Social Debitage: An archaeological and social exploration of the patterns of improper cigarette butt disposal on a university campus

by

Walker Tottman
B.Sc., University of Victoria, 2020

An Essay Submitted in Partial Fulfillment
of the Requirements of the

HONOURS PROGRAM

in the Department of Anthropology

Abstract:

Abstract: Around the globe, trillions of cigarettes are improperly discarded into the environment every year. As the world's most frequently littered item, and made with non-biodegradable materials and toxic chemicals, cigarette butt litter poses serious environmental concerns. Existing studies suggest both smokers and non-smokers espouse negative attitudes towards cigarette butts, and cigarette smokers are increasingly stigmatized. My research studies cigarette littering on the University of Victoria's recently designated no-smoking campus, and asks: Are there spatial distribution patterns in cigarette butt littering related to features of the built environment? Additionally, does the seemingly innocuous activity of cigarette smoking provide deeper insight into social norms and attitudes around garbage and the environment? I collected approximately 8000 littered cigarette butts from the university campus, recording data on their location and condition. My findings indicate a high occurrence of non-designated smoking occurring within the campus, predominantly in areas that are conveniently located, provide shelter from the elements, have seating, and are well-obscured from outside view. Drawing from archaeological and social-cultural studies on waste and value, I argue social norms make the creation of trash illicit and stigmatized, and counterintuitively reinforce the improper smoking behaviours that create litter and pollution. Fostering open dialogues about the issue of cigarette butt littering, rather than marginalizing smokers, is a needed shift in mindset.

Keywords: cigarette littering, garbage, social avoidance of waste, pollution, stigmatization, environmental protection.

Table of Contents

Introduction:

As the world's most frequently littered item and comprised of non-biodegradable materials and toxic chemicals, cigarette butts pose both ecological and economic concerns (Araújo and Costa 2019; Novotny and Slaughter 2014; Novotny and Zhao 1999; Sawdey et al. 2011; Torkashvand et al. 2020). Therefore, an inquiry into cigarette disposal practices offers a unique perspective into the social conceptions of littering behaviours and attitudes around garbage. Existing studies suggest both smokers and non-smokers espouse negative attitudes towards cigarette butts, and cigarette smokers are increasingly stigmatized, particularly in the Canadian context. My research focuses on cigarette butt pollution on the recently designated no-smoking campus of the University of Victoria (UVic) in an attempt to elucidate factors responsible for improper littering behaviours. I estimate the predominance of improperly disposed cigarettes, consider some of the social and environmental factors responsible, and conclude with suggestions to address the issue.

Within this research, I ask: *Are there spatial distribution patterns in cigarette butt littering? Do features of the built environment influence cigarette discard behaviours? And, finally, does the seemingly mundane activity of cigarette smoking provide deeper insight into social norms and attitudes about garbage and the environment*?

Data and Approach:

To answer these questions I use a combined archaeological and social-cultural anthropological approach.

The archaeological lens uses the framework of garbology to investigate modern material culture. Specifically, my research data are counts and distributions of cigarettes from within a no-smoking portion of the UVic campus, as well as from a select few designated smoking sites.

The social-cultural anthropological framing provides the theoretical approach for analyzing these data I generate. Additionally, I use research and survey accounts of smokers' attitudes and behaviours regarding cigarette butt littering to corroborate the archaeological data, by means of providing comparative values for cigarette disposal habits in other locations.

Argument:

I argue that cigarette smokers find themselves amidst a confluence of untenable social circumstances, the results of which yield paradoxical and maladaptive behaviours. Deliberate littering can be a defiant way of acting out and resisting. Additionally, littering frees the individual from remaining in contact with a substance that society perceives as contemptible. At the University of Victoria, cigarette smokers are smoking in non-designated areas and littering as a form of resistance to the stigmatization they face, yet simultaneously their littering behaviours align them with, and reproduce, the social-norms of the very same community that disparages and stigmatizes them.

Significance of Research:

On its most surface level, this research is important because cigarette butts are non-biodegradable and contain toxic chemicals that harm the environment. Beyond these ecological issues, there is an economic incentive to reduce cigarette littering, given the large amounts of money spent cleaning up littered cigarette butts (Araújo and Costa 2019; Sawdey et al. 2011; Torkashvand et al. 2020).

More crucially, cigarettes present a unique opportunity to learn about broader social relations with garbage. The accumulation of improperly discarded cigarettes in the environment is mostly, if not entirely, the result of an equal number of deliberate, individual discard events, the kind which form "strong habits" (Miller and Burbach 2017, 9, 16, 19).

Cigarettes are the single most frequently littered object in the world, on a per-discard rate (Novotny and Slaughter 2014), and yet the trillions discarded annually are often disregarded by many people. This is due in large part to their benign appearance as a compostable substance, and their small size that distracts from their aggregate impact (Novotny and Slaughter 2014; Falsone and Spence 2017). As cigarette littering is not an isolated geographical or cultural phenomenon, it represents an important area of study that provides a window into broader social perceptions on littering and garbage.

Structure of the Essay:

In this essay, I begin with a literature review to situate my study amidst current research on smoking and cigarette discards. Then I define my analytical framework using social theories on garbage, waste, and littering. Next, I describe the results of my data collection, followed by a discussion of this data in corroboration with other scholarly sources. Finally, I summarize the research, and conclude with policy recommendations and strategies to help reduce the occurrence of this and other forms of litter.

A few notes on terminology. The term "designated smoking area" refers to those areas expressly stated within the UVic Smoking Policy (as seen in Figure 1 in *Methods*). All other areas of smoking are referred to as "non-designated." The term "garbage," despite its varied cultural connotations, is defined as the waste product of human consumption; and "litter" as a

subset of garbage, that which is deposited directly in contact with the natural environment (Drackner 2005; Groombridge 2013). “Discarded cigarettes” or “cigarette litter” are periodically also referred to as “cigarette butts,” which are primarily comprised of the plastic cellulose acetate filter of the cigarette, and may or may not have remnant tobacco and rolling paper attached., “Proper” discards denote any discard of a cigarette directed into a trash receptacle of some sort or a deliberately designed smoking ashtray (hereby also termed “smoking pole”). An “improper” discard refers to anything that is not a proper discard, i.e., littering the cigarette butts on the ground.

Literature Review:

Around the entire globe, cigarette butts are the most frequently littered item by count, and people more readily litter cigarettes than other forms of litter (Bator, Bryan, and Schultz 2011; Falsone and Spence 2017, Novotny and Slaughter 2014; Sibley and Liu 2003).

Throughout various circumstances and contexts littering is a significant issue, and two studies showed that rates for improper discards for all materials ranged from 25%-60% (Al-mosa et al. 2017; Bator, Bryan, and Schultz 2011). Regarding cigarettes in particular, the frequency of improper discards varies greatly based on environmental context. In areas that are more open and visible, with clear signage and low amounts of pre-existing cigarette butt litter, 32% of smokers improperly discarded their butts (Curnow and Spehr 2017). In areas that have high amounts of pre-existing cigarette litter, lack signage, and have insufficient or absent disposal receptacles, the improper cigarette discard rates are as high as 80% (Curnow and Spehr 2017). The presence of pre-existing cigarette litter is a commonly cited reason for further littering, as it implicitly

signifies to smokers that smoking and littering is acceptable (Falsone and Spence 2017; Schultz et al. 2013). In contrast with low-visibility areas, places with a high degree of visibility more readily convey the social cues associated with proper disposal of cigarettes, and thus have lower rates of improper discards (Curnow and Spehr 2017).

Data from New South Wales and Denmark suggests smokers often acknowledge their cigarette littering is a harmful action, and yet continue to litter only in a more discrete manner (Falsone and Spence 2017; Lozev 2015). Additionally, when confronted about their discard behaviours, individuals are not generally open to admitting to their actions. For example, in Curnow and Spehr's (2017) study, people who had been witnessed littering their cigarette butts were approached, and only half of the people admitted to littering (Curnow and Spehr 2017). This highlights how smokers readily acknowledge social norms, and attempt to align with them despite not actually changing their behaviours (Miller and Burbach 2017).

As increasingly health-conscious societies are changing their smoking policies,, smokers are facing growing stigmatization (Bayer and Bachynski 2013; Falsone and Spence 2017; Valiente et al. 2020). There are various reasons smokers feel as though they have been wronged: smoking bans remove cigarette smokers to specified and isolated areas; cigarettes have an increasingly high cost due to taxation to the government; anti-smoking campaigns reframe their smoking practices as illegal; smokers believe themselves to be judged by non-smokers; and smokers feel socially ostracized (Falsone and Spence 2017, 15, 21, 36). Smokers are thus marginalized due to the increasing social pressure to smoke less or quit entirely (Falsone and Spence 2017).

Based on their research in New South Wales, Falsone and Spence (2017) note that making littering more socially unacceptable has, ironically, increased littering rather than

fostering proper disposal behaviours. Responding to worries about potential shaming from non-smokers, smokers may increase covert littering to quickly conceal the evidence and reduce internal anxieties. Additionally, the loss of social acceptance can force smokers into areas that lack infrastructure and proper disposal receptacles, or, by having their actions labelled as "illicit", it can cause some smokers to be indifferent about their smoking and littering behaviours altogether (24-25).

