, so do those around us. Mostly, people want to do what others do, and look to the behaviour of others for cues about what they should do (Kallgren et al., 2000). If you see lots of people littering, you will (likely) be more inclined to do so yourself, because what you have observed makes littering more normal.

One way this manifests itself is through observing the results of past behaviour of others. A lot of litter on the ground means littering is a normal and accepted behaviour; no litter means it is abnormal. Unclean environments will nudge people to be relaxed about littering; clean environments will nudge them to use the bin (Dur & Vollaard, 2013; Finnie, 1973; Geller et al., 1977; Krauss et al., 1978; Reiter & Samuel, 1980). In a classic series of studies, Cialdini et al., (1990) explored the role of social norms on littering. Among other things, they confirmed the importance of a clean environment in promoting anti-littering behaviour. When there were no more than two pieces of litter in an area, the great majority did not litter. However, as soon as there were three or more pieces visible, the number of litterers more than doubled.

The importance of seeing what others do forms an important part of the *broken windows theory* (Wilson and Kelling, 1982). Following up this theory, Keizer et al. (2008) showed that as certain norm-violating behaviours

such as littering became more common, they negatively influenced conformity to other norms and rules. Not only does littering encourage more littering, it also influences other anti-social behaviours such as painting graffiti or trespassing.

Many of the heaviest litterers are teenagers (Campbell 2007 and Keep Britain Tidy 2014), who, on the one hand, want to express their independence and nonconformity; and, on the other hand, have a strong need of belonging and being a part of a group. In this context, social proof can work on a cultural level, as a mechanism of building in-group identity. By littering, young people express their disregard for rules while, at the same time, building an, us-vs-them identity, clearly separating themselves from the rest of the society (“the majority”, grown-ups, the government, etc.).

### OTHER SOCIAL FACTORS

Robert Cialdini (2009) distinguishes two additional social factors that encourage (non) compliance: *liking and authority*. The first factor is that people want to say “yes” to those they like. Interestingly, this mechanism is so strong it can work even when people would not necessarily agree (as individuals) with what they are saying yes to. We believe this force explains why (young) people litter more when together; or why increasing the number of available bins doesn’t reduce littering when young people are in groups (The Hunting Dynasty, 2014). Since littering is accepted, sometimes even desired, by young people, other behavioural guidelines or nudges can lose their impact when young people are out, in groups, having fun or trying to impress one another. Luckily, not all young people litter and even those who do don’t spend all of their time together, making space for interactions with influencers who may convey the anti-littering message.

Social scientists have identified several factors that cause liking, which can be used in the design and delivery of anti-littering communications. People tend to like those who are physically attractive, who are similar to them, who compliment them, who are familiar to them, and who they associate with positive things (Cialdini, 2009).

Quite obviously, people also listen to those who they perceive to be in charge. Cialdini argues that people have a deep-seated sense of duty to authority, which can be traced back to childhood and the influence of parents and teachers. The tremendous impact authority has on obedience has been

explored by Stanley Milgram in his famous obedience experiments, showing that normal, emotionally and psychologically stable people are willing to administer high levels of electric shocks to others, when asked to do so by an authority figure (Milgram, 1963).

Together, the effect of authority and liking show the importance of choosing the right person to deliver a message. We can expect that identifying the right anti-littering messengers, whether they are celebrities, authorities or influential friends, will drastically improve the effectiveness of communication campaign.

## THE 'HOW' OF SOLVING COMMONS DILEMMAS

### *Promoting cooperation*

One way to approach commons dilemmas is to look at what promotes cooperation. Based on a meta-analysis of 30 studies, Gifford & Hine (1997) identified 14 factors that promote cooperation. Among the most influential were communication between group members, territorialisation of resources and social values. First, when group members talked to each other, cooperation dramatically increased. Communication between community members allows for education, sharing of common values and the establishment and enforcement of policies aimed at bringing back order.

Second, approaching commons dilemmas from a local, territorialised perspective can help. When land is divided into small, identifiable segments, people are more likely to feel responsible for it (Budescu *et al.*, 1990; Hine & Gifford, 1996). At the same time, in such a divided space, public institutions can better perform their roles – collect litter, manage its disposal or implement and enforce fines. It's not uncommon that, for example, roads in-between two districts of neighbourhoods, which don't clearly belong to anyone, are the most littered ones. Territorialisation can also help to engage private sector, holding business organisations responsible for the cleanliness of their premises. An example there could be fast-food restaurants taking care of the parking lots outside of their premises, which reflect on their image. In summary, the smaller the communities and the lands they operate in, the easier it is to manage public goods, because it is undisputable who is responsible for what and stakeholders' commitment to keeping order can be monitored and enforced. Research shows that the smaller the group, the more likely it is to overcome a commons dilemma. Some studies suggest that groups of

less than 150 members perform best in these situations, even without law enforcement (Edney, 1981).

Finally, social values play an important role in community cooperation. In fact, work by Common Cause Foundation suggests that a common set of values underpins social and environmental concerns and that most people share these values. They are also a key ingredient of behaviour change. The foundation's work suggests that, to effectively influence pro-social and pro-environmental behaviour, one should appeal to intrinsic values, such as broadmindedness, social justice, community feeling and creativity; and avoid appealing to extrinsic values, such as social status, prestige, popularity and wealth. The foundation suggests that strengthening these internal values and creating opportunities for them to be communicated and shared may help to create responses to a wide range of environmental challenges (Common Cause Foundation, 2015). Linking this back to commons dilemmas, groups that share ideals and values, in which members are well-connected and close, are more likely to achieve common goals, even when doing so involves each individual foregoing personal advantages. Research shows that groups with positive interpersonal characteristics, such as a strong feeling of group identity (Dawes & Messick, 2000), similar values (Smith *et al.*, 1988) and better interpersonal relations (Grzelak & Tyszka, 1974) are more likely to overcome commons dilemmas.

While these findings on how to solve social dilemmas come primarily from laboratory experiments, it is easy to imagine how they could be applied to the problem of littering, providing opportunities for people to get together and talk; to focus on litter in their small neighbourhoods; and to build and openly communicate community values.

### *Forming new paths of least resistance*

From the perspective of a self-interested individual, the best way to overcome the commons dilemma is to create a new path of least resistance, which will guide the person towards socially desirable actions when she is reluctant to engage in mental effort.

This reluctance to engage in mental effort is a key feature of the human mind. Daniel Kahneman's (2011) summarised much of what we know about decision-making, by using the metaphor of two information-processing systems. System 1 is fast, impulsive, emotional and automatic. Spontaneous and intuitive decisions are the workings of System 1.

System 2, on the other hand, is rational and takes into consideration long-term well-being. Yet System 2 is lazy and is often not engaged in the decision-making processes.

The laziness of System 2 is said to be one reason for the discrepancy between people's explicitly held preferences and their actual behaviour. When asked about littering, people answer using System 2, and say they disapprove of it and wouldn't do it. Yet when in a hurry or acting spontaneously, people only engage their automatic and fast System 1, and they litter, forgetting about what should be done. This mechanism also helps to explain why rational arguments will often not be an effective behavioural change tool: to successfully change people's behaviours, their System 1 needs to be influenced and not only, or not even necessarily, their System 2. In other words, to change behaviour, a new path of least resistance needs to be created that will guide System 1 to behave in a desired way.

When new paths of least resistance are created new behaviours become habitual. The only effective way to change a habit is to replace it with a new one (Duhigg, 2013), and changing habits is hard. By changing the easy path, this difficulty can be reduced or eliminated. Another way to get people to undertake initially difficult new behaviours is by means of incentives – monetary or otherwise.

While monetary incentives can be costly and awkward to implement on a mass scale, sometimes relatively low-cost and tangible rewards can be just as rewarding. Heyman and Ariely (2004), for example, showed that people are willing to exert as much effort on a task for a candy bar as for a much higher monetary reward. Receiving a candy bar implies the person is participating in a social market (a market with no money, where personal relationships dominate and altruism is of importance), while receiving money frames the situation as a monetary market. As the study showed, monetary markets were highly sensitive to the magnitude of compensation – the higher the incentive, the more effort a person exerted. Social markets, on the other hand, were influenced by altruism, rather than reciprocity, resulting in people exerting higher effort, no matter how big the (non-monetary) payment was. Perhaps the most rewarding type of non-monetary incentives are social rewards. People respond well to positive feedback from others, such as social recognition, status or praise. Social incentives are, at the same time, often cheap, making them a practical tool in behaviour change.

Finally, to effectively use incentives in creating

new paths of least resistance, they need to be delivered immediately (after the desired behaviour is manifested). When rewards are delivered immediately, they are much more likely to be deeply associated with the action that preceded them (e.g., Frederick *et al.*, 2002; Read *et al.*, 2013; Read *et al.*, 2016). Moreover, delayed incentives are much less effective because people considerably devalue even slightly delayed benefits.

## DESIGNING INTERVENTIONS

### *Selecting target groups*

When selecting target groups for behavioural change interventions, it is good to think of people's willingness to change and their reasons for not doing so. Some people litter only occasionally, when circumstances force them to do so, and may be embarrassed or ashamed when they do. Some litter based on a conscious cost-benefit analysis; there are some for whom littering is a conscious “anti-social” act and; some litter habitually and unthinkingly.

It's easy to assume we should target those who litter the most. Yet people for whom littering is a conscious act will require a greater amount of information, stronger social pressure and higher incentives to change. Even under significant social pressure, they may change their behaviour or attitudes only slightly, only occasionally or not at all. Therefore, while it might be tempting to assume that heavy litterers, such as teenagers, should be the main target group of an intervention, focusing on these groups may be doomed to fail. To use smoking as an example: it might be easy to change the behaviour of an occasional smoker, who only lights a cigarette at the odd party, to quit smoking; than to change that of a two-pack-a-day smoker.

Targeting interventions at groups with lower barriers to change not only increases the chance of the intervention being a success, but also maximises the chance of reaching a tipping point (Grodzins, 1958), at which a social change spreads on its own. If enough occasional litterers stop littering, those who litter more will eventually become a visible minority. This can “tip” them to join the majority, who by this point no longer litter.

In short, to design an effective behavioural change intervention, it is best to start with the “low hanging fruit”, i.e. people who litter only occasionally and who are ready to change. With time, as these people stop littering, the heavier litterers will see their behaviour becoming more unacceptable and

abnormal, and will be ready to change. This phenomenon is captured in diffusion models of collective behaviours (e.g. Granovetter, 1978; Granovetter & Soong, 1983; Schelling, 1971) and the transtheoretical model (Prochaska & DiClemente, 1983; Prochaska *et al.*, 1992).

The transtheoretical model is a useful exemplar of these approaches. It describes “stages of change” people undergo on their paths to new, desired behaviours, and tasks necessary to move a person from one stage to another.

The first stage is pre-contemplation, in which a person is not ready to change or is actively resistant to change. People in this group will not change their behaviour in the next six months so it’s not advisable to target an intervention at them.

The next stage is contemplation, with people intending to change their behaviour but in the relatively distant future (often defined as “within six months”). Contemplators are aware of the pros and cons of the desired and undesired behaviours, and often engage in an active contemplation of the two sides. This is a good group to target with communication, aimed at explaining the benefits of the desired behaviour, such as using bins to dispose of litter and the downsides of the undesired behaviour.

Next there are those in the preparation stage who are ready to make a change in the very near future. Only a small trigger is necessary at this point to make the change happen. In other words, these are the “low-hanging fruit”.

Finally, there are action and maintenance phases, in which people have already changed their behaviours and are taking specific steps not to go back to the old, undesired habits.

#### **Four components of intervention design**

Van Vugt (2009) names four necessary components that should be addressed in the design of effective behavioural interventions.

**1. Information:** People like to understand the environment they are in and to be able to predict what will happen. When unawareness or uncertainty come into play, such as the lack of information related to the consequences of littering, people may fall victim to optimism bias. Instead of assuming the worst, people will underestimate the environmental or social damage being done (Opatow & Weiss, 2000). Instead of looking for facts, the majority will ignore the issue, and assume their actions have no negative consequences. It is therefore important to provide enough information, in a clear, explicit and graphic way.

From the business and private sector points of view, information is also necessary to track changes, and to evaluate the effectiveness of behavioural interventions and marketing initiatives. Only by providing and requiring the gathering of reliable and good-quality data is it possible to know if and how much progress in reducing littering has been made.

**2. Institutions:** The commons dilemma will be difficult to solve without the engagement of public or private institutions that form the context in which behaviours take place. Perhaps the quickest and surest way to solve a public goods problem is to change policies and laws.

