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THE AMBIGUITY OF E-CIGARETTES: E-CIGARETTES AS BOUNDARY OBJECTS

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Abstract

This paper explores the perceptions of e-cigarettes held by e-cigarette users and stop smoking advisors in South East England in the United Kingdom (UK). This qualitative study draws on two thematically analyzed datasets: semi-structured interviews with 15 e-cigarette users and 13 stop smoking advisors between 2014 and 2015. The paper applies the Boundary Objects Theory and discusses how e-cigarettes as boundary objects function as both translational and facilitative objects. The data exhibited an ambiguity regarding e-cigarettes' status, efficacy and potential risks and varied goals of using e-cigarettes. E-cigarettes' flexibility allowed for divergent interpretations to co-exist. It is due to the disagreement and different social meanings allocated to e-cigarettes that the boundary objects have formed. As translational boundary objects, e-cigarettes enabled people from multiple social worlds and different conceptions, of nicotine, smoking and e-cigarettes, to agree on similar meanings without consensus. As facilitative boundary objects, e-cigarettes facilitated the acceptance of harm reduction practices. The data showed a potential for social change towards a socially acceptable recreational use of nicotine that mimics smoking. E-cigarettes allowed for the emergence of a new social phenomenon where the boundaries between medicinal and recreational nicotine are reformed.

Keywords: Boundary objects; E-cigarettes; Nicotine addiction; Stop smoking service.

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INTRODUCTION

E-cigarettes are battery-powered devices that do not require tobacco or combustion to operate. They were first marketed in China as an alternative to regular smoking and an aid to stop smoking and received their first international patent in 2007 (Caponnetto, Campagna, Papale, Russo, & Polosa, 2012). They mainly contain water, propylene glycol, glycerine and flavourings, and come with or without nicotine. Over the years, different 'generations' were introduced with a range in complexity; older 'generations' resembling traditional cigarettes and newer ones having different designs (Martin, 2015). The term 'vaping' is used to describe the act of using e-cigarettes. E-cigarettes' popularity has increased in the West (King, Alam, Promoff, Arrazolan, & Dube, 2013; Adkison et al., 2013; Dockrell, Morrison, Bauld, & McNeill, 2013; Pepper & Brewer, 2013). In Britain, it was estimated that in 2016, 2.8 million adults used e-cigarettes; almost entirely made up of current and ex-smokers (ASH, 2016a). Their popularity is attributed to several reasons: the perception that they are less harmful than tobacco cigarettes to users and bystanders; their effective nicotine delivery; imitation to cigarette smoking; lower cost than cigarettes; tobacco-free smell; 'good' innovative look; easy to access; can be used in places where smoking is banned; socially acceptable and varied flavours that can be customised. In general, it was noted across different populations that the top documented reasons for using e-cigarettes were to help stop smoking and harm reduction (McNeill et al., 2015; ASH, 2016a; RCP, 2016).

Harm reduction is a public health approach to reduce the harmful consequences of substances or actions, without necessarily reducing or eliminating the use itself (Newcombe, 1992). In the field of tobacco harm reduction in the UK, nicotine is viewed as the addictive but not the harmful substance in cigarettes (RCP, 2016); and the use of pharmacological "clean" nicotine, even for long term use, was proposed as an alternative to the "dirty" tobacco to fight smoking-related diseases (Russell, 1991). In 2007, the Royal College of Physicians in the UK (RCP) suggested that smokers can stop smoking tobacco without having to stop using the nicotine to which they are addicted (RCP, 2007; 2016, p. xi). The National Institute for Health and Care Excellence (NICE) guidelines explained that smokers can reduce the harm of smoking in four ways: by stopping smoking altogether, cutting down prior to quitting, smoking less, or abstaining from smoking temporarily. They further state that "it is safer to use licensed nicotine-containing products than to smoke", and note that "there is a reason to believe that lifetime use of licensed nicotine-containing products will be considerably less harmful than smoking" (NICE, 2013, p. 10). However, the current programme at the National Health Service (NHS) Stop Smoking Services in England aims to achieve abrupt quitting from smoking with Nicotine Replacements Therapies (NRTs) provided for up to 12 weeks aimed at ending nicotine use (DOH, 1998; NICE, 2008; Rooke, 2013). These services employ trained stop smoking advisors (SSA) to provide "accessible, evidence-based, cost-effective clinical services to support smokers who want to quit" (DOH, 2011, p.110).