Responding to this stigmatization and marginalization, forms of resistance emerge. Many challenge the rules by smoking in places designated as "no-smoking.". Additionally, evidence from Sweden, Denmark, Australia, and the USA, suggests some smokers deliberately litter or flick their cigarettes away rather than place them in a proper receptacle (Baker 2016; Falsone and Spence 2017; Lozev 2015; Rath et al. 2012; Smith and Novotny 2011).

Considering smokers' attitudes around garbage in general, many of Falsone and Spence's (2017) study participants in New South Wales felt that garbage cans were "dirty" and "gross", and participants did not want to interact with them. Additionally, smokers noted that they littered because they "[did not] want to carry around dead cigarette butts in packets or pockets" (24), that "they stink and make your hand stink," and "they will also make your bag stink" (26). In the USA, citizens expressed concerns when initiatives related to garbage or recycling took place, simply because they worried about coming into contact with the "taint of garbage" (Rathje & Murphy, 1992: 208). Similarly, for middle-class Brazilians, association with garbage is connected with pejorative attitudes and poses a liability to one's status (Machado-Borges, 2017).

Regarding smokers' justification for littering, Rath et al. (2012) conclude that a primary factor responsible is the belief that cigarette butts are not considered litter. Many smokers are either uncertain of the material composition of cigarettes, with some believing them to be benign

and made of only cotton, and perceive that there is no environmental impact from their littering behaviours (Miller and Burbach 2017, 21, 25, 49; Rath et al. 2012, 2198). In actuality, despite their cotton-like fiber appearance, cigarette filters are made from a non-biodegradable plastic called cellulose acetate. The filters also contain toxic chemicals, heavy metals, organic pollutants, and they release toxic nanoparticles into the environment upon photodegradation (Novotny et al. 2009; Torkashvand et al. 2020). Approximately 4.5 of the 5.5 trillion cigarettes smoked annually are expected to have theses filters in them (Novotny and Zhao 1999).

Analytical Framework:

A Social Conception of Garbage:

I begin with an investigation of Mary Douglas' (1966) notion of "dirt" and social taboos. The things termed as "dirt" are social constructs, described as "matter out of place". This has a relative context to it, a result of implying that some things have a proper place and everything else is the "rejected elements of ordered systems" (35-36). The notion of "purity" is therefore associated with everything in its place, and proves an important guiding element for how people structure their actions and how they interact with their surrounding environment. Additionally, the "quest for purity creates problems" for many as people try to balance the needs of the circumstance (164). This is evident in how society needs to engage with garbage in order to deal with it, requiring social awareness that it is a problem without being such a problem as to cause people to distance themselves from the garbage because it is an "undesirable" object.

Next, Appadurai's (1988) ideas of value creation is an apt framework. Value is not "an inherent property of objects, but is a judgement made about them by subjects" (3). As an object

circulates through space and time, it takes on different forms of value, and "garbage" is just an object that has lost its value. Appadurai aptly shows how the worth of a given object is a culturally defined value-judgement, and thus provides a useful analytical framework for reinterpreting what might otherwise be considered an immutable aspect of an object: its value.

Douglas and Appadurai's theoretical frameworks are complementary with one another. Each circumscribes the way societies conceptualize their relationships with objects, and provides a means of considering how people rationalize their actions. More crucially, they are both framed in a way that draws attention to the social construction of these notions. Altogether, they highlight that the value of an object, and the way people interact with it, is not a given but rather a social construct, and therefore capable of being redefined and adjusted. This framework provides a means of exploring the rationale in how people interact with cigarettes, the way their value changes as they turn from cigarette into cigarette butt, and why people respond in particular ways to the littered cigarettes. Ultimately, it is suggestive that there is great room for changing the ways smokers (and people in general) interpret cigarette butts and garbage, and this where solutions to cigarette littering will stem from.

Actions and Reactions that Create Litter and Pollution:

Bourdieu's *Habitus* (1977) provides another lens for inquiry. It is defined by Bourdieu as "structured structures predisposed to act as structuring structures" (Bourdieu 1977, 72; Mackie 2001), and conceptualizes the "evolving process through which individuals act, think, perceive, and approach the world and their role in it" (Costa and Murphy 2015, 7). This is useful in that, under this theory, actions are unconsciously created and reinforced by social circumstances until habits form (Miller and Burbach 2017). In the context of environmental implications, considering the works of Cialdini (2015), Schultz et al. (2013), and Al-mosa et al. (2017), there

is corroborating evidence that littering patterns can be highly influenced by the physical environment, and there is a positive correlation between littering rates and the presence of pre-existing litter. With regards to improper smoking behaviours, it may be argued that there is a positive feedback loop wherein exposure to pre-existing cigarette litter unconsciously signals that smoking and improper discards is acceptable (Curnow and Spehr 2017; Falsone and Spence 2017; Valiente et al. 2020). A critical point here is the unconscious and unintentional way that the environment may be supporting such improper smoking behaviours (Mackie 2001). Considered as a whole, this fits with the theory of *stigmergy*, wherein an interaction with the environment increases the signal that supports the original interaction, instilling a positive-feedback loop.

The Visibility of Waste:

By convention, garbage is routinely made invisible, being quickly removed from an individual's immediate awareness. Emerging from Douglas' concept of "purity," De Coverly et al. (2008) described this as the *social avoidance of waste*. Interestingly, however, this does not mean limiting the creation of waste, but rather briskly and expediently removing any waste that is generated. Thus, they conclude, society fails to ever acknowledge and experience the true implications of their waste (291). In a strange paradox, participants in their study readily acknowledge the ubiquity and inevitability of waste with modern consumerist societies, and yet equally find themselves uncomfortable when exposed with their own trash (297). This reticence to be associated with garbage relates to cigarette smoking because, as previously mentioned, the majority of cigarettes are made with a filter, and therefore smoking cigarettes in its modern form will inherently create a waste by-product. Therefore, the social conception that is predicated on

the avoidance of garbage is influential in the way people interact with their cigarette butts (Bayer and Bachynski 2013; Falsone and Spence 2017).

Methods:

This research uses a mixed-method comprised of quantitative and qualitative data, derived from archaeology and social-cultural anthropology.

Situating the Cultural Context:

This study takes place at the UVic campus, located in Victoria, BC, Canada. UVic is a campus with approximately 21,800 undergraduate and graduate students, and 900 full-time faculty. The majority of students are between the ages of 18 and 23 for undergrads, and between 23 and 30 for graduate students (University of Victoria 2013a and 2013b). Although smokers might also be staff members or non-students students, there is no data available for visitors or other staff. The university was a "gold star" performer in the 2017 Sustainable Campus Index, indicative of UVic's perception as a socially responsible institution (University of Victoria, a).

Responding to worries about second-hand smoke, in 2011 UVic enacted a smoking policy prohibiting smoking of cigarettes (and marijuana as of 2018) on the campus except at designated smoking areas outside of Ring Road (University of Victoria, b).

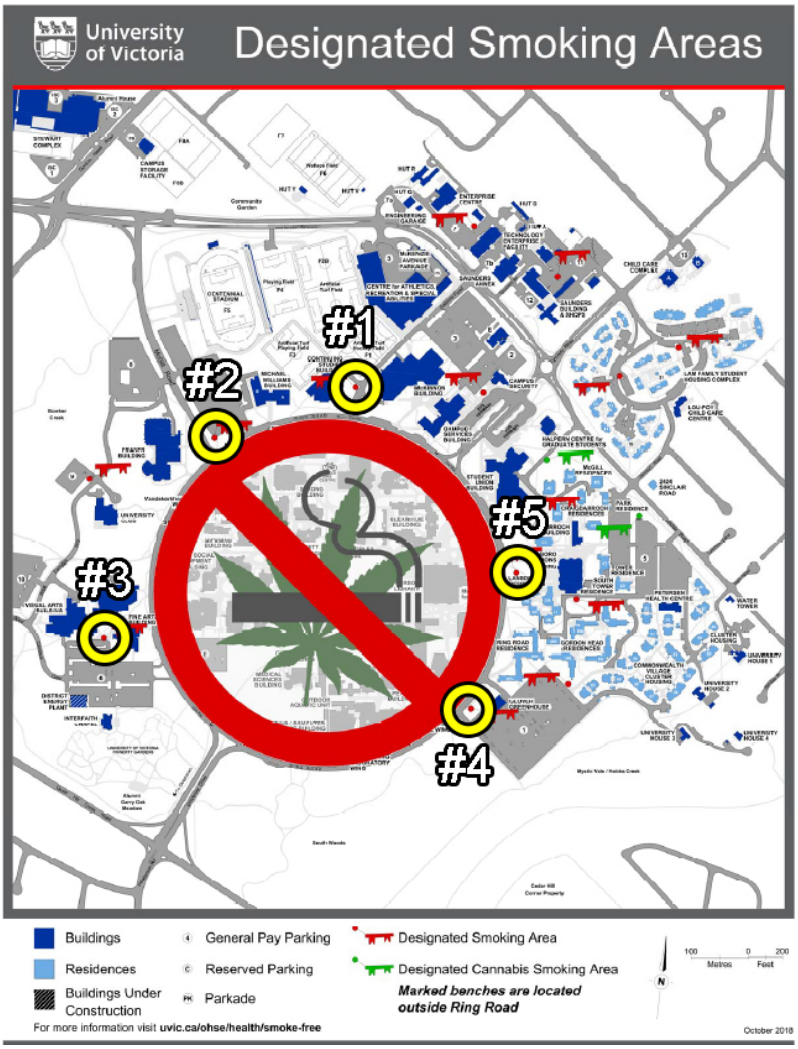

Figure 1 - Designated smoking areas at UVic. Selected designated sites studied in this research are highlighted within the yellow circles and numbered accordingly. Note that all other designated sites are increasingly more distally located from the main campus inside Ring Road. The non-designated area that I cover in this study is area residing within the perimeter of the "no" symbol (see Figure 2).