Littering already is illegal but since penalties are rarely imposed on litterers, who may not even know it is illegal, this law has little effect. It is necessary to impose reliable sanctions on those who break the law, and to enforce them.

**3. Incentives:** The introduction of incentives can be an effective way to solve the problem of littering. If people were immediately paid for disposing every single piece of litter in a bin, most people would do it.

Of course, it is quite easy to see that while this might in theory solve the problem of littering, it would do so at very high cost, and would produce perverse incentives such as the tendency to produce more litter or to subdivide litter into smaller components to maximise reward. However, as we have already mentioned, non-monetary and social incentives can play a crucial role in reducing littering.

**4. Identity:** Identity has a two-fold role. First, promoting group identity can increase pro-social behaviour – the more attached to a group a person feels, the more likely she is to do what’s good for the community. Research shows that:

- forces such as in-group reputation can promote pro-environmental action (Hardy & Van Vugt, 2009; Milinski *et al.*, 2006);
- high-identifying group members tend to compensate for resource overuse of their fellow group members (Brewer & Kramer, 1986);
- households that identify strongly with their communities don’t need financial incentives to behave more pro-environmentally (e.g. consume less water; Van Vugt, 2009).

Because each person belongs to multiple social groups, the influence of different groups and group identities will be varied. For example, a teenager may litter more when

she's with her school friends (when her “peer identity” is active) but not litter at all when she's with her family (and her “family identity” is active). Likewise, a younger child may not litter at all when she's with her school friends but may litter when she's with her parents, who themselves litter. To effectively reduce littering, therefore, one needs to identify to which groups litterers feel they belong and which of those group identities may be used to nudge people to litter less. By strengthening the link between social group identity and positive behaviour (in this case, not littering), the decision-maker may build new habits which, then have a chance to spill over to other parts – social contexts and group identities – of her life.

Second, self-perception (Bem, 1967), i.e. the type of person one thinks she is, can influence choices. People like to feel good about themselves, and to think of themselves as good people. Therefore, using appropriate language to provoke certain identities in people can have an influence on how people behave (an approach which is further addressed in more detail below).

### **BEHAVIOURAL INTERVENTIONS TO REDUCE LITTERING**

A question remains: do people litter because of the way the environment is designed or because of their personal characteristics? Wesley Schultz and colleagues (2013) estimated that 15% of littering acts resulted from contextual variables, such as the lack of, or distance to, litter bins, and the amount of litter already present; and 85% resulted from personal qualities. While it might be tempting to, therefore, conclude that personal qualities should be the focus of any behavioural intervention aimed at reducing littering, this is not what the analysis showed. The only personal quality variable that had a significant influence on littering was age – young people littered more. Since changing a person's age is not something one can do, we propose the following intervention ideas to tackle all other important personal and environmental qualities that influence littering.

#### ***Behavioural interventions***

Below we outline behavioural intervention recommendations which can be used by companies and policy-makers to reduce littering in the UK. These suggestions are based on all the theories, models and frameworks we have presented in the first part of the article. Our objective here is to suggest solutions that, based on behavioural science

insights, should help reduce littering and have a visible impact on litterers' behaviours. These recommendations are described in a way to make them universal, so that they can be applied in many settings. However, littering, like all human behaviour, is *context specific*. Consequently, it is important to remember that each intervention should be modified in such a way that it addresses the individuality of the target group and the situation. Most importantly, our ideas are merely suggestions and should be tested, ideally evaluated through randomised controlled trials (Haynes *et al.*, 2013), before being rolled-out on a mass scale.

Our suggestions are divided into two categories, depending on whether their objective is to change the perceived cost or the perceived benefit. Most of these interventions are based on decreasing the cost of using bins or on increasing the cost of not using them. We believe this approach to be most successful because it targets the “low-hanging fruit”. Specifically, these interventions re-design the choice environment in a way that makes using bins automatic – something System 1 does spontaneously, or at least more often.

#### ***Changes in personal cost***

*Availability, accessibility and visibility.* Litter bins need to be available, accessible and visible. They should be placed in key locations – along the most congested pedestrian pathways, and in places where people litter the most. Areas with many fast-food restaurants or sites where people smoke, such as bus stops, are the obvious choices. Local authorities responsible for picking up litter may be of help in determining the best locations for placing additional bins.

Bin accessibility means not only the right location but also the right design. Bins should be convenient, appealing and easy to use. Litter may be associated with the feeling of disgust so the less contact with the bin one needs to have, the more likely the person is to use it. Open-top bins that don't require much effort or precision to be used; clean, well-kept bins and; more visible bins in bright, contrasting colours are all more likely to be used than overfilled, dirty bins with small holes on the sides.

*Attractiveness.* Fun bins are fun to use. Depending on the location and the target group – pupils around schools or football fans around stadiums – “fun” will mean different things. In all circumstances, however, the goal is to make putting litter in bins more enjoyable. Bins that resemble sharks, bins that

can be used for voting or bins that burp when someone puts a piece of litter in them are all great examples of nudges that use fun and positive emotions to encourage pro-social and pro-environmental behaviour.

*Monetary penalties.* The most direct way to increase the personal cost of littering is to impose fines on those who do it. Loss aversion is strong motivating force – people don't like losing what they already have. Actually, they don't even like the risk of losing money. If people knew that there was a real chance of getting a fine when they dropped litter, they would not do it as often.

The size of the fine can serve as a nudge on its own, by signalling the frequency and severity of the act. A fine of £20 will imply that the act is common and relatively inconsequential, while a fine of £200 implies it is rare and severe. Considering the importance of social proof in guiding human behaviour, a fine suggesting the behaviour is rare will be better.

For fines to work, they need to be enforced. If people know there is zero chance to be penalised, fines are not going to have the desired impact. Therefore, while the recent decision to double littering fines in the UK, and to allow local authorities to apply these penalties to vehicle owners, if it can be proved litter was thrown from their car – even if by somebody else (Department for Environment, Food & Rural Affairs, 2017) – is a step in the right direction, it needs to be enforced enough so that people know the cost can become real to them personally.

*Social penalties.* Monetary cost is just one type of cost. Social rewards and penalties are a form of currency too and so social shaming may encourage people to litter less (Grasmick *et al.*, 1991). We suggest setting up a Facebook page and coming up with a unique hashtag that people can use to post pictures and videos of litterers. People may think twice before dropping an unwanted piece of wrapping on the ground if they know there is a chance their face may end up on social media with an unflattering comment.

To keep things on a more positive note, a similar approach, one of *social encouragement*, can be applied to promote good behaviour. Those who pick up litter, organise clean-up days, or help reduce littering in any other way, could be praised for their initiative. Positive incidents that result from picking up litter could be communicated via such a page as well. For example, one of the authors of this report picked up an old envelope that was left behind, lying on the grass, in a local

park. As she was about to throw it into a bin, she opened it and found a £20 note inside. Now that's a nice reward, and a good social encouragement message, for picking up litter.

*Reducing the amount of packaging.* Defaults have a powerful effect on encouraging positive behaviour, as they take away any effort required from the decision-maker. Put simply, the less unnecessary paper and plastic is used to package food items, the less litter will end up on the streets. We encourage companies, especially fast-food chains, to limit the amount of unnecessary packaging used. Packing a hamburger in a paper wrapping, then putting it in a paper box, and then putting the box in a take-away paper bag means that three pieces of litter may end up on a street. If the default is changed into using less packaging, and any additional wrapping is made available upon request, most people will leave the restaurant with much less potential litter.

A similar, now familiar, example of establishing new defaults is the plastic bag levy that has been introduced in many countries. The overall effect of the levy has been a considerable reduction in plastic bag use (although the size of the reduction varies considerably from place to place, depending on how the levy was implemented). One interesting study is from Homonoff (2013), who showed that while a plastic bag levy was highly effective, the use of a no-plastic-bag bonus (with shoppers being paid for not using bags plastic provided at a store) was much less effective.

*Making retaining litter easier until proper disposal is possible.* People sometimes litter because there is no seemingly convenient alternative. Discarding a chewing gum, one of the most commonly found items when surveyed (INCPEN, 2014), can be problematic when most producers changed packaging from packing each gum in a separate foil paper to putting all pieces in one package. If there is no bin around when a person finishes chewing a gum and she has no spare foil paper, then she may be more likely to discard the gum on the ground.

Those who use drive-through fast-food restaurants face a similar problem. Once a person is done eating in her car, in order to reduce the odour of the leftovers, she may throw everything out the window. Redesigning packaging in ways that make it easier to keep litter until bins are available, including ways of reducing odour of food left-overs, or even encouraging people to reuse the packaging, could reduce littering.

*Multi-use packaging.* Yet another way to encourage people to not litter is to show

them ways in which empty packaging can be (re)used. A great example of such approach is Coca-Cola's "2nd lives" initiative in which the company designed 16 different caps that turned empty Coca-Cola bottles into water guns, painting "pens", rattles, soap bubble makers, spray bottles or lamps.

*Clean-up days.* One characteristic of habit-formation is that the longer a person engages in a new behaviour, the less costly it becomes. Actually, as many people whose new year's resolution was to exercise more know, the first step is usually the hardest. Therefore, clean-up days, apart from helping to set a new social norm of a clean environment, can help reduce littering behaviour. Previous studies show that involving community residents in clean-up activities can increase people's motivation not to litter and to promote a long-term reduction in litter (Roales-Nieto, 1988). If people are asked to clean up their neighbourhoods on a specific day, even if it's just once a year, they will have taken the first step in reducing littering, using bins and even picking up others' litter. Moreover, if such clean-up days were organised in schools and companies, all these activities would be done with friends, making it a community activity, using the strength of social networks as a motivating force to promote pro-social and pro-environmental behaviours.

Clean-up days at schools would also help set a desired social norm in children who, when they grow up to be teenagers, should be less likely to litter. If such cleaning up (just as the cleaning up done by local councils) takes place during the day, it will help even further to set a new social norm, as seeing other people pick up litter is a strong anti-littering nudge (Cialdini *et al.*, 1990).

Clean-up days might be an important precursor to all other initiatives. Before one can hope to see a significant change in the attitudes and behaviours of litterers, existing litter needs to be removed from streets, highways, parks and other public locations. Otherwise the strong motivating force that is social proof will work against the goal of cleaning up litter, rather than in support of it.

*Timely prompts.* People often don't think about their actions. A simple verbal prompt from sales personnel, at the time of purchase, may therefore nudge people to hold on to litter until they can use a bin – they will hear a request to bin the litter and will automatically follow it, without giving it much thought. Making the prompt personal (e.g. by using the customer's name) and specific will make it more powerful.

Much litter can be generated from customers who use drive-through restaurants. People who eat in their cars, on the roads, often don't want to keep the empty packaging once they finish eating; implying that much of fast-food litter may be disposed in a several-mile-radius area from the restaurant. Installing signs around that radius will encourage people to keep litter until the next stop and using bins should reduce littering along highways.

*Personalised wrappers.* People's attention is drawn to what is relevant to them. Putting customers' names on take-away packaging is likely to draw people's attention and create a sense of ownership and responsibility and should, therefore, deter people from mindlessly throwing rubbish on the ground.

*Being watched.* People behave better when they are being watched, even when the watcher is a picture of staring eyes placed on a litter bin or a wall. A study conducted by Francey and Bergmuller (2012) examined how individuals reacted to litter left at a bus stop bench, depending on the design of litter bins. The researchers provided separate bins for each of the two types of litter used in the study (paper and plastic) and investigated whether people would deposit more items if a bin had a picture of eyes on it. While the presence of eyes on a bin had no effect on the likelihood that individuals present at the bus stop would remove rubbish, it did have a positive impact on those who did choose to dispose the litter. Those people who engaged in cleaning up the bench spent more time doing so in the presence of eyes. In a similar study, Keep Britain Tidy (2015) showed that placing poster with glow-in-the-dark eyes nudges dog owners to pick up after their pets, reducing dog fouling rates, on average, by 46% and as much as up to 90% in some areas.

*Start small.* The *foot-in-the-door* technique involves obtaining compliance for a small initial request, which increases the likelihood of complying with a much larger request later. We encourage businesses and policy-makers to think of such small, foot-in-the-door interventions rather than "going big" all the time. Sometimes starting small leads to greater long-term benefits rather than trying to change too much at once – another manifestation of the "low-hanging fruit" approach.

Just like other foot-in-the-door approaches, a "one-a-day" campaign, which would encourage people to throw (just) one piece of litter a day in the bin, should have a positive long-term effect on littering behaviour.