Different countries have different stances towards e-cigarettes. In the UK from May 2016, it has been permitted to sell e-cigarettes either as a medicinal or a consumer good (Kennedy, Awopegba, De León, & Cohen, 2016). Nevertheless, E-cigarettes have created a controversy. It was stated that "Harm reduction, and in particular the role of e-cigarettes, has probably split global and, to some extent, national opinion on tobacco control more than any other issue" (RCP, 2016, p. 3). Many consider e-cigarettes a breakthrough in public health and harm reduction history (Britton & McNeill, 2013; Hajek, Etter, Benowitz, Eissenberg, & McRobbie, 2014; Nicotine Policy, 2014; McNeill et al., 2015). Others warn that their safety, quality and long term use have not been established fully, and therefore oppose their promotion (Chapman, 2014; Centre for Tobacco Control Research and Education, 2014). Concerns were raised that e-cigarettes are used to substitute smoking, that they might glamorise it and provide an entryway for people to become addicted, thus, maintaining nicotine addiction, promoting continued smoking or deterring smokers from using existing cessation aids (Cobb & Abrams, 2011; McMillen, Maduka, & Winickoff, 2012; De & Hastings, 2013).

Scholars Bell and Keane (2012, p. 245) believe that the controversy of e-cigarettes originates from "the ideological challenge they pose to the binary categorisation of nicotine into not only remedial and harmful forms, but morally "good" and "bad" ones". "Good" nicotine, they explain, does not connote smoking and is used for treatment purposes, as opposed to "bad" nicotine that is used recreationally. They also highlight how mainstream tobacco control programmes work against the visibility of smoking and other similar practices. Although NRTs claimed their position in the worlds of "good" (medicinal) nicotine, e-cigarettes' vague identity places them in both worlds simultaneously as they can be used both medicinally and recreationally. It is this dilemma that is explored in the context of this paper through applying the concept of boundary objects. The boundary objects theory is proposed as an approach for understanding the social construction of e-cigarettes among a group of e-cigarette users and a group of SSA. The boundary objects, it has been argued "are one way that the tension between divergent viewpoints may be managed" (Bowker & Star, 1999, p. 292).

Boundary objects

The boundary objects theory was introduced by Star and Griesemer (1989) when they were studying a zoology museum and noticed how some objects such as the specimens of dead birds had very different meanings to amateur collectors and professional biologists, but "the same" bird was used by each group. They defined boundary objects as those objects used within multiple social worlds and adapted to many of them "simultaneously"; these objects have diverse meanings but cross the boundaries between the different social worlds (Star & Griesemer, 1989, p. 408). Boundary objects, they noted, "are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p.

393). Strauss (1978, p. 121) referred to social worlds as "universes of discourse" with typical forms of communication, symbolisation, activities, sites, technologies and organisations. He stated that, among each social world, various issues are debated, negotiated and contested (p. 124). Although this article refers to both e-cigarette users and SSA as separate social worlds, it is recognised that among each group heterogeneity in opinions and actions exists.

Boundary objects are used to explain people's roles in "allocating meanings to ambiguous scientific objects and "facts"" (Garrety, 1997, p. 755). However, the concept was criticised for being sociologically under-theorised as some critics suggest it does not explain how boundary objects function and how the roles of different human agents influence that function (Riesch, 2010; Fox, 2011). Nevertheless, the theory has been used in different disciplines and by several social scientists (e.g. Fujimura, 1992; Halfon, 2006; Williams, Wainwright, Ehrich, & Michael, 2008; Meyer, 2010). Boundary objects play a role in facilitating interactions, translations and coherence among different social worlds; hence providing a useful framework for analysing the social worlds of both groups in this study. The article shows how as boundary objects, e-cigarettes can be adapted to the goals of one group while retaining enough congruity to be useful to others. It describes how e-cigarettes function as translational boundary objects by "mediate [ing] boundaries" (Lee, 2010, p. 53), and illustrates how e-cigarettes work to establish a shared context that "sits in the middle" (Star, 1989, p. 47). Boundary objects were defined by Bowker and Star (1999, p. 297) as "the working arrangements that resolve anomalies of naturalization without imposing a naturalization of categories from one community or from an outside source of standardization." Based on this understanding, the article highlights the ways in which e-cigarettes "expose the artificial boundaries placed upon "good" and "bad" nicotine" (Bell & Keane, 2012, p. 246). By reflecting on this categorisation of nicotine, the concept helps to understand the ways that the boundary objects arise from the problems created when "two or more differently naturalized classification systems collide" (Bowker & Star, 2009, p. 297).