Archaeological Data

There are two main areas of study for generating these data: those of designated smoking sites, and non-designated smoking areas.

I studied five designated sites, those closest to the inner campus on the outer perimeter of Ring Road (Figure 1). Each designated smoking site has a bench and a "smoking pole" directly adjacent to it, with clearly marked signage saying that smoking is permitted. I coordinated with UVic Facilities to discontinue any cleanup at these sites for the length of my study. On February 9th, each site had detailed photographs taken. Next, I cleaned up all cigarette butts from the ground, and emptied out the smoking poles. Although there were perhaps a few missed cigarettes butts, this initial site survey provides the baseline of essentially zero cigarettes on the ground and in the smoking poles. Twenty days later, on the 29th of February, I returned to each site and performed the same survey method: photographing the area, collecting the entirety of the littered cigarettes from the ground, and cleaning up each smoking pole. With this information, I generate a ratio of proper-improper discards.

For the non-designated smoking areas occurring within Ring Road, I performed a systematic survey of the entire campus, noting the location and condition of all littered cigarette butts (Figure 2). One hundred percent coverage of every path and walkway was achieved by walking transects in a systematic manner, and marking the area covered on a map, alongside a GPS for later confirmation. Areas of grass and lawn that appeared to be undisturbed were generally not covered, although exceptions were made, for example, as I made sure to cover the central quad. The distance between transects varied with the surface conditions, rationalized ad hoc to ensure that I maintain enough detail of the ground to notice any possible cigarettes. I would estimate this at approximately three meters on either side of me when on an open and road, and approximately one meter when the was lots of ground cover. Additionally, some parking lots were not covered, as well as a few currently under construction, those on the north side the MacLaurin building, and to the southeast of the library. A photo was taken for each

collected cigarette using an iPhone camera, with a piece of Duksbak graph paper used as a scale bar. Although the photos are automatically geotagged, I also used a handheld GPS device with greater accuracy than the iPhone's built in location services, typically between (+/-) 3-4 meters. Upon returning from the field, the photos were updated with these more accurate GPS locations.

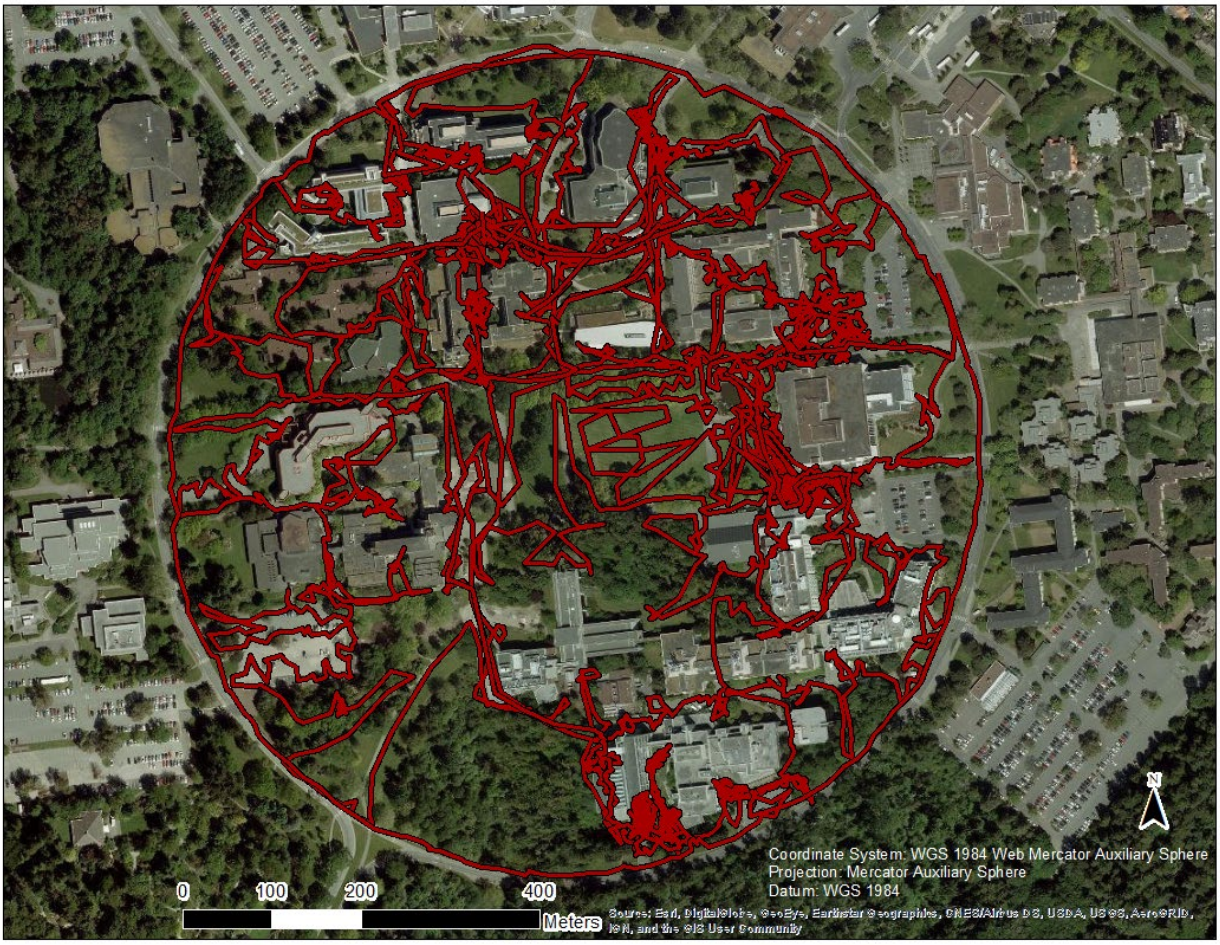

Figure 2 - Survey coverage area, representing approximately 33 km of surface area.

Post-survey analysis consisted of using a GIS software (ArcGIS v.10). First, the *Geotagged Photos to Points* tool was used to plot the locations of each cigarette discard in their accurate geographical context, using the associated GPS coordinates within each photo's

metadata. ArcGIS was further used to analyze the data, with a kernel density estimation highlighting the "hotspot" areas that had the proportionally greatest amount of cigarette discards. The output cell size was automatically set at 2.209 E -05, and the output value was based on predicted densities.

Social-Cultural Data:

For the social-cultural side of my research, I investigate prior scholarly accounts on smokers, alongside literature analyzing social attitudes around garbage most broadly speaking. A majority of studies take place in New Zealand, Australia, and throughout the USA.

To further bolster my research, I performed a comparative analysis of previous studies on cigarette discarding frequency, thereby attempting to corroborate prior estimations on the severity of the issue from a global perspective. I considered only the values of observational reports on cigarette discard rates. Ten studies were used, featuring 11 records of discard rates. Where available, additional information comprising of location, "n", variation, and group dynamics were included.

Results:

Analysis of Littering Frequency:

An overview of the current scholarly understanding of the frequency of cigarette littering helps to corroborate these data I have generated.

It is estimated that 5.5 trillion cigarettes are smoked annually around the globe (Mackay and Erikson 2002; Novotny and Zhao 1999). In quantifying the global rate for improper discards, a frequently quoted figure is that approximately 4.5 trillion of these 5.5 trillion are littered (e.g.

Araújo and Costa 2019; Booth et al. 2015; Dieng et al. 2014; Micevska et al. 2005; Moerman et al. 2011; Mohajerani et al. 2017; Novotny and Slaughter 2014; Ou et al. 2016; Torkashvand et al. 2020). Despite being so frequently cited, upon inquiring into the original source of this figure, there is nothing to be found. None of the papers that quote this figure perform their own research, and they frequently reference either another previously cited paper, a newspaper article that provides no original sources, or a resource such as a website that is no longer available. On this last point, the internet archive "Wayback Machine" also yielded no results. It is my opinion that Novotny and Zhao's 1999 paper has been misquoted. They calculate that there are 4.5 trillion cigarettes containing filters as a subset of 5.5 trillion cigarettes smoked in total (therefore with approximately 1 trillion not containing filters). The paper is referring to there annually being 4.5 trillion filtered cigarettes discarded *somewhere* in the world, yet they are not suggesting these cigarettes are all necessarily improperly discarded.