Such a “start small” approach will help form a new, desirable habit. At the same time, it focuses on just one concrete behaviour, making the intervention more likely to be a measurable success.

Similarly, we propose launching a campaign, in which people are asked to bin only one type of litter, e.g. cigarette butts or chewing gum. Again, while at first it may seem that such a message limits the potential impact of the campaign, the specificity and simplicity of the message, together with the lowered threshold required to do what one is asked for, should have a greater long-term impact on behaviour change than an initially more complex approach.

*Local pride identity.* Litter is most prevalent in more deprived neighbourhoods (Beaufort Research, 2010). Those who live in these neighbourhoods might not view litter as a relatively major issue when found among such things as low salaries, unemployment, crime, drugs and poorly kept roads. The state should undertake to address all these social problems, but it may be that removing litter, a symbolic and highly visible sign of problems, may serve as a morale builder and a stepping stone to something bigger.

Qualitative studies done in Wales suggest that people who live in such run-down areas feel neglected, but that this feeling, in turn, creates a strong connection with where one comes from. We suggest turning this feeling of belonging to a feeling of local pride and agency. Litter is the one component of the aesthetics of the environment that can be improved almost immediately and by the people themselves. Positioning anti-littering behaviour as an indicator of local pride and community strength could both help to reduce anti-social behaviour and to boost the morale of the most disadvantaged.

In fact, the approach based on promoting group identity is one of the more effective solutions to the commons dilemmas. Studies show that people often make self-sacrificial choices when they are made aware of the fact that the benefits will go to members of their group (Dawes & Messick, 2000). When people are reminded that they are a part of a community, they care more about the group’s wellbeing than their own, either automatically or to behave “in an appropriate manner”.

*Do it for your future self.* Studies show that people are just as likely to do something for others as for themselves, especially if those others are their future selves. Bryan and Hershfield (2012) showed that when people

felt a strong connection to their future selves, giving them messages that emphasised their responsibility to these future selves made them more likely to increase future-oriented choices. Following on from this, we recommend using a responsibility-based message to nudge the more connected-to-self individuals to behave responsibly, e.g.:

*We urge you to consider the responsibility you have to yourself in keeping the environment clean. After all, your “future self” is completely dependent on you. Your decisions now determine what your hometown and the streets your future self will live in will look like.*

*Communicating consequences.* While it is true that people often act automatically and follow the design of the environment they are in, in some cases understanding *why* a certain behaviour is preferred or undesired can help people understand the broader context and may increase their motivation to change behaviour.

For this approach to be effective, communication needs to be *concrete*. It is difficult for individuals to be motivated by abstractions and statistics. People respond in a stronger manner to specific images and individual cases, a phenomenon called the *identifiable victim effect* (Jenni & Loewenstein, 1997). As Stalin famously said, “The death of a single Russian soldier is a tragedy. A million deaths is a statistic” (*Time*, 1943). When designing communication, convey the concreteness of the message by using photographs and concrete phrases; emphasise the specific and personal aspects of the impact litter has on the environment and health. Showing concrete examples of people harmed by litter will be more effective than using general statistics. The more a person can relate to the message, the more effective it will be. Language should engage emotions and paint a clear picture in the litterers’ minds.

People also react strongly to easily understandable, clear problems. Based on this insight, the UK government started adding labels on home appliances that display the lifetime cost of energy usage of each appliance. By re-framing an abstract concept of “energy-efficiency” to concrete costs, it has shown a positive effect on people’s washer-dryer purchases, resulting in an estimated 6.6% reduction in annual energy consumption (Behavioural Insights Team, 2015).

Instructions to use the bins should be specific. For example, instead of saying “Use the bin”, say “Put your cigarette butt in the bin once you finish smoking.”

*Showing desired behaviour.* People are social animals and mimic what others do, especially what those they like, aspire to or respect, do. This is especially true of young people, who are still shaping their identities. Since young people are among the heaviest litterers in the UK, using appropriate ambassadors to show the desired behaviour is important. Nowadays, social media is where life happens. We therefore recommend designing a “behaviour placement” (rather than product placement) campaign on social media, with the focus on YouTube, Snapchat, Vine and other video-based platforms. Rather than recruiting celebrities who are relevant to 40 and 50-year olds, YouTube stars, who have channels devoted to sports (e.g. football) or gaming, who have hundreds of thousands or even millions of followers, should be involved in the campaign. By having these celebrities show the desired behaviour, the message will become personally relevant and will be conveyed in a manner that is aspirational to youth.

## CONCLUSIONS

In this article, our aim was to provide an overview of the commons dilemmas and to explain how littering is an example of this class of problems, and how policy-makers, organisations and individuals can, therefore, approach this issue. By drawing on behavioural science research and theory, we outlined the behavioural underpinnings of littering behaviours and provided a framework one can use to tackle these issues. Finally, we suggested some ideas, which – based on our knowledge – can become effective in nudging people to not litter or to pick up litter.

While we believe behavioural science can be of great benefit to anyone wanting to address litter and littering, it is important to remember that a key component of a good behavioural change intervention is its fit to a specific context. We recommend that those using this article take time to analyse the nuances of the problem they want to address, thinking of aspects such as location, timing, target group, specific behaviour that needs to be changed and what it should be substituted with (remembering that to get rid of a bad habit, it needs to be replaced with a new habit; it can't be just eliminated). These characteristics should be identified and described in as much detail as possible. Such an approach will help not only to properly design and execute an intervention, but will also make it possible to reliably measure its effects.

Finally, we encourage all those who want to tackle the problem of littering to be patient and

persistent in their efforts and to work together, on all fronts, to achieve the goal of cleaning up litter. Commons dilemmas, because of their innate characteristics, are difficult to overcome. Littering, with its complex socio-economic roots, is no exception. In situations like this, cooperation between stakeholders is of fundamental importance. Much more can be achieved if policy-makers, public and business parties, individuals and marketing experts work together tackle the problem in multiple ways – with environmental re-design and communication; nudging people gently and using law to encourage people behave pro-socially; involving public and private institutions; big organisations and individuals; tackling the problem directly, while simultaneously working on improving the living conditions of the lowest social classes, where littering is most prevalent. If we expect citizens to cooperate and help clean up the country, all those who wish to reduce littering and have the resources to help achieve this goal need to cooperate as well.

## REFERENCES

- Abraham, A., Sommerhalder, K., & Abel, T. (2010). Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments. *International Journal of Public Health, 55*(1), 59–69.
- 
- Archer, M. (1995), *Realist Social Theory: The Morphogenetic Approach*. Cambridge University Press: Cambridge.
- 
- Bagozzi, R. & Moore, D. (1994). Public Service Advertisements: Emotions and Empathy Guide Prosocial Behaviour. *Journal of Marketing, 58*(1), 56–70.
- 
- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*(5), 1252–1265.
- 
- BBC (2015). *Dog poo fines 'down by almost 20% in England and Wales*. Retrieved from <http://www.bbc.com/news/uk-33064119>
- 
- Beaufort Research. (2010). *Litter in Wales: Understanding littering and litterers*. Retrieved from [http://keepwalestidy.org/research/0415litter\\_perception\\_summary\\_report%5B1%5D.pdf](http://keepwalestidy.org/research/0415litter_perception_summary_report%5B1%5D.pdf).
-

- Behavioural Insights Team (2015). *Update report 2013-2015*. London.
- Behavioural Insights Team (2016). *Update report 2015-2016*. London.
- Bem, D. J. (1967). Self-perception: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, 74, 183-200.
- Brewer, M.B., & Kramer, R.M. (1986). Choice behaviour in social dilemmas: Effects of social identity, group size and decision framing. *Journal of Personality and Social Psychology*, 3, 543-549.
- Bryan, C. J., & Hershfield, H. E. (2012). You owe it to yourself: Boosting retirement saving with a responsibility-based appeal. *Journal of Experimental Psychology: General*, 141(3), 429-432.
- Bryan, C. J., Adams, G. S., & Monin, B. (2013). When cheating would make you a cheater: Implicating the self prevents unethical behavior. *Journal of Experimental Psychology: General*, 142(4), 1001-1005.
- Budescu, D.V., Rapoport, A., & Suleiman, R. (1990). Resource dilemmas with environmental uncertainty and asymmetric players. *European Journal of Social Psychology*, 20, 475-487.
- Campbell, F. (2007). People who litter. ENCAMS report. Retrieved from [http://www.littering-toolbox.ch/files/people\\_who\\_litter\\_litterseg2006\\_763.pdf](http://www.littering-toolbox.ch/files/people_who_litter_litterseg2006_763.pdf)
- Cialdini, R. (2009). *Influence: The psychology of persuasion*. London: HarperCollins Publishers Ltd.
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026.
- Common Cause Foundation (2015). *Common cause communication A toolkit for charities*. Retrieved from <http://valuesandframes.org/download/Communication-Toolkit/Common-Cause-Communication-A-Toolkit.pdf>
- Dawes, R. M., & Messick, D. M. (2000). Social dilemmas. *International Journal of Psychology*, 5(2), 111-116.
- De Kort, Y. A., McCalley, L. T., & Midden, C. J. (2008). Persuasive trash cans: Activation of littering norms by design. *Environment and Behavior*, 40(6), 870-891.
- Department for Environment, Food & Rural Affairs (2017). *New steps to tackle littering announced* [Press release]. Retrieved from <https://www.gov.uk/government/news/new-steps-to-tackle-littering-announced>
- Dubner, S. J., & Levitt, S. D. (2005). Dog-Waste Management. *The New York Times Magazine*. Retrieved from [http://www.nytimes.com/2005/10/02/magazine/dogwaste-management.html?\\_r=0](http://www.nytimes.com/2005/10/02/magazine/dogwaste-management.html?_r=0).
- Duhigg, C. (2013). *The power of habit: Why we do what we do in life and business*. London: Random House.
- Dur, R., & Vollaard, B. (2013). The power of a bad example: A field experiment in household garbage disposal. *Environment and Behavior*. (TILEC Discussion Paper No. 2013-037). Retrieved from SSRN [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2100372](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2100372).
- Ebbesmeyer, C. & E. Scigliano. (2009). *Flotsametrics and the floating world: How one man's obsession with runaway sneakers and rubber ducks revolutionized science*. New York: HarperCollins Publishers.
- Edney, J.J. (1981). Paradoxes on the commons: Scarcity and the problem of equality. *Journal of Community Psychology*, 9, 3-34.
- Finnie, W C. (1973). Field experiments in litter control. *Environment and Behavior*, 5, 123-144
- Francey, D., & Bergmuller, R. (2012). Images of eyes enhance investments in a real-life public good. *PLoS ONE*, 7(6), e37397.
- Frank, R. H. (2010). *Luxury fever: Weighing the cost of excess*. Princeton, NJ: Princeton University Pre

Frederick, Sh., Loewenstein, G. and O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, XL, 351–401.

---

Geller, E. S. Witmer, J. E., & Tuso, M. A. (1977). Environmental interventions for litter control. *Journal of Applied Psychology*, 62, 344–351.

---

Gifford, R., & Hine, D. W. (1997). Toward cooperation in commons dilemmas. *Canadian Journal of Behavioral Science*, 29(3), 167–178.

---

Granovetter, M. S. (1978). Threshold models of collective behavior. *American Journal of Sociology*, 83(6), 1420–1443.

---

Granovetter, M., & Soong, R. (1983). Threshold models of diffusion and collective behavior. *Journal of Mathematical Sociology*, 9(October 2013), 165–179.

---

Grasmick, H. G., Bursik, R. J., & Kinsey, K. A. (1991). Shame and embarrassment as deterrents to noncompliance with the law: the case of an antilittering campaign. *Environment and Behavior*, 23(2), 233–251.

---

Gregory, M. R. (2009). Environmental implications of plastic debris in marine settings – entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1526), 2013–2025.

---

Grodzins, M. (1958). *The metropolitan area as a racial problem*. Pittsburgh: University of Pittsburgh Press.

---

Grzelak, J., & Tyszka, T. (1974). Some preliminary experiments on cooperation in n-person games. *Polish Psychological Bulletin*, 5, 80–91.

---

Hardy, C. & Van Vugt, M. (2006). Nice guys finish first: The competitive altruism hypothesis. *Personality and Social Psychology Bulletin*, 32, 1402–1413.

---

Haynes, L., Service, O., Goldacre, B. & Torgerson, D. (2013). *Test, learn, adapt: Developing public policy with randomised controlled trials*. Retrieved from [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/62529/TLA-1906126.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/62529/TLA-1906126.pdf)

---

Heyman, J. & Ariely, D. (2004). Effort for payment: A tale of two markets. *Psychological Science*, 15(11), 787–793.

---

Hine, D.W. & Gifford, R. (1996). Individual restraint and group efficiency in commons dilemmas: The effects of uncertainty and risk-seeking. *Journal of Applied Social Psychology*, 26, 993–1000.

---

Homonoff, T. A. (2013). *Can small incentives have large effects? The impact of taxes versus bonuses on disposable bag use*. Retrieved from [wagner.nyu.edu/files/faculty/publications/Homonoff%20-%20Can%20Small%20Incentives%20Have%20Large%20Effects\\_0.pdf](http://wagner.nyu.edu/files/faculty/publications/Homonoff%20-%20Can%20Small%20Incentives%20Have%20Large%20Effects_0.pdf)

---

Humpel, N., Owen, N. & Leslie, E. (2002). Environmental factors associated with adults' participation in physical activity: a review. *American Journal of Preventive Medicine*, 22(3), 188–199.

---

The Hunting Dynasty. (July 2014). Research commissioned by Coca-Cola and Keep Britain Tidy, *Non Alcoholic Drinks Littering Behaviour*. London

---

INCPEN (2014). *Litter composition survey of England*. Retrieved from [www.incpen.org/docs/KBTINCPENLitterComposition2014.pdf](http://www.incpen.org/docs/KBTINCPENLitterComposition2014.pdf)

---

International Coastal Cleanup (2010). *Trash Travels: from our hands to the sea, around the globe and through time*. Retrieved from <https://oceanconservancy.org/wp-content/uploads/2017/04/2010-Ocean-Conservancy-ICC-Report.pdf>

---

Jenni, K. & Loewenstein, G. (1997). Explaining the identifiable victim effect. *Journal of Risk and Uncertainty*, 14(3), 235–257.

---

Jones, M. (2005). *Happiness economics: Gross National Happiness & Wellness Index*. Retrieved from [www.iim-edu.org/thinktank/papers/gnw-index/index.htm](http://www.iim-edu.org/thinktank/papers/gnw-index/index.htm)

---

Kahneman, D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.

---

- Kallgren, C.A., Reno, R. R., & Cialdini, R. B. (2000). A focus theory of normative conduct: When norms do and do not affect behavior. *Personality and Social Psychology Bulletin*, 26, 1002-1012.
- 
- Keep Britain Tidy (2015). *Keeping an eye on it*. Retrieved from [http://www.keepbritaintidy.org/sites/default/files/resource/Keeping%20an%20eye%20on%20it\\_Final%20report.pdf](http://www.keepbritaintidy.org/sites/default/files/resource/Keeping%20an%20eye%20on%20it_Final%20report.pdf)
- 
- Keep Britain Tidy (2014). *The wider cost of litter*. Wigan.
- 
- Keizer, K., Lindenberg, S. & Steg, L. (2008). The spreading of disorder. *Science*, 322(5908), 1681-1685.
- 
- Keizer, K., Lindenberg, S. & Steg, L. (2011). The reversal effect of prohibition signs. *Group Processes & Intergroup Relations*, 14(5), 681-688.
- 
- Krauss, R. M, Freedman, J. L. & Whitcup, M. (1978). Field and laboratory studies of littering. *Journal of Experimental Social Psychology*, 14,109-122.
- 
- Laist, D. W. (1987). Overview of the biological effects of lost and discarded plastic debris in the marine environment. *Marine Pollution Bulletin*, 18(6), 319-326.
- 
- Law, K. L., Morét-Ferguson, S., Maximenko, N. A., Proskurowski, G., Peacock, E. E., Hafner, J., & Reddy, C. M. (2010). Plastic accumulation in the North Atlantic subtropical gyre. *Science*, 329(5996), 1185-1188.
- 
- Lichtenstein, S. (2006). *The Construction of Preference*. Cambridge University Press: Cambridge.
- 
- Lloyd, W.F. (1833). *Two lectures on the checks to population*. England: Oxford University.
- 
- Marine Debris Program (1 November 2017). *How Debris Accumulates*. Retrieved from [marinedebris.noaa.gov/movement/how-debris-accumulates](http://marinedebris.noaa.gov/movement/how-debris-accumulates)
- 
- Martin, S. J., Goldstein, N. & Cialdini, R. (2014). *The small BIG: Small changes that spark big influence*. Grand Central Publishing: London.
- 
- Meikle, J. (2009, January). Fast food firms taken to task after survey of street litter, *The Guardian*. Retrieved from <https://www.theguardian.com/business/2009/jan/13/fast-food-litter-mcdonalds-greggs> .
- 
- Milgram, S. (1963). Behavioral study of obedience. *Journal of Abnormal Psychology*, 67(4), 371-378.
- 
- Milinski, M., Semmann, D., Krambeck, H.. & Marotzke, J. (2006). Stabilizing the Earth's climate is not a losing game: Supporting evidence from public goods experiments. *Proceedings of the National Academy of Sciences, USA*, 103, 3994-3998.
- 
- Mischel, W., Cantor, N., & Feldman, S. (1996). Principles of self-regulation: The nature of willpower and self-control. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (329-360). New York: Guilford Press.
- 
- Ocean Conservancy (2010). *Trash travels: From our hands to the sea, around the globe, and through time*. International Coastal Cleanup report. Retrieved from [act.oceanconservancy.org/images/2010ICCRReportRelease\\_pressPhotos/2010\\_ICC\\_Report.pdf](http://act.oceanconservancy.org/images/2010ICCRReportRelease_pressPhotos/2010_ICC_Report.pdf)
- 
- OECD (2017), *Behavioural Insights and Public Policy: Lessons from Around the World*, OECD Publishing, Paris.
- 
- Opatow, S. & Weiss, L. (2000). New ways of thinking about environmentalism: Denial and the process of moral exclusion in environmental conflict. *Journal of Social Issues*, 56, 475-490.
- 
- PETA (2016). *How litter kills animals*. Retrieved from [www.peta.org/features/litter-kills-animals/](http://www.peta.org/features/litter-kills-animals/)
- 
- Populus (2015, May). *Public Perception on Litter in the UK*. London.
- 
- Poundstone, W. (1992). *Prisoner's dilemma*. Anchor Books: London.
- 
- Prochaska, J. O. & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51(3), 390-395.
-

Prochaska, J. O., DiClemente, C. C. & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47(9), 1102-1114.

---

Read, D. (2004). Intertemporal choice. In: D.J. Koehle, N., Harvey (Eds.) *Blackwell Handbook of Judgment and Decision Making* (424-443). Oxford: Blackwell.

---

Read, D., Frederick, S. Scholten, M. (2013). DRIFT: An analysis of outcome framing in intertemporal choice. *Journal Experimental Psychology: Learning, Memory, Cognition* 39(2), 573-589.

---

Read, D., Olivola, C. Y. & Hardisty, D. J. (2016). The value of nothing: Asymmetric attention to opportunity costs drives intertemporal decision making. *Management Science*, 1-22.

---

Reiter, S. M. & Samuel, W. (1980). Littering as a function of prior litter and the presence or absence of prohibitive signs. *Journal of Applied Social Psychology*, 10, 45-5.

---

Roales-Nieto, J. G. (1988). A behavioral community programme for litter control. *Journal of Community Psychology*, 16, 107-118.

---

Roper, S., & Parker, C. (2013). Doing well by doing good: A quantitative investigation of the litter effect. *Journal of Business Research*, 66(11), 2262-2268.

---

Schelling, T. C. (1971). Dynamic models of segregation. *Journal of Mathematical Sociology*, 1(2), 143-186.

---

Schultz, P. W., Bator, R. J., Large, L. B., Bruni, C. M. & Tabanico, J. J. (2013). Littering in Context: Personal and Environmental Predictors of Littering Behavior. *Environment and Behavior*, 45(1), 35-59.

---

Science Learning. (2008). *Measuring biodegradability*. Retrieved from [sciencelearn.org.nz/Contexts/Enviro-imprints/Looking-Closer/Measuring-biodegradability](http://sciencelearn.org.nz/Contexts/Enviro-imprints/Looking-Closer/Measuring-biodegradability)

---

Seltenrich, N. (2015). New link in the food chain? Marine plastic pollution and seafood safety. *Environmental Health Perspectives*, 123(2), A34-A41.

---

Seresinhe, Ch., Preis, T. & Moat, S. (2015). Quantifying the impact of scenic environments on health. *Scientific Reports*, 5, 1-9.

---

Smith, J.M., Bell, P.A. & Fusco, M.E. (1988). The influence of attraction on a simulated commons dilemma. *Journal of General Psychology*, 115, 277-28.

---

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New York: Penguin Books.

---

Time (1943). Die, but not retreat. *Time Magazine*. Retrieved from <http://content.time.com/time/magazine/article/0,9171,790648,00.html>

---

Van Lange, P., Balliet, D. P., Parks, C. D. & Van Vugt, M. (2013). *Social dilemmas: Understanding human cooperation*. Oxford University Press.

---

Van Vugt, M. (2009). Averting the tragedy of the commons: Using social psychological science to protect the environment. *Current Directions in Psychological Science*, 18(3), 169-173.

---

Williams, D. (2016, January 19). *Plastic to outweigh fish in oceans by 2050, study warns*. Retrieved from <http://phys.org/news/2016-01-plastic-outweigh-fish-oceans.html>.

---

Wilson, J. Q. & Kelling, G. L. (1982, March). Broken windows: The police and neighbourhood safety. *The Atlantic*. Retrieved from [www.theatlantic.com/magazine/archive/1982/03/broken-windows/304465/](http://www.theatlantic.com/magazine/archive/1982/03/broken-windows/304465/).

---

World Bank (2015). *World Development Report 2015: Mind, Society, and Behavior*. Retrieved from [www.worldbank.org/en/publication/wdr2015](http://www.worldbank.org/en/publication/wdr2015)

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# PRAGMATIC CONSIDERATIONS AND SOCIAL BENEFITS: AN ANALYSIS OF ENGAGEMENT WITH A FLY-TIPPING REDUCTION PROJECT

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## BACKGROUND

The Repurpose Project was a three-year European Union LIFE+ funded pilot scheme designed to reduce fly-tipping at five London estates: Grahame Parke in Barnet, White City in Hammersmith, Andover in Islington, Pembury in Hackney and Samuel Lewis in Lambeth. The Repurpose Project (henceforth referred to as the project) was led by Groundwork London, an environmental community charity, and partnered by the London Community Reuse Network and Middlesex University (London). The project formally came to an end in 2017. The core effort of this scheme was to encourage re-use of items through the development of centres (referred to as Loops) on each estate. Each Loop would enable the repair, sale and purchase of old items, while also training local people in how to repair items and educating them about the benefits of re-use. Loops were run largely by volunteer effort under the direction of staff employed by Groundwork.

Loops were created from existing and underused spaces within the five estates. For example, the Loop at Grahame Park was created from a disused betting shop at the heart of the estate. The shop was refurbished and two interconnected functional spaces created – one for repairs and one for sales. From these centres, activities were run to engage the residents in the project and items were collected and brought to the Loops by residents, volunteers and Groundwork staff.

Middlesex University ran a series of behaviour change workshops for Groundwork staff at Groundwork London headquarters. These

workshops were designed to facilitate planning of engagement activities by Groundwork staff. At these workshops staff were introduced to key theories of behaviour change and then asked to develop ideas for activities that could be run according to behaviour change principles. These activities were then written up and shared between all Groundwork staff on the project.

The key objectives for the project were: to engage residents in order to reduce fly-tipping of re-usable items on the estates by 25%; to increase re-use in those same estates by 25%; and, to train the local residents in repair and re-use practices. Loops were seen as interventions that would facilitate practical aspects of dealing with unwanted items, but also demonstrate the residual economic value of unwanted items, thereby providing a direct benefit to the residents. Moreover, residents would be able to access repurposed and refurbished items at considerable savings relative to the market value for new goods. This economic activity was embedded within clear messages about the environmental benefits of recycling and repurposing, and the costs of fly-tipping. The project was largely successful in meeting these objectives (see Phillips, 2017). Alongside this effort, Middlesex University monitored *attitudes about recycling and re-use*, and also assayed any *additional benefits accruing as a result of the project*. It is this activity that is the focus of the current article.