In an attempt to more accurately estimate the predominance of cigarette littering, I analysed of ten studies (Figure 3). From the variation in discard rates, we can see it is highly context dependant. Regardless, considering all observations, the evidence suggests a majority of cigarettes are improperly discarded, with an average of 61% of disposed of into the environment as litter. Based of this figure, as 4.5 trillion filtered cigarettes are smoked annually, we can infer that approximately 2.7 trillion cigarettes may be littered each year throughout the globe.

Granted, this is not a rigorous meta-analysis, but it nonetheless provides an approximation that, although below the often-cited 4.5 trillion, is still exceptionally high.

			Additional Information:	
Authors:	**Improper Discard Percentage**	**N=**	**Location:**	**Variation:**
Patel, Thomson, & Wilson, 2012	76.7%	219	Along streets. Wellington, New Zealand	95%CI of 70.8-82.0%
Curnow & Spehr, 2017	52%	2700	New South Wales (NWS), Australia	Varied from 80% in "hotspot" areas, to 32% in "streamlined" areas.
Wilson, Oliver, & Thomson, 2014	84%	112	At bus stops only. In Wellington & Lower Hutt, New Zealand	95%CI of 77-90%
Schultz, Bator, Large, Bruni, & Tabanico, 2013	65%	530	USA: 44 urrban, rural, and suburban sites throughout ten states.	
Sibley & Liu, 2003	64.4%	181	Victoria University, Australia	
Bator, Bryan, & Schultz, 2011	45%	31	USA: Arkansas, California, Georgia, Kentucky, New Mexico, Nevada, New York, and Vermont	
" "	57%			
Novotny & Slaughter, 2014	33%		Tacoma, Washington, USA. 2010.	
Lozev, 2015	88%	5380	Roskilde University canteen, Denmark, 2014	
Callaham, 1995	45%	148	Richmond, Virginia	
Miller & Burbach, 2017	56%	244	All on Beaches on Jekyll Island, Geogia, USA	Ages 19-66 (Mean age 39 years), equal males and females
Average:	**61%**			
Estimated Global Improper Discards (4.5 of 5.5 trillion)	82%			

Figure 3 - Results from an analysis of ten studies observing the rate of improper cigarette discards

To corroborate the above discard rates, I calculate the ratio of proper-improper cigarette discards at five designated smoking areas at UVic (Figure 4). On average, approximately one-third (34%) of the cigarettes smoked at these sites were littered on the ground. Additionally, on February 29th at Site #5, the cigarettes from within the smoking pole had been dumped onto the bench. As such, I counted them as a separate subset in between proper and improper. For the final calculation, they were included in the "Improper" average. When they are excluded, the average improper discards at Site 5 on February 29th is 42%, with a total average across all sites dropping from 34% to 29%, which is still a relatively high amount of littering. As is evident from the count of cigarettes, some sites are used more than others. Sites #1 and #5 had the most amount of use over the 20-day period.

		Cigarette Location:						
Date:	**Site**	**Ground**	**(Bench)***	**Pole**	**Total Cigarettes Smoked:**		**% Improper**	**% Proper**
Feb 9th								
	#1	158		450	608		26%	74%
	#2	112		301	413		27%	73%
	#3	38		95	133		29%	71%
	#4	43		313	356		12%	88%
	#5	190		564	754		25%	75%
Feb 29th								
	#1	95		181	276		34%	66%
	#2	100		58	158		63%	37%
	#3	7		36	43		16%	84%
	#4	20		160	180		11%	89%
	#5	292	382	22	696		97%	3%
Total		1055		2180	3617	**Average Percentage:**	**34%**	**66%**

Figure 4 - Results from cigarette collection at designated smoking sites on the UVic campus (for site map see Figure 1).

From an anlysis of cigarette discards within Ring Road, a total of 7524 cigarette butts were collected (Figure 5). Two kernel density estimations were performed, using an equal interval classification first (Figure 6), and a Jenks natural breaks (Figure 7). Figure 6 shows the nine areas with the absolute highest densities. These areas are: one on the eastside of the Business and Economics building (110 cigarette butts); two around the University Center (405 cigarette butts); one to the east of the Clearihue building (818 cigarette butts) (Figure 8); along the southside of McPherson Library (1351 cigarette butts) (Figure 9); on the western and southern sides of the Engineering/Computer Sciences building (ECS) and laboratory wing (2037 cigarette butts) (Figure 10); and in a small forested park in the south-west of the campus (98 cigarette butts, all around a single bench).

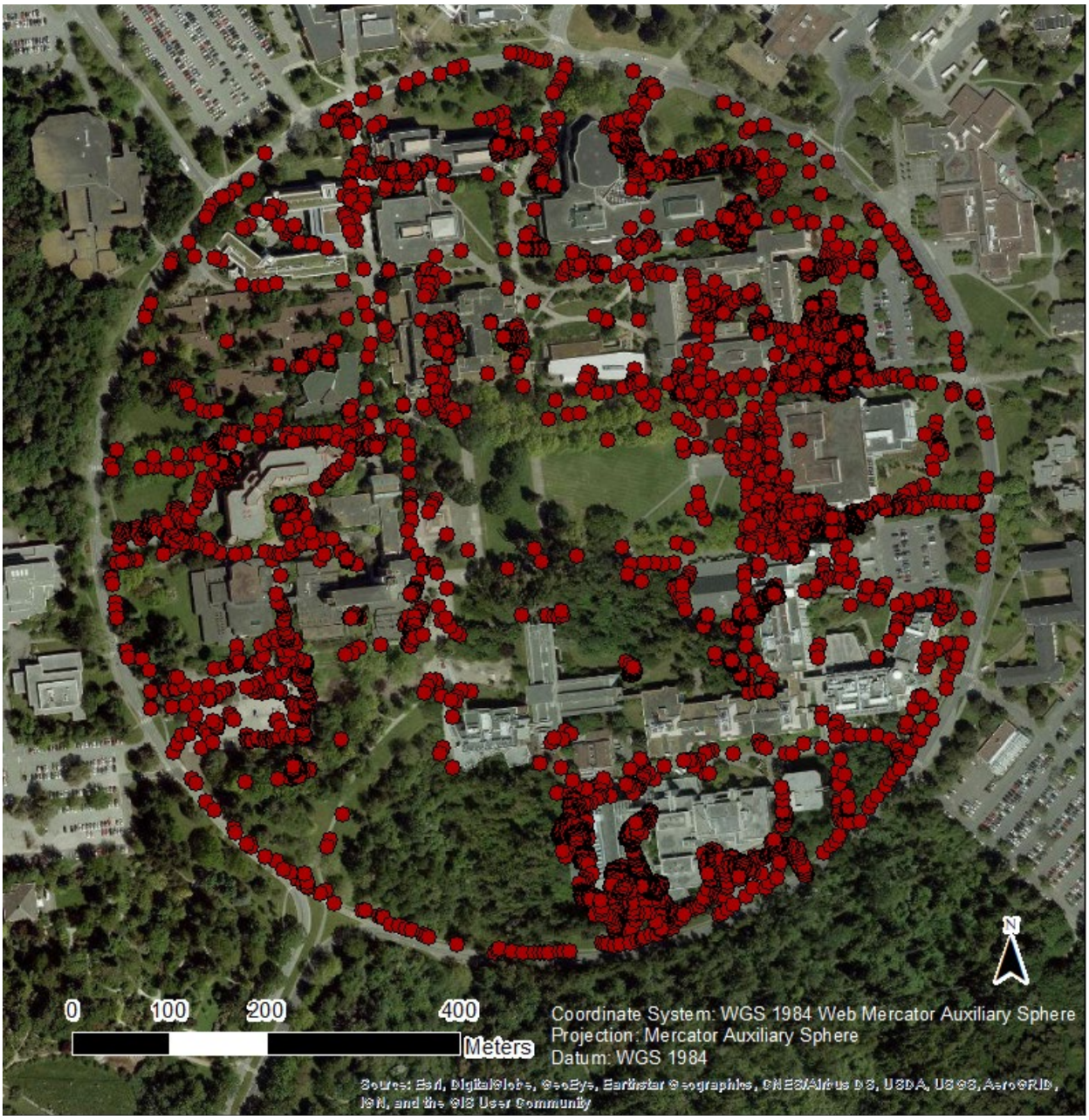

Figure 5 - Distribution map of improperly discarded cigarette butts within Ring Road on the UVic campus. Points represent 7524 cigarette butts in total.

Figure 6 - Kernel density analysis of areas of highest cigarette discards, using an equal interval classification scheme. A redder colour signifies an increase in density. Note the point of significance at the lower lefthand side of the campus, within the white circle.

Figure 7 - Kernel density analysis of areas of highest cigarette discards, using a Jenks natural breaks classification scheme. A redder colour signifies an increase in density.