Toward the end of the project, from December 2016 to January 2017, a resident survey was conducted across the five estates. The survey

adopted and adapted two existing attitudinal measures. The first assessed *attitudes toward recycling and repurposing of objects*. The second assessed to what extent residents reported that *future consequences helped to determine current actions*. Data was also collected about social connectedness and engagement with the Loops, as well as about *general awareness of fly-tipping as a problem* and of existing facilities and practices for dealing with unwanted objects.

While no formal hypothesis was pursued in this exploratory and pilot project, guiding research questions was the objective to understand whether those residents who reported using “future consequences” to guide current action were more likely to have positive attitudes toward recycling and repurposing, and were more likely to engage with the Loops. Secondly, we were interested in the social connectedness of those who chose to engage with the Loops. Fly-tipping and, more generally, littering are problems that could conform to a tragedy of the commons dynamic<sup>1</sup> (Hardin, 1968). It is possible that the more isolated individuals are, the less ownership they have of the commons and its problems. Equally, coming together to solve a commons problem should increase social connection.

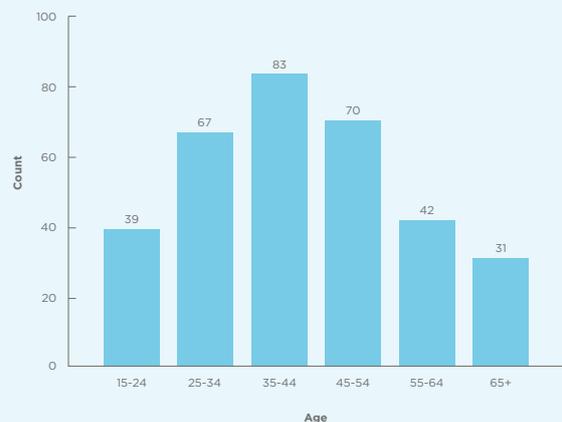
## PARTICIPANTS

The Grahame Park (Barnet) and the White City (Hammersmith) estates were both large, with close to 2,000 households each. The Andover (Islington) and Pembury (Hackney) estates had approximately 800 households each, and the Warner Road (Samuel Lewis Trust, Lambeth) estate had just 250 households. These estates were selected by Groundwork London based on previous working relationships with the relevant local authorities and additionally all the estates had problems with fly-tipping (Phillips, 2017).

The only demographic data recorded was the age range and sex of residents sampled. A decision was reached not to pursue socioeconomic data collection during any phase of the project as this was felt to be too intrusive and also likely to discourage participation. Similarly, it was decided not to track individual residents across the duration of the project. Both of these decisions were based upon the prior experience of

Groundwork London that demonstrated that distrust of third-party data collection on these estates was high, with fears that individualised data could be used to make detrimental decisions about residents. Groundwork London’s experience, while anecdotal, gives some indication of the challenges faced by residents on the estates. These estates would be described as deprived areas and, as with much of London, they are areas undergoing change. For example, Grahame Park is to be demolished and a new development built, leading to rehousing for residents and schemes to entice a broader demographic to the area.

**Figure 1: The age distribution (n = 332), from all estates, of participants surveyed. Numbers within the columns refer to count data.**



In total, 393 residents were questioned across the Andover, Grahame Park, Pembury, Warner Road and White City estates in London. A total of 277 residents had heard of the Repurpose project (assayed by asking whether they had heard of the Loop prior to any engagement with it). Of those, 229 were sampled from residents who were known to have engaged with the Loop at some point in the project and 48 were randomly selected residents.

The majority of residents surveyed were from the Grahame Park estate (251) while Warner Road yielded 16, Pembury 40, Andover 36 and White City 50 participants each. Of those that disclosed, 215 were female and 120 were male and the age sample was close to a normal distribution<sup>2</sup> (Figure 1).

<sup>1</sup> The tragedy of commons is an economic theory of a situation within a shared resource system where individual users acting independently according to their own self-interest behave contrary to the common good of all users by depleting or spoiling that resource through their collective action.

<sup>2</sup> Normal distribution sometimes called the bell curve is the distribution that occurs naturally in many situations.

## RESEARCH METHODS AND PARTICIPANT ENGAGEMENT

Participants were engaged by Groundwork London staff at their homes and asked to respond to a series of questions. Participants were made up of residents known to the project organisers, along with residents chosen at random. Their verbal responses were recorded via a spreadsheet using a digital tablet device.

A variety of research tools were used to develop the survey to gather the data for the project. These are described below and all questions are presented in the appendix.

Two attitudinal measures formed part of the question set. The **first** was a slightly modified version of a 18-item scale assessing general attitudes toward recycling (Sidique *et al.*, 2010). The modification made to the original scale was simply to include terms referring to re-use and repurposing within the questions. This scale captures four factors:

- **attitudes** to recycling, predominantly focused upon the extent to which participants believe behaviours are good for the environment and for personal outcomes;
- views on the **convenience** of recycling;
- **social pressure** to recycle;
- how **familiar** participants were with recycling options.

By error, one item was dropped from the attitudes factor, so 17 items were used. Responses are given on a five-point Likert scale, where 1 indicates strong agreement and 5 strong disagreement.

The **second** measure, the 12-item consideration of future consequences (CFC) scale (Strathman *et al.*, 1994), assessed to what extent residents' used the future consequences of actions to determine their current behaviour. This is a generic and one-dimensional scale that asks participants to think about the majority of their behaviour. The original questions for this scale were repackaged into a simpler register, designed to be more readily understandable by a diverse participant pool. The CFC scale also uses a five-point Likert scale, where a score of 1 indicates that participants are very unlikely to consider the future consequences of an action, and 5 indicates that they are very likely to consider future consequences. This gives an available range of scores, asking 12 questions, from 12 to 60, with 36 as a

mid-point score. Scores increasing in value above 36 indicate increasing consideration of future consequences for actions.

Both measures were checked for reliability. Cronbach's alpha (statistical estimate for reliability) for the modified 17-item general attitudes to recycling and repurposing scale was 0.79, and for the modified CFC scale was 0.76. Generally, 0.7–0.8 is regarded as an acceptable value, especially if the scales have a small number of items, which both did (Field, 2007). Values of 0.8–0.9 are considered good and 0.9 and above, excellent. Field studies advise running reliability analyses within factors. To this end, Cronbach's alpha was also calculated for attitudes (0.92), convenience (0.78), social pressure (0.79) and familiar (0.80) factors that show statistical reliability.

Participants were also asked if they had ever heard of the Loop project before the full data collection began. Given that the construction of Loop centres was the most salient feature of the Repurpose project for residents, we assumed (and hoped) that news of Loop project might have reached them. We also hoped that participants would have engaged, so they were also asked in what way they had engaged with the project, from which a dummy variable of engagement strength was created. Participants were regarded as having weak engagement if they had only walked past or heard of the Loop, and strong engagement if they had used the Loop to donate items, buy, volunteer or attended an event or training at the centre. A Pearson Chi-square analysis<sup>3</sup> was conducted across the two categories (heard of the loop (Yes/No) and strength of engagement (Strong/Weak)). This proved significant ( $\chi^2 = 25.79$ ,  $df = 1$ ,  $n = 309$ ,  $p = 0.0001$ ) with the likelihood of weak or strong engagement being higher in those who had previously heard of the Loop. This is to be understood as a reliability measure. Logically participants who had not heard of the Loops should not have engaged with them in any form, this analysis confirms that their self-report is consistent.

It should be noted that having only heard of the Loop was also a criterion for weak engagement; so the assumption was that those who had not heard would fall into the weak category. However, of the 30 participants that had not heard of the Loop, four were strong engagers. A further 79 had not heard of the Loop and had not responded to the

<sup>3</sup> A statistical test applied to sets of categories of data to evaluate how likely it is that any observed difference between the sets arose by chance.

engagement question. It is likely that the four who had not heard, but had engaged strongly, interpreted the question differently, assuming it was asking about knowledge prior to the project arriving in the estate. Overall, relying on self-report alone, 72% of the 393 residents sampled had heard of the Loop.

Other questions interrogated participants' perceptions of fly-tipping on the estate as well as their views about fly-tipping; what they would do with broken and with unwanted items; whether their recycling and reusing behaviour had changed since hearing of the Loop; whether there had been any changes in their social behaviour since getting involved with or simply hearing of the Loop; and whether or not they engaged with their neighbours by stopping and talking with them and the number of neighbours they felt they could call upon for help.

Participants were given a range of options to choose from when dealing with broken or unwanted goods and asked to choose which they were most likely to adopt. The broken goods question used two examples – furniture and a fridge – and this sometimes elicited a double response. Similarly, some participants gave multiple responses to the question about unwanted goods. In both cases the first response was adopted as an analysis variable unless the first response was “none of the above” in which case the next substantive response was taken.

Other than the formal measures adopted to assess attitudes to recycling and repurposing, and CFC, all questions were developed by Groundwork London in consultation with Middlesex University. No stipulation was made about the order in which Groundwork London staff asked the questions.

**CFC AND ATTITUDES TO RECYCLING AND RE-USE**

Descriptive statistics for the CFC and recycling scales are presented in Table 1. The data is normally distributed and the means from the recycling scale tend to the central point on the 1 to 5 Likert scale adopted to assess attitudes etc., with standard deviations indicating less than a one scale-point shift either side. This suggests that 68% of the population is drifting toward the central response. None the less, there is variance within the overall sample.

A one-way analysis of variance (ANOVA)<sup>4</sup> was conducted to assess the difference in CFC scores across the five estates. This was significant ( $F = 3.82 (4,327), p < 0.005$ ). Subsequent independent t-tests (to test statistical hypothesis) demonstrated that Grahame Park had a significantly lower mean CFC score than White City, Warner Road and Pembury. The higher the score on CFC, the more consideration is given to future consequences of current actions.

During an initial baseline survey period (July–August 2015) for the Repurpose project an ANOVA was conducted to investigate differences in response to the four factors across the five estates, from 74 participants (a sub-sample of a wider survey conducted at the time). A significant effect was found for attitudes ( $F = 12.10 (4,69), p < 0.0001$ ). Post hoc Bonferroni analyses (method that allows comparison statements to be made) revealed that there were significant differences between Warner Road and Grahame Park, Pembury and White City, Grahame Park and White City, and Andover and White City (see Figure 2 overleaf). There were no other significant effects for the other factors.

**Table 1: Descriptive statistics for all four factors from the modified Sidique *et al.* (2010) and the CFC scale (Strathman *et al.*, 1994) measures collapsed across all estates**

	Attitude	Convenience	Social pressure	Familiar	CFC
Mean	3.94	2.52	3.10	3.70	40.57
Median	4.00	2.33	3.00	4.00	42.00
Mode	4.00	2.00	3.00	4.00	42.00
Standard Deviation	0.56	0.85	0.79	0.85	4.95

<sup>4</sup> Analysis of variance is the statistical method used to test differences between two or more means.

**Figure 2: Mean attitudes scores for each location. Note that a score of 1 indicates strong agreement and 5 strong disagreement. All locations seem to produce agreement as a mean response. The items in this factor were all assessing how much residents agreed with statements indicating positive personal and environmental outcomes from recycling.**



A similar analysis was conducted on the data reported here. The data violated assumptions around the homogeneity of variance; given this, a Kruskal-Wallis H-test was employed. Responses to all four constructs were unevenly distributed across the five estates: attitudes ( $H = 35.466$ ,  $df = 4$ ,  $p = 0.0001$ ); convenience ( $H = 38.087$ ,  $df = 4$ ,  $p = 0.0001$ ); social pressure ( $H = 16.903$ ,  $df = 4$ ,  $p = 0.002$ ); familiarity ( $H = 42.259$ ,  $df = 4$ ,  $p = 0.0001$ ). This was followed up with pairwise comparisons. For attitudes and familiarity, Grahame Park differed significantly from all other estates; for social pressure only Grahame Park and White City differed significantly; and convenience was significantly different between Warner Road and both White City and Grahame Park.

In short, residents at Grahame Park were more positive in their attitudes and *more familiar with existing recycling options*, compared with

those on other estates. Grahame Park residents also felt *more social pressure to recycle and re-use* than their counterparts in White City, and *found recycling and re-use marginally more convenient* than residents in Warner Road. It is likely that the very much larger sample size from Grahame Park contributed to this effect and due caution should be applied when interpreting these findings.

Four linear regressions were conducted between CFC (as a predictor variable) and attitude, convenience, social pressure and familiarity (as dependent variables) using the pooled data from all estates. All analyses were significant (see Table 2).

As can be seen from Table 2, CFC predicts approximately 22% of the variance in attitude, 14% in convenience and familiarity each, and only 7% in social pressure. The standardised beta values give indication to the direction of this effect. It is negative only for convenience. This construct is negatively phrased, therefore residents who consider the future more, find the current facilities less convenient. A key question for convenience was about lack of time; it would appear that those who consider the future might also regard themselves as having less time to perform key recycling and repurposing tasks. The standardised beta values also give indication of the effect sizes. They should be interpreted as follows: for every single unit increase in CFC (the predictor) the dependent variable will shift by this fraction of a single unit in a positive or negative direction. For example, for every one unit increase in CFC, the attitudes score shifts by 0.47 of a unit. As attitudes are scored from 1 to 5, a marginal increase in CFC would begin to significantly shift attitudes. This relationship suggests that the more individuals consider the future consequences of their actions, the less likely they are to agree that their recycling behaviour has a significant positive impact on the environment. Note that, overall, scores are tightly distributed and the full range of scoring has not been used (Table 1).

**Table 2: Results of four linear regressions with CFC as the predictor variable**

Dependent variables	F-ratio	P =	Adjusted R <sup>2</sup>	Standardised $\beta$
Attitude	94.12 (1,331)	0.0001	0.22	0.47
Convenience	56.39 (1,331)	0.0001	0.14	-0.38
Social pressure	27.18 (1,330)	0.0001	0.07	0.28
Familiarity	53.35 (1,331)	0.0001	0.14	0.37

**PERCEPTIONS OF FLY-TIPPING**

A key objective of the project was to tackle fly-tipping in the estates. Residents were asked about their perception of the amount of fly-tipping and whether or not it was a problem. Population level responses to these yes/no questions are displayed in Table 3.

Table 3: Percentage of the residents (n = 393) responding yes or no to specific questions about fly-tipping		
	Yes	No
A lot of fly-tipping	71.9	28.1
Fly-tipping has little impact	36.4	63.6
Fine people who fly-tip	68.2	31.8
People only fly-tip when there is no choice	29.3	70.7
Fly-tipping is not a problem	29.2	70.8
Fly-tipping is normal	32.3	67.7
Concerned things could be repaired	78.7	21.3

As can be seen, the general view is that there is a lot of fly-tipping on the estates, and that it is a problem. Fly-tipping is not regarded as a normal behaviour, and it is one that most feel should attract the punishment of a fine. There is also a consensus that many of the items could be repaired. One must be cautious of demand

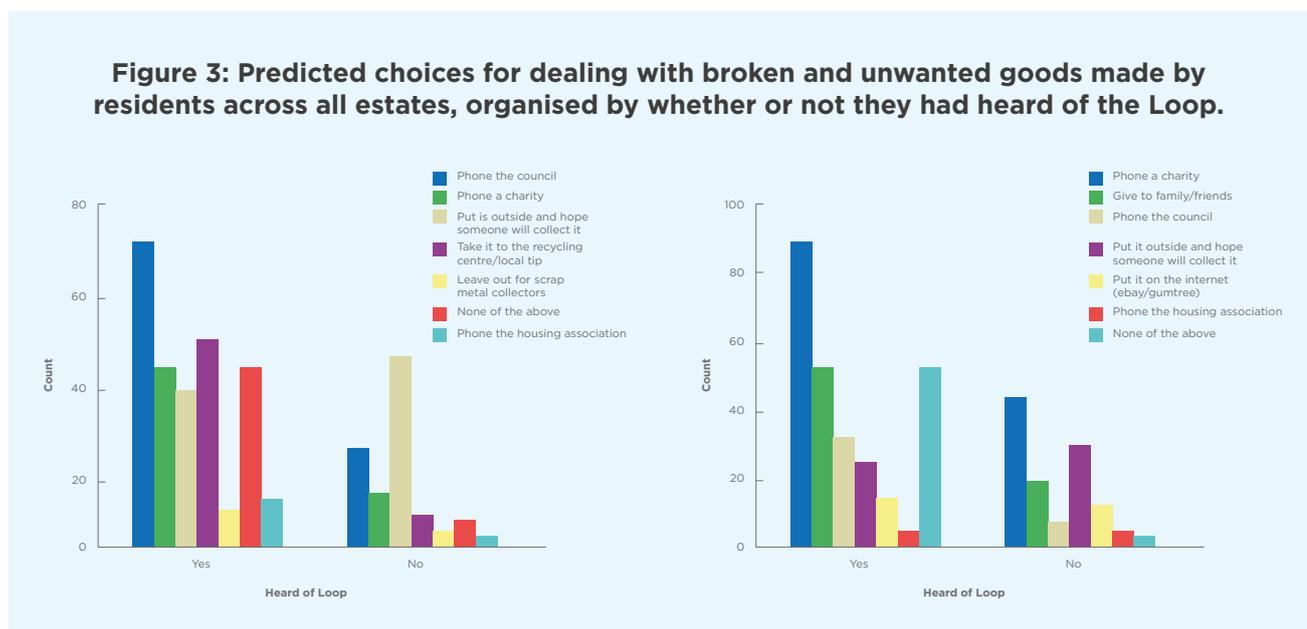
characteristics when interpreting this data, as questions were asked within the context of a general enquiry about the Repurpose project, which was expressly designed to tackle fly-tipping and to repurpose objects.

**DEALING WITH BROKEN AND UNWANTED GOODS**

Pearson Chi-square tests were executed across the choice categories for each question, using the yes/no categorisation from the self-report question asking if participants had heard of the Loop. This enabled the use of most of the data, and captured a distinction between those who were aware and those who were not.

The analysis for broken goods proved significant ( $\chi^2 = 44.62, df = 6, n = 388, p = 0.0001$ ) and also for unwanted goods ( $\chi^2 = 39.03, df = 6, n = 386, p = 0.0001$ ). The pattern of the differences across Yes/No (Heard of Loop) can be seen in Figure 3. A notable finding here is that very few people who had not heard of the Loop would consider taking a broken item to the tip or local recycling centre; but phoning a charity about an unwanted item was a popular option for both categories of resident.

More specifically, a Pearson Chi-square analysis tests for associations in data. The test calculates expected frequencies of individuals within each of the behavioural choice categories, organised by having heard of the Loop (Yes/No) and compares them with observed frequencies. If the observed frequencies differ radically then the test is statistically significant. In this case, fewer



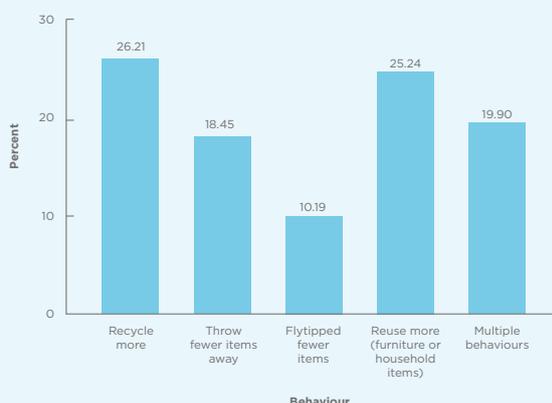
people than expected in the Yes (heard of the Loop) category opted for leaving broken items outside in the hope that they will be collected; and, more than expected have opted to recycle or take to the tip. The exact reverse of this trend is true for those who had not heard of the Loop (so, more than expected opted to leave broken items outside, and fewer than expected opted to take them to the tip or recycle).

Of those who had heard of the Loop, fewer than expected left unwanted items outside in the hope of collection; and more than expected opted for none of the above. For those who had not heard of the Loop, more than expected phoned a charity, left items outside in the hope of collection, and used the internet to find items a new home. It would seem that broken items are more of a problem for those who had not heard of the Loop, compared to unwanted items.

### SELF-REPORTED RECYCLING BEHAVIOURS AND SOCIAL BENEFITS

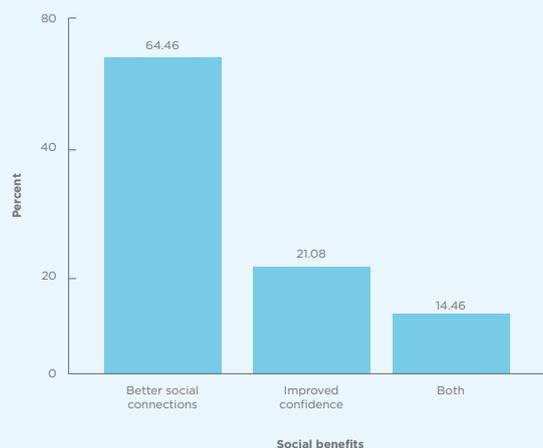
Participants were asked whether they had improved recycling related behaviours since hearing of the Loop. 187 participants did not respond to this question, leaving 206 that did. As with previous questions, there were multiple responses recorded. In this case, as all categories were positive behavioural choices, any participant with two or more was recorded as having undertaken multiple behavioural changes. The data is presented in Figure 4.

**Figure 4: Percentage of participants (n = 206) reporting increases in recycling and re-use related behaviours since engagement with the Loop, organised by behavioural category. Precise percentages are within bar annotations.**



Participants were also asked if they had better social connections, improved confidence or both since hearing about, or getting involved with the Loop. 166 participants chose to answer this question, and the data is presented in Figure 5.

**Figure 5: Percentage of participants (n = 166) reporting social benefits since engagement with the Loop, organised by benefit category. Precise percentages are given in the within bar annotations.**



Of those who disclosed information about how many neighbours they could call upon for help, those who had heard of the Loop ( $n = 222$ ) reported significantly more neighbours to call upon than those who had not heard of the Loop ( $n = 69$ ;  $t = 3.06$ ,  $df = 289$ ,  $p = 0.002$ ). This amounted to a mean difference between 5.8 (heard) and 2.2 (not heard) neighbours by category. When analysed by strength of engagement (strong  $n = 146$ ; weak  $n = 93$ ) there was a significant difference between the two group means of 7.04 and 3.18 neighbours, in favour of the strong engagement group ( $t = 3.18$ ,  $df = 237$ ,  $p = 0.002$ ). This suggests that strength of engagement is related to sociality; given that self-report data indicates a large increase in social connectedness we can cautiously hypothesise social benefits accruing from engagement with the Loops and the Repurpose project.

Of those participants that disclosed ( $n = 118$ ), there was no statistically significant difference between them (by groups), with regard to how strongly they agreed with the statement “I regularly stop and talk with people in my neighbourhood.” The mean response was Agree.

**ASSESSING ENGAGEMENT WITH THE LOOPS**

A series of binary logistical regression models were run, using engagement strength as the outcome variable. No significant main effects were found for attitude, social pressure, convenience or familiarity, nor for CFC or any other categorical variables assaying views about fly-tipping; other than the item asking for a yes/no response to the statement “People only fly-tip when they have no choice.” As can be seen from Table 3 a smaller proportion of participants responded yes to this category. None the less, making this response more than doubled the odds of strong engagement with the Loop ( $Exp-\beta = 2.24$  (1.35–3.70 95% CI),  $df = 1, p = 0.02$ ). It is worth noting that this model only correctly allocated 61% of the participants to the correct strength of engagement group; but this is a significant improvement on a constant only model. What this indicates is that other, unmeasured variables, will be contributing to strength of engagement.

Second, generalised linear modelling (GLM) was used in order to see which combinations of variables best predicted whether residents had heard of the Loop. A series of main effect GLM models were produced, using a binomial probability distribution with a logit link. This produced close to equi-dispersion for each model produced.

The modelling strategy was as follows. First, a main effects model including CFC, attitudes,

familiarity, social pressure and convenience as covariates was produced. Then this model was used as a core to add responses to neighbourly interactions, Age, Sex and each Yes/No response variable referring to fly-tipping as a factor (one at a time; no cumulative factorial model was produced). Aikake Information Criterion scores, corrected for small samples (AICC) were then compared (Burnham & Anderson, 2001) between each model. Generally the lowest AICC value represents the best-fit model. Models that differ by < 2 are regarded as being similarly good fits, but models differing by > 2 are regarded as less good fits.

Within each model, effect sizes for each variable were also assessed for size and significance. Where variables were repeatedly making no statistically significant difference to the model, they were removed. Table 4 displays the core model (model 1) and the best models by information theory criteria. Model 5, the simplest main effect model, is by far the best.

All three-way and two-way interactions were modelled for the variables in Model 5 (Table 4). This did not improve upon Model 5 in terms of AICC values or statistical significance.