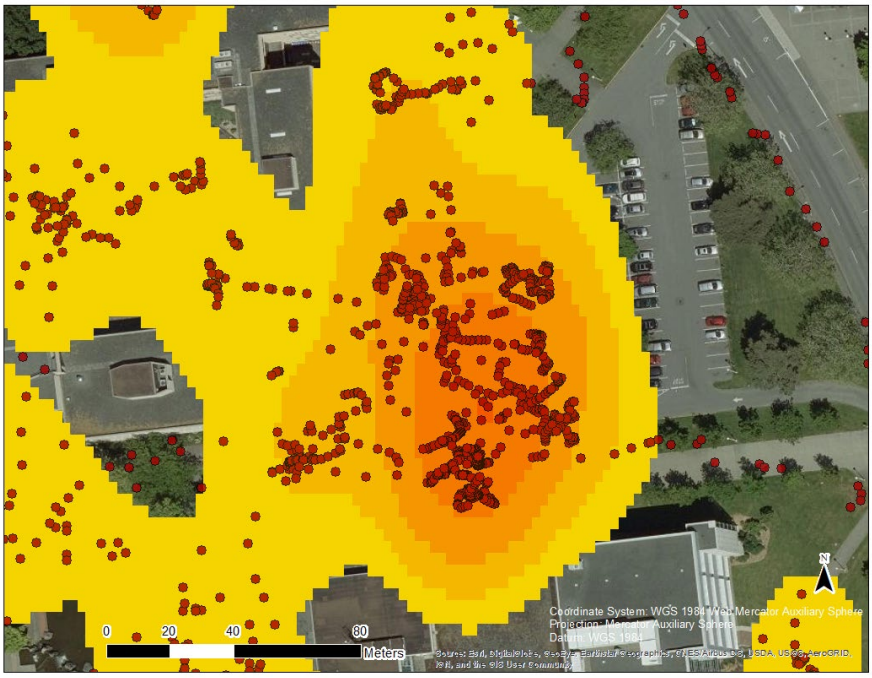

Figure 8 - Clearihue building kernel density analysis. The discards within the center of the hotspot represent 818 cigarettes.

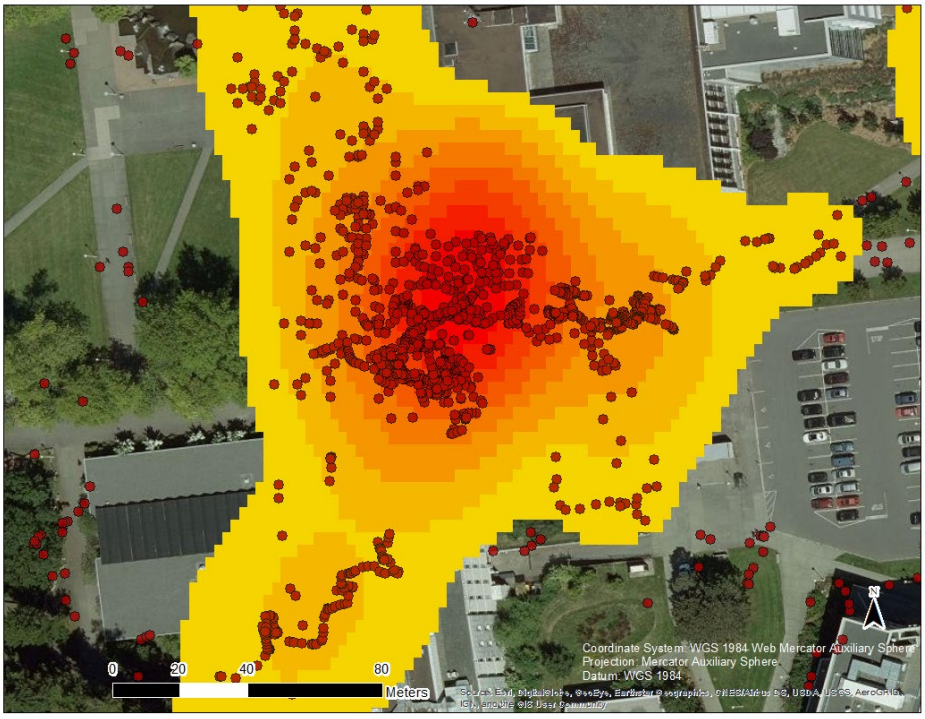

Figure 9 – McPherson Library kernel density analysis. The discards within the center of the hotspot represent 1351 cigarettes, the majority of which, approximately 800, were collected from on and within a long stretch of drainage gutter.

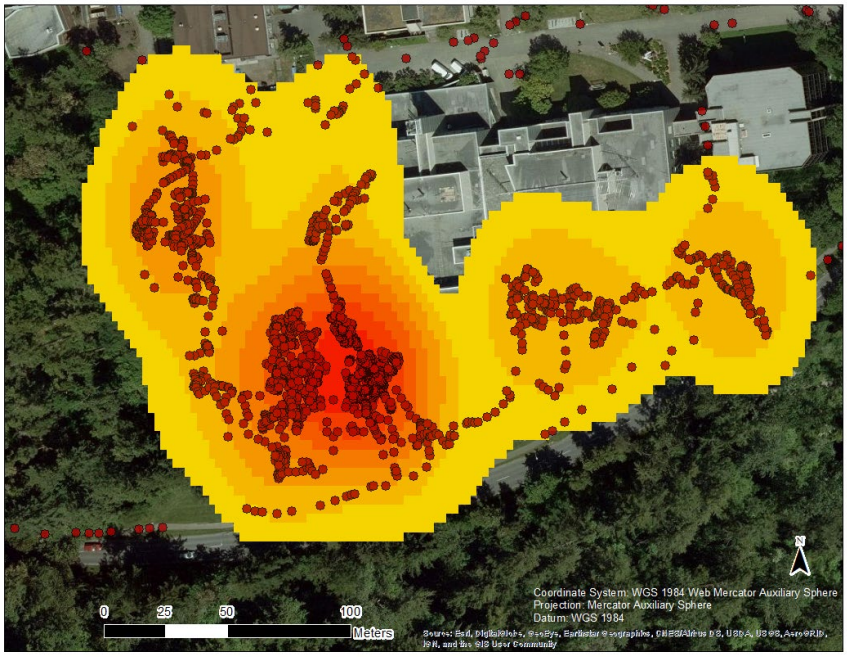

Figure 10 – Engineering/Computer Science building and laboratory wing kernel density analysis. The discards within the highlighted area represent 2037 cigarettes.

Identifying the material type of deposits, 2600 cigarettes were recovered on organic surfaces such as dirt, grass, leaves, or barkmulch; 390 cigarettes were found among small rocks and pebbles, mostly filling planter boxes; 806 cigarettes were recovered either lying directly on, or from within, sewage drains and gutters; and the remaining 3728 cigarettes were collected on cement or a similar surface.

The five areas in the upperhalf of the campus, around the Business and Economics building, the University Center, the Clearihue building, and McPhersons library are noted hotspots with shared structural features. Three were amidst stairwells, and very well hidden from outside view, one tucked behind a large generated. All of them have at least a slight degree of coverage from the elements: at the library, for example, the entire southside stretch is a sheltered bicycle storage area with a roof over top. The drainage gutter that runs the length of this area, as well, seems well-suited for collecting the cigarette butts either from wind or rain. Given that

Victoria is a coastal area and does not treat its seweage before dumping it into the ocean, this is worrisome.

In the to the south, the majority were recovered along a small walkway delineating between the ECS building and the laboratory wing. These were all found amidst the dirt, barkmulch, and in the bushes, and many of which were so deeply embedded into the dirt that they were only recognizable when closely inspected. Along the southwestern side, approximately 287 were found in four large planter boxes filled with small rocks and pebbles. The cigarettes easily slip inbetween the cracks of the rocks and become hidden from view (Figure 11). This entire building is located on the periphery of the campus, directly adjacent to two forests from botht the west and the south, and as such is not highly exposed.

Lastly, the small wooded park in the southwestern part of the campus is a secluded area with a bench. Similar to much of the discards at the ECS building, many of these were hardly recognizable as cigarette filters, as they were half-burried and stained with dirt.

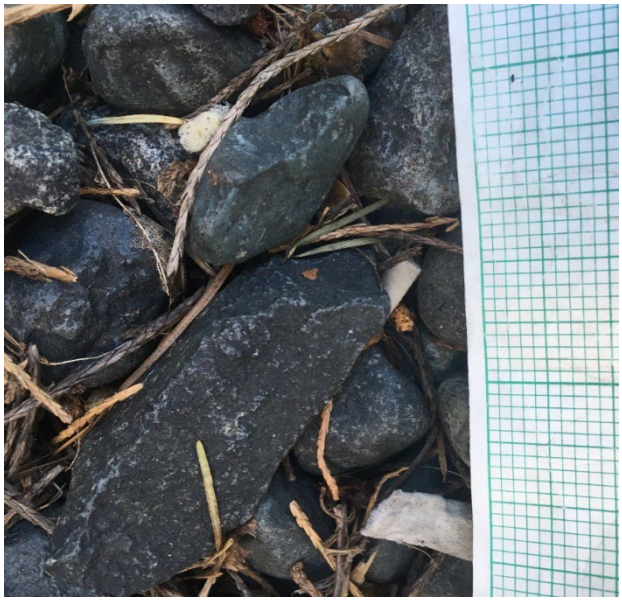

Figure 11 - One of four open planters behind the Engineering/Computer Sciences building, filled with cigarette butts as they eventually work their way between the cracks.