Table 5 gives the details of how the best model works.  $Exp-\beta$  should be read as odds-ratios. Thus, for every 1-point increment of the associated independent (predictor) variable

**Table 4: Main effects models, AICC values and difference in AICC ( $\Delta$ AICC) compared with the lowest value model**

Model	Predictors	AICC	$\Delta$ AICC
1	CFC, attitudes, familiarity, social pressure, convenience	278.986	27.198
2	Model 1 + Age	266.701	14.913
3	Model 2 + Sex	265.944	14.156
4	Model 2 + A lot of fly-tipping	258.984	7.196
5	Convenience + Age + A lot of fly-tipping	251.788	-

**Table 5: Effect sizes for variables in Model 5 (see Table 4).**

Variable	Wald	Significance (p =)	Degrees of freedom	$Exp-\beta$
Convenience	7.671	0.006	1	0.583
A lot of fly-tipping (Yes)	10.478	0.001	1	2.990
Age	12.590	0.0001	1	1.508

the odds of having heard of the Loop will increase by so much.

Increasing values of the convenience variable indicate that residents find existing recycling facilities inconvenient. Table 5 makes clear that the more inconvenient residents found such facilities, the less likely there were to have heard of the Loop (as the odds ratio was less than 1). In other words, if they found them convenient, they were more likely to have heard of the Loop. This could be because the Loop provided a convenient facility and they have included this in their assessment. If residents felt there was a lot of fly-tipping, they were almost three times as likely to have heard of the Loop as residents who did not feel there was a lot of fly-tipping. Finally, older residents were more likely to have heard of the Loop.

### CONCLUDING COMMENTS

This article provides the findings from a survey of residents of five London estates. Overall, the data allow us to cautiously conclude that the Loops did help a good proportion of residents sampled to increase recycling and repurposing behaviours. Moreover, residents also reported social benefits from engagement with the Loop. Those residents who had heard of the Loop felt that they could call upon significantly more neighbours to help them when in need, suggesting that prior social connections may have either facilitated take-up of the Loop offer or that more socially engaged people are more likely to look for such opportunities. Exploring the role of social networks should prove fruitful in any future work.

The only predictor of strong engagement with the Loop was a belief that people only fly-tipped when they had no choice. While the model was statistically significant, much variance is still unaccounted for. None the less, it implies that the problem is regarded as one of opportunity and the Loops clearly fill that need. The second model, looking to predict whether residents had heard of the Loops, showed that convenience in conjunction with the view that there was a lot of fly-tipping, as well as age, were significant contributors. Both models strongly suggest that fly-tipping and the more general issue of what to do with broken items are seen purely pragmatically, and not in the context of broader attitudes about the environment and future.

### ACKNOWLEDGEMENTS

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### REFERENCES

- ABurnham, K. P. & Anderson, D. R. (2001). Kullback-Leibler information as a basis for strong inference in ecological studies. *Wildlife Research*, 28(2), 111-119. doi.org/10.1071/WR99107
- 
- Field, A. (2007). *Discovering Statistics Using SPSS*. SAGE Publications. Retrieved from books.google.co.uk/books?id=5253SAL5nDgC
- 
- Hardin, G. (1968). The tragedy of the unmanaged commons. *Science* (New York, N.Y.), 162(5364), 1243-8. Retrieved from www.ncbi.nlm.nih.gov/pubmed/21236819
- 
- Phillips, R. (2017). A Case Study on the Repurpose Project: A London estate-based pilot tackling fly-tipping through re-use. *Journal of Litter and Environmental Quality*, 1, 26-32.
- 
- Sidique, S. F., Lupi, F. & Joshi, S. V. (2010). The effects of behavior and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling*, 54(3), 163-170. doi.org/10.1016/j.resconrec.2009.07.012
- 
- Strathman, A., Gleicher, F., Boninger, D. S. & Edwards, C. S. (1994). The consideration of future consequences: Weighing immediate and distant outcomes of behavior. *Journal of Personality and Social Psychology*, 66(4), 742-752. doi.org/10.1037//0022-3514.66.4.742
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## APPENDIX

### **Questions adapted from Sidique et al. (2010)**

Please respond to the following statements using the five-point scale below:

1: Strongly disagree

2: Disagree

3: Neither agree nor disagree

4: Agree

5: Strongly agree

*For me, household recycling and re-use is a difficult task*

*I do not have enough time to sort the materials for recycling or re-use*

*The recyclables that I store attract pests*

*I am familiar with the recycling and re-use facilities in my area*

*I am familiar with the materials accepted for recycling and re-use in the facilities in my area*

*My neighbours expect me to recycle and re-use household materials*

*My friends expect me to recycle and re-use household materials*

*My family expect me to recycle and re-use household materials*

*I feel good about myself when I recycle or re-use*

*Recycling and re-use is a major way to reduce pollution*

*Recycling and re-use is a major way to reduce wasteful use of landfills*

*Recycling and re-use is a major way to conserve natural resources*

*Recycling and re-use will improve environmental quality*

*I believe that my recycling and re-use activities will help reduce pollution*

*I believe that my recycling and re-use activities will help reduce wasteful use of landfills*

*I believe that my recycling and re-use activities will help conserve natural resources*

*I believe that my recycling and re-use activities will help improve environmental quality*

### **Adapted CFC measure**

*For each of the statements below, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) please write a "1" to the left of the question; if the statement is extremely characteristic of you (very much like you) please write a "5" to the left of the question. And, of course, use the numbers in the middle if you fall between the two extremes. Please keep the following scale in mind as you rate each of the statements below.*

1: Very unlike me

2: Quite unlike me

3: Not sure

4: Like me

5: Very much like me

*I think about the future, and try to improve it with the decisions I make now.*

*I often do things now that will have an impact in many years' time.*

*I only think about now, the future will work itself out.*

*I make decisions based on what their impact will be over the next couple of days/weeks.*

*I make decisions based on what will be easiest now.*

*I am willing to make sacrifices now to have a better future.*

*I worry about the influence actions I take now might have on the future.*

*It is more important to do things that will have a big impact on the future than things that will have a little impact on the present.*

*I don't worry about problems in the future, they will be sorted out in time.*

*There's no point sacrificing now as we can deal with the future when it comes.*

*I live for now, I will deal with future problems in the future.*

*Because the outcomes of what I do now are clear, future outcomes are less important.*

**Other questions:**

*If you had broken furniture or a broken fridge what would you do with it?*

*Phone the council*

*Phone a charity*

*Put it outside and hope someone will collect it*

*Take it to the recycling centre/local tip*

*Leave out for scrap metal collectors*

*Phone the housing association*

*None of the above*

*If you had an item that you no longer wanted but you thought could be used by someone else, what would you do with it?*

*Phone a charity*

*Give to family/friends*

*Phone the council*

*Put it outside and hope someone will collect it*

*Put it on the internet (ebay/Gumtree)*

*Phone the housing association*

*None of the above*

*There is a lot of fly-tipping in my neighbourhood – Yes/No*

*Fly-tipping has little impact upon the environment – Yes/No*

*People who fly-tip should be given a large fine – Yes/No*

*People only fly-tip when they have no choice – Yes/No*

*Fly-tipping is not a problem as someone always cleans it up – Yes/No*

*Fly-tipping is normal; most people do it – Yes/No*

*I am concerned that things that could be repaired are going to waste – Yes/No*

*Have you heard of the Loop before? – Yes/No*

*Since hearing about the Loop, have you improved any of these behaviours below?*

*Recycle more*

*Throw fewer items away*

*Fly-tipped less items*

*Re-use more*

*Since hearing about/getting involved in the Loop, have you experienced any of these impacts?*

*Better social connections*

*Improved confidence*

*To what extent do you agree with this statement: I regularly stop and talk with people in my neighbourhood.*

*Strongly agree*

*Agree*

*Neither agree nor disagree*

*Disagree*

*Strongly disagree*

# TACKLING CURRENT ISSUES IN FLY-TIPPING – A VIEW FROM A LONDON BOROUGH

**Jacki Ager** has 14 years' experience in local authority waste services. She is a former secretary for the London Recycling Officers' Group and now sits on the London and Southern Counties Centre Council of the Chartered Institution of Waste Management.

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Fly-tipping is a major issue for the London Borough of Croydon. This article sets out the objective of tackling fly-tipping within the council priorities, reviews the initiatives being put in place to tackle this problem (including operational technology, information technology among others) and outlines the next steps that are being undertaken. Over time, the hope is that these initiatives will work to decrease the incidence of fly-tipping and help the council achieve its vision of being the cleanest and greenest London borough.

## INTRODUCTION

Croydon is the second largest borough in London by area, and the city's most populous borough with a population of 363,000 people. It is made up of 24 wards, each with its own characteristics, from the leafy suburbs in the south to inner-city, high-density housing and commerce in the north. With regeneration high on the agenda and the introduction of Croydon Box Park, a new "pop-up" dining and entertainment complex, Croydon's profile is being raised as a centre of culture and leisure. Significant diversity in both environment and demographics is a driving force behind this, but it also provides a range of challenges.

Despite the provision of a cheap bulky waste collection service, a culture of fly-tipping in Croydon remains, with both residents and traders continuing to leave waste in public places (Figure 1). A high proportion of, up until recently, fairly unregulated rented accommodation could be the cause of bulky waste items being frequently found dumped on street corners.

In 2016/17 the borough received more than 20,000 reports of fly-tips, totalling nearly 12,000 tonnes of waste and costing the taxpayer over £1 million to collect and dispose of.



*Figure 1: Fly-tipping in the London Borough of Croydon*

In addition to this, balancing financial pressures and public expectations is an ongoing challenge to the authority. New zoning and scheduling to achieve operational efficiencies and monetary savings has standardised sweeping frequencies to daily

(town centre/shop fronts), twice-weekly, weekly, fortnightly and six-weekly. Public expectations therefore need to be managed accordingly in areas with lower sweeping frequencies.

Croydon is one of the leading boroughs working to tackle the national problem of fly-tipping. Significant work has been carried out in the borough to improve street cleanliness, both operationally and through behavioural change. The vision of the London Borough of Croydon is to be:

- The cleanest and greenest borough in London
- A clean place where people choose to live, work and visit
- A place that communities are proud of

As a key part of this vision, Croydon looked to develop an integrated approach to tackling fly-tipping, clearing up the borough and changing both public behaviours and perceptions. The borough aims to improve clearance rates of fly-tipping and tackle it at the source through education and enforcement. There needs to be a balance between clearing fly-tipping events quickly, while recording evidence, where found. Therefore, buy-in from the fly-tip clearance crews is important, and training on reporting and retaining evidence is highly valuable. Yet while rapid clearance is essential in reducing the likelihood of fly-tips being added to, this does not resolve the underlying problem.

Education and publicity are integral to improving public perceptions, particularly in the north of the borough where fly-tipping is more prevalent, with a high resident turnover in rented properties leading to items such as mattresses becoming a blight on the urban environment. Enforcement powers are used where education has not had the desired effect, and publicity has led to a greater interest from the general public and encouraged residents to get involved in keeping their local areas clean.

As outlined in the next section, the council is using a combination of operational technology (street cleansing technologies), making service improvements, developing new information technology and enforcement and campaigns to create an integrated approach to fly-tipping to bring about change.

## APPROACH

### *Operational technology*

Croydon's Capital Investment Programme has allowed £1.3m to be invested in new technologies to help achieve greater efficiencies and effectiveness in street cleansing. Working with Croydon's waste contractor, Veolia Environmental Services Ltd, the council has introduced the following:

- Twenty-five barrow beats enhanced with electric "Green Machine" vacuums: these are ideal for town centres, with the added value of zero CO2 emissions. These aim to both improve the standards of cleansing and raise public perceptions of Croydon's street cleansing services. The vacuums have been tested on a wide range of areas and the bedding-in period has been subject to trial and error in parts. They are particularly useful in town centres and housing estates, on fresh litter and cigarette butts. They are also extremely efficient at clearing fresh leaf fall in the autumn months, however less so on wet leaves.
- Four new "mini" mechanical Schmidt sweepers: these have been introduced to support manual barrow beats, particularly six-weekly sweep schedules. They allow for a deeper cleanse, particularly on pavements and in housing estates where the larger brooms are unable to navigate due to their width and weight. Seasonally, they provide more effective removal of moss and leaves. The new sweepers are achieving a visual impact, with sharper back lines and a noticeable reduction in moss, particularly on roads that are subject to lower sweeping frequencies that have traditionally led to a moss build-up.
- Two additional caged vehicles and one additional 18-tonne Refuse Collection Vehicle (RCV): The caged vehicles provide narrow access for fly-tip clearance (e.g. housing estates or alleyways), meaning more flexibility and faster reaction times. The variety of vehicles provides greater flexibility when addressing incidents of fly-tipping.
- Eighty "Big Belly" Solar Compactor bins: these have mainly been deployed to areas of high footfall. Rubbish deposited in these bins is compacted up to eight times and the bins send a message to Veolia when they are full. This ensures they are emptied only when required, freeing up resources to be spent on other tasks. Croydon is

currently achieving an average of 87% efficiency rating on these bins, meaning that on average they are at 87% capacity when emptied. When compared to the performance of other boroughs using these, Croydon is in the upper quartile. The impacts of these bins are difficult to quantify, but the general findings are: fewer overflowing bins; less spillage on the streets; less time spent emptying the bins and changing the liners leading to more attention being made to sweeping duties; fewer passes by the caged tipper crews, allowing them to focus on collecting fly-tips.