Discussion:

Improper Cigarette Discards:

Firstly, it is of importance to consider the frequency of cigarette littering on both local and global perspectives. As explored in the results section, other literature observing improper discard rates reveal that on average, the majority of cigarettes smoked are improperly discarded (61%) (see Figure 3). Observing the amount of improper discards at UVic's designated sites, they are approximately 34%. It is worth noting that individuals who smoke at designated sites are already making a conscientious decision to follow social expectations by their very use of a designated smoking site. It is therefore likely that smokers at these sites have higher rates of properly disposing of their cigarette butts compared with people who smoke in non-designated areas. Therefore, it is expected that more than 34% of smokers improperly discard their cigarettes when under different circumstances.

In the interior of the campus, in the area within Ring Road, the amount of cigarette litter was approximately 7524 cigarettes. Given the nature of this study, it cannot be said how many individuals who smoked in these non-designated areas properly disposed of their cigarettes. Regardless, theses data from the archaeological record imply that an equal number, 7524 if not more, individual smoking events have taken place within the campus in a relatively recent amount of time.

Factors Influencing Improper Cigarette Littering:

Based on my research, I identified four principal factors that influence the way smokers interact with cigarette butts. These are, most broadly speaking, the structure of the built

environment, the process of site formation, social pressures, and attempts at resisting stigmatization.

The Built Environment:

Miller and Burbach (2017) note the importance that the physical environmental plays in influencing behaviour, regardless of an individual's motivations. In observing my collected data, the built environment of non-designated smoking areas share several features. The non-designated smoking hotspots generally had shelter from the elements, low visibility from the view of casual passersby, and were in close proximity to central buildings (Figure 12). While most non-designated areas are centrally positioned in the campus, some reside on the outer edges. Of interest is that some are even close to designated sites, for example, the hotspot area to the left of the Clearihue building is within 100 meters of a designated site, and yet people still use the non-designated site.

Considering the site layouts, designated sites are located on the periphery of the university campus, with the closest being adjacent to Ring Road. The five designated sites I studied were those most central in the campus, directly adjacent to Ring Road, but they are still relatively far away. Additionally, none have any shelter from the elements, they are only a bench and a smoking pole. Regarding the improper discard patterns at the designated sites, sheltering features such as nearby large trees have increased amounts of cigarette litter suggestive they have been used for rain cover. According to Falsone and Spence (2017), the frequency of improper discards increases when it is raining, due to wanting to avoid getting wet walking to a designated site or walking to a bin, and because of the belief that the rain would wash the butts away in a benign manner (4, 6, 17, 25). My study took part during a part of the year when it frequently

rains, and confirms the point offered by Falsone and Spence (2017) that climatic variables have a significant impact.

All of this is highly suggestive that the designated sites, as they are spatially removed and have insufficient infrastructure to protect from the elements, are encouraging smokers to seek out novel, non-designated areas that address their needs.

Figure 12 - Areas of high discards. From top to bottom, left to right: McPherson Library, eastern wall of the MacLaurin building, inner courtyard of cornet, east wall of Business and Economics building, and northeastern section of the University Center. All but one have a roof, three are below ground level, and all except the library are unobservable from the outside.

Site Formation Processes:

Considering the question of what explains the development of these non-designated smoking areas, this is where the concept of stigmergy is appropriate. Rather than through deliberate, social planning to establish the locations, it is arguably a result of what may be termed "unintentional harmonic action" (Mackie 2001, 62). The importance of this concept is to highlight how the environment may be indirectly supportive of improper smoking behaviours, as the initial presence of smoking increases subsequent behaviours.

Previous studies suggests that the presence of litter is positively correlated with more littering (Al-mosa et al. 2017; Cialdini et al. 1990; Schultz et al. 2013). Regarding cigarettes, as a self-reinforcing activity, without conscious or explicit communication between actors, the initial occurrence of non-designated smoking and littering produces environmental conditions that signal smoking and cigarette littering is acceptable in that location (Bourdieu 1977; Ch'ng, Gaffney, and Hakvoort 2014; Costa and Murphy 2015; Heylighen 2015). Thus, we see individuals' unconscious "structured dispositions" leading to the "structured deposition" of cigarettes on the UVic campus, which then acts to reinforce the depositions (Mackie 2001, 62).

As mentioned previously, there is a generalized understanding by people that littering is frowned upon, as evinced by smokers who lie about whether they have littered, or by people who continue to litter but do so in a more discrete manner (Curnow and Spehr 2017; Falsone and Spence 2017; Lozev 2015; Miller and Burbach 2017). With this in mind, part of the reason for people's willingness to litter cigarette butts has to do with the very design of cigarettes, which lend themselves to easy concealment.

Studies suggest under average climatic conditions for the West Coast it takes approximately one month to reduce the majority of a cigarette's mass down to just the filter (Bonanomi et al. 2015). Once this happens, the cigarette filter quickly appears to blend into the natural environment, despite its toxic cellulose acetate composition never actually decaying (Araújo and Costa 2019; Novotny et al. 2009; Torkashvand et al. 2020). Figure 13 shows two such examples of the extent to which cigarette filters can blend into the environment while remaining fundamentally intact. Other additional taphonomic processes are also at play. Given their small size and light composition, cigarette butts are easily lost amidst cracks, hidden in rock (Figure 11), or carried by winds and water currents. This signifies that a great deal of improper discards are not noticed, or, if they are, they soon become disguised amidst the environment.

Figure 13 - Two examples of cigarette filters that blend into the environment unless closely inspected. For both examples, the filters were still intact when I collected them, and there were many other similar occasions as these.

With regards to the emergent behavioural harmonization implicit with a theory of stigmergy, I argue there is a balance between the rate of deterioration and the rate of accumulation of cigarettes. In areas where smoking occurs regularly, smokers are exposed to high enough volumes of littered cigarettes that they can perceive an implicit social-cue condoning their smoking and littering. Simultaneously, the continual deterioration of the cigarette filters keeps the volume of cigarette litter in check enough to assuage the environmental guilt of smokers and allows them to avoid seeing the full impact of their littering behaviours. Additionally, the overall design of the cigarette, being relatively small, and appearing like cotton, gives it a benign appearance, and causes people to think that littering cigarettes has no environmental consequence (Falsone and Spence 2017; Schultz et al. 2013).

Social Pressure:

As discussed above, implicit social cues serve to reinforce and unconsciously encourage littering behaviour. Similarly, these same social norms also influence the values people associate with objects, and thus shape how they will interact with those objects. It is in this regard that we see the general social attitudes towards garbage expressed through the way people relate with cigarette litter.

A predominant attitude in industrialized and high-economic communities is that garbage is an "impure" and "contaminating" substance that warrants social avoidance and quick removal (De Coverly et al. 2008; Douglas 1966; Drackner 2005; Furniss 2017; Machado-Borges 2017; Moore 2012). Cigarettes are no exception to this derision, and it is my contention that cigarettes may actually receive more social ridicule than regular garbage. Not only does smoking create a waste product (the cigarette butt), the very act of smoking itself is also coming under increased social scorn for its health impacts (Bayer and Bachynski 2013; Miller and Burbach 2017).

Considering that common perceptions of garbage revolve around similar "health" notions of contamination and cleanliness, it may be suggested that societies have conflated the otherwise inert item of the cigarette butt, with the health concerns of smoking. Thus, the cigarettes become a primary conduit to channel the general social attitudes of garbage. As both a literal and figurative embodiment of the negative aspects of garbage, everything that is "contaminating" and thus harmful to one's very wellbeing, the cigarette butt is something to be distanced from as quickly as possible.

Resistance in Practice:

In the 2015 Smoking Policy, the University of Victoria (2018) stated that the university is attempting to be a leader for the community by "not [endorsing] or [condoning] practices which harm health." Smoking, as a "controllable health hazard" is something to be "eliminated." This initiative, although well intentioned, institutionalizes the stigmatization of smokers. It is but one example in recent years from around the globe (Bayer and Bachynski 2013; Falsone and Spence 2017; Valiente et al. 2020). Considering the social pressures faced by smokers, it is apt to expect a form of resistance to emerge, as has been explored by others (Baker 2016; Falsone and Spence 2017; Lozev 2015; Rath et al. 2012; Smith and Novotny 2011). Using the archaeological record from this study at UVic, a few tangible pieces of evidence may be used to suggest smokers are acting out.

In a basic sense, the high degree of smoking taking place in a non-designated area is a form of resistance, albeit a very passive form. The "no-smoking" signage throughout the campus makes it generally understood the area is non-smoking, and any cigarette smoking represents a deliberate action. However, cigarette smoking is a complex nexus with associations to issues such as nicotine dependency, and as such, the evidence of smoking in non-designated places

may, in a certain sense, be a practical necessity. The point remains, however, that it is consciously divergent to the understood expectations for the circumstance.

From the discards recovered within the central courtyard at the Cornett building, a cluster of them were found directly surrounding a no-smoking sign in a small alcove (center frame, Figure 12). Such behaviour appears deliberately antagonistic. Similarly, as mentioned earlier (Figure 4), at Site #5 the smoking pole had apparently become full, and in response someone emptied it on the bench (at least, it is my educated guess that was the reason the person(s) did it) (Figure 14). By rendering most of the bench unusable, and capitalizing on what might be described by Douglas (1966) as *everything* "out of place", I suggest this action is an intentional attempt to reverses the expectations of what is socially appropriate and desirable.

These three occurrences are suggestive of different acts of resistance against an oppressive power of some sort, varied in their methods and messages, and ranging in severity (Frazer 1999; Wright 2016).

Figure 14 - Site #5. The pile on the bench represents 382 cigarettes, which I believe someone dumped from the smoking pole onto the bench.

The Paradox of Smokers:

I argue that cigarette smokers find themselves amidst a confluence of untenable social circumstances, all of which come together to yield paradoxical and maladaptive behaviours. In the context of the University of Victoria, cigarette smokers are smoking in non-designated areas and littering as a form of resistance from the stigmatization they face by society, yet simultaneously their littering behaviours are a means of aligning with, and reproducing, the same society's negative social attitudes towards garbage.

As discussed previously, the act of smoking is becoming increasingly stigmatized and regulated. Due to these regulations, staff, faculty, and students at UVic are obliged to go to the margins of the campus where the only designated sites are. In this way, smokers are treated in a similar fashion as that of garbage itself – something to be quickly whisked away. The designated sites provide some but not all of the necessities wanted by those who smoke. In response, alternative, non-designated places for smoking within the campus emerge.

These non-designated sites lack the infrastructure of ashtrays, and, with the exception of two locations within the center of the campus, UVic no longer has outdoor garbage cans. As cigarette butts are socially regarded as the embodiment of all the negative aspects of the act of smoking, smokers don't wish to be in close contact with their cigarette butt, yet there is no readily accessible means of proper disposal.

This is where littering presents itself as the desired response for a few reasons:

Deliberate littering can be a way to defy social expectations. Given that smokers are routinely socially scorned, littering cigarettes provides an express means of going against commonly recognized values of "order" or "cleanliness," and thus "sticking it to the man."

Simultaneously, the act of littering cigarettes frees individuals from the burden of association with garbage. However, by it is in this way that the littering is aligning with the same social-systems that scorned the smokers in the first place.

Yet, the presence of pre-existing cigarette litter operates as an unconscious queue to encourage more improper discard behaviours. This is the positive feedback loop. Additionally, as cigarettes are routinely removed from an area by natural taphonomic processes, any environment guilt felt by littering is assuaged, as the cigarette butts are soon out of sight and out of mind, much the same way society deals with garbage.

This paradox is a problem that Douglas (1966) touches on, something that emerges from the desire for order and purity, and we see it regarding society's present conceptions of garbage. It operates similar to a catch-22. Littering as resistance depends upon the social construction of garbage as a contaminating substance. If society did not believe garbage to be harmful, there would be no way to use it as a form of resistance. However, there is a balance needing to be found here between dislike and a total embracing and outright "love" of garbage. If society believed garbage was not inherently harmful, if it cared more about the potentially constructive value that garbage might have instead of simply as contaminating, then smokers likely would not be so stigmatized either. Ironically, without this stigmatization, there would be nothing to resist against, and so no littering; and nor would there be social pressures making people want to distance themselves from garbage, and thus no littering either.

Suggestions for Policy Implementations and Future Directions:

With the above in mind, I synthesize the supporting evidence to conclude on the implications for the University of Victoria's cigarette littering. Without an adequately supportive

social and physical environment, UVic has not "[eliminated] a controllable health hazard" (University of Victoria 2018), but rather has pushed a pre-existing issue into the margins. As the 7500 littered cigarette butts I collected will attest to, this policy has not stopped smoking, and in what is a bittersweet irony, it may have actually had a detrimental impact to the environment with the increased covert smoking.

My belief is that a change in attitude by both smokers and policy makers might improve the situation.

Improper littering is often a self-reaffirming action, as it immediately and effortlessly frees smokers from their worries about how to interact with the cigarette butt. So while there are mechanisms in place that reinforce improper littering behaviour, and some which punish the improper behaviours by way of fines, the reinforcement of appropriate cigarette butt disposal is infrequent and represents an area with great potential (Falsone and Spence 2017, 8).

Additionally, although there is plenty of signage stating an area is smoke free, rarely (if ever) does the signage direct people to the nearest designated smoking area (Falsone and Spence 2017, 25). In UVic's context, rather than "no-smoking" signs, perhaps it would be opportune to put signs up in the areas of high non-designated smoking that give directions to designated smoking areas. , I wonder whether putting ashtrays on no-smoking signs might be counterintuitively productive. Although on the one hand it may be seen as encouraging smoking, on the other hand by making smokers interact with the no-smoking sign it may help nudge them towards more proper discard behaviours.

For smokers and policy makers, returning to the notion of stigmergy as an unconscious, non-directed positive feedback loop provides a means of reaching progressive changes. By

preventing the initial improper behaviour in the first place it is suggested that the improper behaviour unlikely to take off. Similarly, when people see others cleaning up an area they are more likely to treat the space with respect. On this note, as a personal anecdote, when I was cleaning up cigarettes off the ground at Site #2, someone arrived to smoke. As I was racing around to collect the cigarette butts, upon their own initiative this person picked up a few littered cigarettes and passed them to me. By picking up pre-existing litter, it begins to disrupt the unconscious habits that forms around improper littering behaviours.

Overall, in whatever manner it presents itself as, I encourage the UVic campus to create more inclusive and safe spaces for smoking that reduce stigmatization, provides for the needs of smokers, and fosters an awareness of the impacts of cigarette pollution. Marginalizing littering, rather than marginalizing smokers, is a useful shift in mindset for facility designers, policy makers, and staff and students alike.

Future Directions of Study:

Although I have attempted a robust study, there are some areas of inquiry which have not been addressed in my project. My data was generated through only one season (during the transition from winter to spring), and as such the climatic conditions likely influenced the desire for "shelter" that was evinced . If there was less need for shelter and therefore more use of the benches, the increased proximity to the smoking poles might also increase the use of the poles. Additionally, the focus on designated sites may have influenced the discard rates, as people who are visiting designated sites are already performing the socially approved "proper" way of smoking. Lastly, as a function of my methodology, there is no information generated about how many proper disposals occur from people who smoke at the non-designated sites within UVic.

Although this is not the direction of my study, it perhaps warrants future considerations, as it may be informative.

Conclusions:

The littering of cigarette butts is a global phenomenon; and among the University of Victoria, this is no exception. In this paper, I performed a systematic study of the UVic campus, with approximately 7500 improperly discarded cigarette butts recovered. The areas with the greatest number of discards share features like low visibility from the outside, shelter from the elements, seating, and are proximally located. From observing these data, the way that smokers have responded to UVic's relatively new smoking policy has not been very advantageous. What is has done is to generate of a complicated set of covert smoking areas across the campus that provide a semblance of support for comrades in arms who smoke, but it has not served to help the greater issues of smoking and littering in the first place.

This project has been framed around the notion of garbage. As we are currently in a society that is creating large amounts of garbage, and yet simultaneously considers it a contemptible object, relatively few productive dialogues are taking place about how we should interact with the world. In order to reach for a better future, we might need to leave some things behind, and it is my contention that starting with our notions of what is valuable, and what is garbage, is a good start.

In this study, I have endorsed cigarette butts as one such object of inquiry, in the hopes that it offers even just the semblance of an opportunity to explore a deeper aspect of ourselves. So with that in mind, I am encouraged to keep looking and to search for whatever might present itself that we can learn from.

Acknowledgements:

The creation of this project has covered the span of about a year since my very first ruminations on it, after having spent my time lamenting all the cigarettes on the ground. So this research is right up my alley: I always say that if I had a superpower, it would be the ability to spot a piece of trash from a mile away. I'm glad I could put that to good use.

And cigarettes, why, right? I have a running joke in my head that from all this research I've just come up with some really good data about the most popular types of cigarettes. It's *at least* that, if not more…

Seeing this project come together has taken a lot of help from my family and from people in the community at UVic. Thanks to my parents and sisters for always being supportive, even when I wanted to spend my weekends picking up garbage for some reason ("Wash your hands!" what a novel sentiment). Thank you to Dr. Mitchell and Dr. Mackie for the amazing help in turning a chaotic jumble of Jell-O into what is a slightly-less chaotic discourse, into an emergent scalar harmonized property… Thanks Robert for helping make some sweet maps. And thank you to UVic and everyone there for letting me run with this project! Thanks, and all the best!

References:

Al-Mosa, Yara, Joy Parkinson, and Sharyn Rundle-Thiele. 2017. "A socioecological examination of observing littering behavior." *Journal of Nonprofit & Public Sector Marketing* 29 (3): 235-253.

Appadurai, Arjun, ed. *The social life of things: Commodities in cultural perspective*. Cambridge University Press, 1988.

Araújo, Maria Christina B., and Monica F. Costa. 2019. "A critical review of the issue of cigarette butt pollution in coastal environments." *Environmental research*.

Baker, Keith. 2016. "Like leaves on the ground: A Qualitative Study of Practices and Attitudes Towards Cigarette Filters in Gothenburg." *University of Gothenburg School of Global Studies*: 1-34. Retrieved from http://hdl.handle.net/2077/52198

Bator, Renée J., Angela D. Bryan, and P. Wesley Schultz. 2011. "Who gives a hoot?: Intercept surveys of litterers and disposers." *Environment and Behavior* 43 (3): 295-315.