Overall, this investment in technologies goes some way in improving efficiency of street cleansing teams in Croydon, and the effectiveness of their work. Although these improvements are largely reactive and are not the whole solution to fly-tipping and other environmental quality issues in the area, we suggest this is an important step in improving public perceptions of street cleaning services. Improved perceptions could in turn impact on how likely residents are to look after the area.

### **Service improvements**

Along with investments in technology, it was important to review current service provision to identify where minor improvements may be introduced that would have a noticeable effect. Croydon will join the South London Waste Partnership integrated waste management contract in 2018, therefore any operational changes need to take this into account as they would be fairly short-term arrangements. The following actions have been taken:

- Reinstatement of afternoon street cleansing shift in the town centre to ensure standards are maintained throughout the day. This ensures a more consistent level of cleanliness compared to previous noticeable dips during busier periods.
- Introduction of afternoon shift and a dedicated weekend resource for fly-tip removal to ensure clearance of fly-tips within 48 hours. The new vehicles mentioned above allow Veolia flexibility to direct resources as needed. Alongside this, Veolia operates a proactive clearance of fly-tips where street cleansing operatives report them to their charge hands for clearance.
- Clearance of street cleansing bags: To support Croydon's aim of keeping the

streets as clear of fly-tips as possible, it is important for the borough to practise what it preaches. All street cleansing bags are cleared on the day of sweep, with a dedicated afternoon shift for bag removal operating borough-wide.

- Seasonal operations: Issues such as leafing affect operations and can be very weather-dependent. Up to ten support teams and two extra mechanical brooms are deployed over the autumn/winter leafing period in order to target leafing hotspots and support the regular sweepers who find their work dramatically slowed down by leaf fall.
- A new regime of joint monitoring of streets between council officers and contract supervisors to generate more proactive rectification of issues. Joint training was provided to all council monitoring officers and contractor supervisors in order to ensure consistency across the contract. The training was provided by Keep Britain Tidy in order to familiarise staff with NI195 standards of cleanliness.
- As a result of this, more than 90% of roads are now being swept to standard across the borough. This is a marked improvement, particularly in areas of high footfall that have historically suffered from high levels of littering. Furthermore, on average 87.9% of fly-tips are now cleared within 48 hours versus 80.84% in 2016.

### **Information technology**

- The *My Croydon* mobile phone app was developed to allow residents to report a number of local concerns, including noise nuisances, hate crimes, highways defects and street cleansing issues. Fly-tipping can be reported via the app, and the resident is able to drop a pin at the exact location of the fly-tip, as well as include photographs and free text. While the app is not yet fully integrated with Veolia's system, we hope to develop this in the coming months. At the present time, the crew is able to see location (narrowed down to a segment of street) and waste type. Previously the crew could only see the road name, which posed problems where particularly long roads were concerned. The addition of the segmented reporting has helped to improve the clearance rate and reduce the amount of complaints associated with failed clearances. Current functionality does not allow for photographs to be passed to the crews, but this is being developed and will be operational in 2018

so that photographs can be viewed in cab, which it is hoped will further improve the accuracy of clearances and increase the clearance rate. April to October 2017 has seen a decrease in the number of fly-tips reported of more than 20%. While it is difficult to establish if this is a result of fewer duplicate or repeat reports, improvements in reporting technologies are highly likely to be a contributing factor.

- March 2018 will bring integration between Croydon's CRM customer management system and Veolia's Echo system. Customers reporting street cleansing issues via the online reporting system, *My Account*, will not only be able to log a fly-tip via a pin drop, which as above gets translated into a street segment, they will also be able to view recently reported fly-tips, which it is hoped will reduce duplicate reporting. Feedback will also be provided to customers via text message and/or email, in order to confirm when a fly-tip or other street event (dog fouling, drug paraphernalia, etc.) has been cleared, or inform the resident if the event has been locked out. This may include where the contractor is unable to access a location (e.g. private land) or if further action is to be taken, for example if the event has occurred on parks land or involves hazardous waste that needs to be passed to the City of London Corporation for clearance. It is hoped that this provision of real-time information will reduce the level of repeat customer contact.

#### ***Environmental enforcement and 'Don't Mess With Croydon' campaign***

While effective operations are an integral part of achieving clean streets, behavioural change is what will ultimately bring about sustained improvements. Croydon's team of 38 Neighbourhood Safety Officers work seven days a week on a combination of routine shifts and special operations. They are split into three geographical teams, as well as two dedicated teams rolling out and monitoring Time Banded Waste Collections (TBWCs) and investigating fly-tipping and other environmental offences. A team of six Environmental Enforcement Officers undertake more complex enforcement activities, for example in investigating large scale fly-tips.

- Time-Banded Waste Collections: Beginning in winter 2016 and now covering five busy high streets and counting, these are aimed at businesses and residents living in flats

above shops. For London Road, a long, busy high street, officers worked in partnership with Croydon's waste contractor Veolia to arrange appropriate time-banding, with no rubbish to be presented between 9am and 6pm. Fewer black bags on the street throughout the day has led to less litter and a more pleasant shopping environment. While an attempt has been made to measure changes in the tonnage of fly-tips collected, due to the large areas in which the fly-tip teams operate, it is difficult and time-consuming to measure the tonnage collected just from participant streets, and data has been too piecemeal to provide meaningful results. However, anecdotal feedback from collection teams has been positive, with more predictable and concentrated collections taking place. As part of the time-banding initiative, all businesses on the target streets are visited by officers to ensure they are fulfilling their Duty of Care obligations. TBWCs are being introduced to a number of high streets around the borough, and this is being done through a phased approach so that each location receives appropriate attention from enforcement officers, hopefully ensuring a successful roll-out. As part of the first two phases of the project (South Norwood and Thornton Heath, South Croydon, Purley and Coulsdon, then South Croydon), 2,885 visits were carried out, including 1,167 to businesses, to ensure Duty of Care compliance. A further 232 businesses in Selsdon will be visited as part of phase three. So far, 368 Section 34 notices have been issued, with 359 businesses complying, either by producing documentation or taking up trade waste contracts. Fines have been issued to the remaining businesses for failing to produce trade waste documentation, six fines for littering have been imposed and 43 fixed penalty notice warnings. Furthermore, 115 new trade waste contracts have been taken up with the council. Although businesses can choose any registered commercial waste carrier, this has provided an extra source of revenue for the council where businesses have chosen to take up a contract with Croydon.

- Fly-tip investigations: In the past year, a higher number of fixed penalty notices for fly-tipping and other environmental offences has been issued than ever before – 1,433 since April 2016 – and more prosecutions have been issued than ever before (55 since 2016) including one

six-month prison sentence. This has also led to the confiscation of 14 vehicles involved in waste and fly-tipping offences in the past 12 months. Croydon is now a national leader in this field, providing briefings and advice at Defra and for many councils across London and England. A designated Fly Tip Task Force hopes to build on this still further, and cross-departmental working is one facet of this intelligence-led operation. As an example, Croydon's Geographic Information Systems team has worked to identify hotspot areas for fly-tipping, enabling "sting" operations to take place.

- **Community engagement:** A dedicated officer has led the recruitment of 300 Street Champions and, in partnership with other departments, has organised more than 300 clean-up events. Street Champions come from all over the borough and often work in groups to identify areas that are being neglected or abused. These may be on areas of housing land or streets. A separate community engagement officer liaises with "Friends" groups in parks. The engagement officer for Community Champions provides support by means of advice, equipment, small amounts of funding and staff resourcing to help residents bring about changes in their local area. Activities include litter picks, clearance of overgrown back alleyways and community fun days. These have empowered local residents to take pride in their community, and have shown to bring about sustained change in the local environment with fewer fly-tips and incidents of antisocial behaviour, not only by clearing neglected areas but also by enhancing them through the introduction of street furniture such as flower planters that are then maintained by local community groups. This work was supported by the 'Don't Mess With Croydon' campaign (Figure 2) which was launched in the area (e.g. on posters, lamp post banners).

While it is too early to measure consolidated findings, preliminary data from time banding phases 1 and 2 demonstrate that Purley, and South Norwood have both had a reduction in fly-tipping from 2016 to 2017 (based on calendar years) by 5.6% and 34.6% respectively.

Overall, the data for the borough reveals that the total number of fly tips reported in the borough between 2016 and 2017 calendar



Figure 2: Don't Mess With Croydon Campaign Logo

years has decreased by 5,000 – from 25,442 in 2016 to 20,192 in 2017, which is very encouraging.

#### NEXT STEPS

Despite hard work and considerable advances being made in street cleanliness in Croydon, there is still much more to do. The upcoming priorities of the London Borough of Croydon include:

- **Developing partnerships:** In 2018 Croydon joins the South London Waste Partnership (SLWP), an integrated waste management contract with savings of c. £4m per annum. Croydon will be working with the other SLWP boroughs to ensure an intelligent, consistent approach to waste collection and street cleansing services. As part of the new operations, there is to be a review of the current street cleansing schedules in order to adopt a more dynamic, demand management approach and where possible, align sweeps to waste collection days. Included in the new approach will be a move away from scheduled sweeps and instead the adoption of a specification-based approach. This will ensure that sweeping frequencies are reviewed where standards regularly drop below an agreed level. These standards will continue to be based on NI195 grading to ensure a consistent monitoring approach, which will be used by all SLWP boroughs as part of monthly Service Performance Indicator reporting.
- **Developing Information Technology:** Developing Croydon's street cleansing schedule online to provide better information on last and next cleanses

via integration with Veolia's demand management system. Improved reliability of My Croydon smartphone app to report fly-tipping effectively and increased scope of the app to allow a greater range of street care issues to be reported.

- **Develop communications:** Continue developing a communications strategy that encourages behavioural change as these help to build relationships and increase public knowledge. More work with letting agents and landlords is making the best use of the Selective Licensing scheme. Joint working between cleansing team, Enforcement Team and housing officers identifies hotspots and educates local residents. Unfortunately, public perception surveys are not carried out as frequently as they once were, but where surveys are carried out (for example in council housing areas), waste, cleansing and antisocial behaviour are seen as key indicators and will continue to be monitored for improvements.
- **Better Enforcement:** Greater intelligence-led approach leading to tackling fly-tips and environmental crime with a continued focus on enforcement and prosecutions, including increased communication between Croydon's Enforcement Team, Monitoring Officers and Veolia. Increasing issuance of fixed penalty notices for fly-tipping and environmental crime include the new £400 Fixed Penalty Notice. Continuation of time-banded waste collections and working with local businesses ensures responsible waste management. While this is a relatively new initiative, over time it is hoped that the results will show a sustained increase in compliant businesses. Through continued

monitoring and analysis of fly-tipping instances, including hotspots, attempts will be made to identify any correlations between enforcement and community engagement work, and the level of fly-tipping. Elsewhere, adoption of automatic Number Plate Recognition systems at Household Reuse and Recycling Centres will help identify site abusers. This information will be shared with Croydon's Enforcement Team where there is thought to be a breach of Duty of Care obligations or a risk of fly-tipping.

The above activities and service improvements will continue to enable Croydon to become a national leader in efforts to tackle fly-tipping. With positive changes already taking effect in the area, it is recommended that other authorities take a similar integrated approach of technology, enforcement and community engagement in tackling street cleansing issues.

## CONCLUSION

A key objective of the London Borough of Croydon is to address the issue of fly-tipping. This article has provided an overview of some of the initiatives that the council has put in place around education and enforcement to tackle fly-tipping. Preliminary findings show that between 2016 and 2017 there has already been a reduction in fly-tipping of 5,000 incidents. Additional findings from these initiatives are being gathered and the hope is that the collective impact will show a decrease in fly-tipping in the borough over time. This then will serve as a useful guide for other boroughs who are working to tackle the issue of fly-tipping.

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