Bayer, Ronald, and Kathleen E. Bachynski. 2013. "Banning smoking in parks and on beaches: science, policy, and the politics of denormalization." *Health Affairs* 32 (7): 1291-1298.

Bonanomi, Giuliano, Guido Incerti, Gaspare Cesarano, Salvatore A. Gaglione, and Virginia Lanzotti. 2015. "Cigarette butt decomposition and associated chemical changes assessed by 13C CPMAS NMR." *PLoS One* 10 (1) (2015).

Booth, David J., Paul Gribben, and Kerryn Parkinson. 2015. "Impact of Cigarette Butt Leachate on Tidepool Snails." *Marine Pollution Bulletin* 95 (1): 362-364.

Bourdieu, Pierre. 1977. *Outline of a Theory of Practice*. Vol. 16. Cambridge University Press.

Callaham, Page. 1995. "Summary of Environmental Qualitative Research." *Philip Morris U.S.A. Confidential: Interoffice Correspondence – Richmond, Virginia*.

Ch'ng, Eugene, Vince Gaffney, and Gido Hakvoort. 2014. "Stigmergy in comparative settlement choice and palaeoenvironment simulation." *Complexity* 21 (3): 59-73.

Cialdini, Robert B., Raymond R. Reno, and Carl A. Kallgren. 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.

Costa, Cristina, and Mark Murphy, eds. 2015. *Bourdieu, habitus and social research: The art of application*. Springer.

Curnow, Rob, and Karen Spehr. 2017. “Butt-littering behaviour in context. The Butt Litter Check: A foundation for the NSW EPA cigarette butt litter reduction program.” *NSW Environment Protection Authority*.

de Coverly, E., et al. 2008. “Hidden Mountain: The Social Avoidance of Waste.” *Journal of Macromarketing* 28 (3):289-303.

Dieng, Hamady, Sudha Rajasaygar, Abu Hassan Ahmad, Che Salmah Md. Rawi, Hamdan Ahmad, Tomomitsu Satho, Fumio Miake, et al. 2014. "Indirect Effects of Cigarette Butt Waste on the Dengue Vector Aedes Aegypti (Diptera: Culicidae)." *Acta Tropica* 130: 123-130.

Douglas, Mary. 1966. *Purity and danger: An analysis of the concepts of pollution and taboo.* London: Ark.

Drackner, Mikael. 2005. “What is waste? To whom? - An anthropological perspective on garbage.” *Waste Management & Research* 23 (3):175-181.

Falsone, Christina, and Bettina Spence. 2017. “Qualitative Research of Cigarette Disposal Behaviour.” *Hall& Partners; Open Mind*.

Frazer, Bill. 1999. "Reconceptualizing resistance in the historical archaeology of the British Isles: an editorial." *International Journal of Historical Archaeology* 3 (1): 1-10.

Furniss, Jamie. 2017. "What type of problem is waste in Egypt?." *Social Anthropology* 25 (3): 301-317.

Groombridge, Nic. "Litter, criminology and criminal justice." *Routledge International Handbook of Green Criminology* (2013): 394.

Heylighen, Francis. 2015. "Stigmergy as a universal coordination mechanism I: Definition and components." *Cognitive Systems Research* 38: 4-13.

Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. “What a Waste 2.0: A global snapshot of solid waste management to 2050.” *World Bank Group*.

Lozev, Rosen. "Cigarette butts-environmental problem that has its innovative solutions (Experimental case study on Roskilde University canteen)."

Machado-Borges, Thaïs. 2017. "Out of Sight, Out of Mind? Middle-Class Households, Waste, Consumption, and Environmental Awareness in Southeastern Brazil." *The Journal of Latin American and Caribbean Anthropology* 22 (2): 298-319.

Mackay, Judith, and Michael Eriksen. 2002. *The tobacco atlas*. World Health Organization.

Mackie, Quentin. 2001. *Settlement archaeology in a Fjordland archipelago: Network analysis, social practice and the built environment of Western Vancouver Island, British Columbia, Canada since 2,000 BP*. Vol. 926. British Archaeological Reports Limited.

Micevska, Tina, M. St J. Warne, F. Pablo, and R. Patra. 2005. "Variation in, and causes of, toxicity of cigarette butts to a cladoceran and microtox." *Archives of Environmental Contamination and Toxicology* 50 (2): 205-212.

Miller, Maranda R., and Mark E. Burbach. 2017. "Understanding Cigarette Butt Littering Behavior on Public Beaches: a Case Study of Jekyll Island, Georgia." *Conservation and Survey Division*. 173.

Moerman, J. W. and G. E. Potts. 2011. "Analysis of Metals Leached from Smoked Cigarette Litter." *Tobacco Control* 20 (Suppl 1): i30-i35.

Mohajerani, A., Tanriverdi, Y., Nguyen, B. T., Wong, K. K., Dissanayake, H. N., Johnson, L., Rezaei, A. 2017. Physico-mechanical properties of asphalt concrete incorporated with encapsulated cigarette butts. *Construction and Building Materials*, 153, 69-80. doi:10.1016/j.conbuildmat.2017.07.091

Moore, Sarah A. 2012. "Garbage matters: Concepts in new geographies of waste." *Progress in Human Geography* 36 (6): 780-799.Moore, S. A. 2012. “Garbage matters: Concepts in new geographies of waste.” *Progress in Human Geography* 36(6):780-799.

Novotny, Thomas E., and Elli Slaughter. 2014. "Tobacco product waste: an environmental approach to reduce tobacco consumption." *Current environmental health reports* 1 (3): 208-216.

Novotny, Thomas E., and Feng Zhao. 1999 "Consumption and production waste: another externality of tobacco use." *Tobacco control* 8 (1): 75-80.

Novotny, Thomas E., Kristen Lum, Elizabeth Smith, Vivian Wang, and Richard Barnes. 2009. "Cigarettes butts and the case for an environmental policy on hazardous cigarette waste." *International journal of environmental research and public health* 6 (5): 1691-1705.

Ou, Junfei, Beibei Wan, Fajun Wang, Mingshan Xue, Huiming Wu, and Wen Li. 2016. "Superhydrophobic Fibers from Cigarette Filters for Oil Spill cleanup. DOI: 10.1039/c6ra01303a." 6 (5): 44469-44474.

Rath, Jessica M., Rebecca A. Rubenstein, Laurel E. Curry, Sarah E. Shank, and Julia C. Cartwright. 2012. "Cigarette litter: smokers’ attitudes and behaviors." *International journal of environmental research and public health* 9 (6): 2189-2203.

Rathje, William, and Cullen Murphy. "Rubbish! The archaeology of garbage." (1992).

Sawdey, Michael, Ryan P. Lindsay, and Thomas E. Novotny. 2011. "Smoke-free college campuses: no ifs, ands or toxic butts." *Tobacco Control* 20: i21-i24.

Schultz, P. Wesley, Renée J. Bator, Lori Brown Large, Coral M. Bruni, and Jennifer J. Tabanico. 2013. "Littering in context: personal and environmental predictors of littering behavior." *Environment and Behavior* 45 (1): 35-59.

Sibley, Chris G., and James H. Liu. 2003. "Differentiating active and passive littering: A two-stage process model of littering behavior in public spaces." *Environment and Behavior* 35 (3): 415-433.

Smith, Elizabeth A., and Thomas E. Novotny. 2011. "Whose butt is it? Tobacco industry research about smokers and cigarette butt waste." *Tobacco Control* 20: i2-i9.

Torkashvand, Javad, Hamid Reza Sobhi, and Ali Esrafili. 2020. "Littered cigarette butt as a well-known hazardous waste: A comprehensive systematic review." *Journal of Hazardous Materials*: 121242.

University of Victoria, a. [nd]. "Facts and Reports. UVic at a glance." Accessed [April 16, 2020]. https://www.uvic.ca/home/about/facts-reports/index.php

University of Victoria, b. [nd]. "Smoke-free program." Accessed [April 16, 2020]. https://www.uvic.ca/ohse/health/smoke-free/index.php

University of Victoria. 2013a. "Undergraduate Head Count by Age." Accessed [April 16, 2020]. https://www.uvic.ca/institutionalplanning/assets/docs/enrolment/Factbook%20Table12a.pdf

University of Victoria. 2013b. "Graduate Head Count by Age." Accessed [April 16, 2020]. https://www.uvic.ca/institutionalplanning/assets/docs/enrolment/Factbook%20Table12b.pdf

University of Victoria. 2018. "Smoking Policy AD2405." Accessed [April 16, 2020]. https://www.uvic.ca/universitysecretary/assets/docs/policies/AD2405.pdf

Valiente, Roberto, Francisco Escobar, Jamie Pearce, Usama Bilal, Manuel Franco, and Xisca Sureda. 2020. "Estimating and mapping cigarette butt littering in urban environments: A GIS approach." *Environmental Research* 183: 109142.

Veolia. October, 2018. "Plastic recycling: a key link in the circular economy".

Wright, Fiona. 2016. "Resistance." *Cambridge Encyclopedia of Anthropology*.