Fox (2011) proposed that objects can function as boundary objects in relation to knowledge transfer between communities. He suggested this function may be either facilitative or inhibitory depending on the meanings that these objects encapsulate for key actors. At the time of collecting the data, e-cigarettes were marketed as a consumer product in the UK. English Stop Smoking Services (SSS) were not prescribing or recommending e-cigarettes, but SSA were advised to tell people that these products are not regulated and that although there is a lack of evidence on their effectiveness, safety and quality, e-cigarettes "are likely to be less harmful than cigarettes" (NICE, 2013, p.16). Evidence from this study and later developments in the field of e-cigarettes in the UK illustrate how e-cigarettes function as a facilitative boundary object for harm reduction knowledge.

This paper explores the different meanings that two groups, e-cigarette users and SSA in two counties in South East (SE) England in the UK, allocated to e-cigarettes. Firstly, the

goals of using e-cigarettes by each group are discussed, and in the second part, the perceptions of e-cigarettes' risk are discussed. The disagreement and different social meanings allocated to e-cigarettes which enabled the formation of e-cigarettes as boundary objects is explored. In both parts, some of the ways in which those worlds have become connected and the shift in the way e-cigarettes acted, from boundary objects to a translational and facilitative boundary objects are explored. This article argues that e-cigarettes have emerged as boundary objects as a result of the problematics created when the classifications of "good" and "bad" nicotine collided (Bowker & Star, 1999, p. 297). The article highlights the role of e-cigarettes in bridging different worlds together and enabling the emergence of a new social phenomenon where the boundaries between medicinal and recreational nicotine are reformed.

METHOD

The study aimed to answer three questions: 1) How are e-cigarettes perceived by the e-cigarette users and SSA? 2) What are the risks and benefits associated with e-cigarettes, as perceived by both groups? 3) How do these understandings shape participants' attitude towards e-cigarettes? The study used an convenience sample. Users with severe dementia, learning difficulties and inability to conduct interviews in English were excluded. SSA from two SSS in SE England were invited to participate in the research and invite their clients who use e-cigarettes to participate. Leaflets and posters were distributed at some local shops and e-cigarette stores and an advert was put on some social media platforms and on a UK university website inviting e-cigarette users to participate. Based on the literature review, a draft interview topic guide was designed to explore reasons and attitudes towards e-cigarette use; perceptions of their status, efficacy, risk and/or benefit. Semi- structured interviews were conducted with 13 SSA and 15 e-cigarette users between April 2014 and August 2015. Fourteen interviews were conducted face to face and the rest were conducted by phone. Each interview lasted between 40-60 minutes and were transcribed verbatim. Participants were given an ID for anonymity. A data-driven inductive approach of thematic analysis was applied as proposed by Braun and Clarke (2006) to identify, analyse and report patterns (themes) within the data. The analysis was an iterative and reflexive procedure with the data collection and analysis undertaken concurrently. Since this study was interpretative from the outset, the questions were developed and amended throughout the study. Data collection continued until the researcher believed that no new themes would be identified from conducting more interviews. The researcher continuously reflected on the previous stages of the process before undertaking further analysis to ensure that the identified themes were grounded in the data.

***Table 1*. The characteristics of e-cigarette users**

E-cigarette users ID	Gender	Age	Occupation	Stop Smoking Service user	Age started smoking(y)	Gave up smoking completely after using e-cigarettes	started e-cigarette use (1)	Used other aids to stop smoking (2)
1A	F	44	Counsellor	NO	15	Yes	8 months	NO
2B	M	39	Audit manager	NO/ ex-user	12	No	2 years	Yes
3C	M	36	Unemployed/disabled	NO/ ex-user	14	Yes	3 years	Yes
4D	F	50	Unemployed/disabled	Yes	20	No	6 months	Yes/ ongoing
5E	F	67	Retired	Yes	20s	Yes	Few months	Yes/ ongoing
6F	M	44	Unemployed	Yes	9	Yes	3-4 months	NO
7G	F	31	Unemployed	Yes	19	No	15 months	Yes/ ongoing
8H	M	51	Surgeon	NO	22	No	4 months	Yes
9I	M	21	IT worker	NO	16	Yes	2 years	Yes
10J	F	37	Gym instructor	NO	21	Yes	2 years	Yes
11K	M	34	Lecturer	NO	23	Yes	12-15 months	Yes
12L	M	38	Lecturer	NO	18	Yes	2 years	Yes
13M	M	58	Retired	NO	15	No	9 months	NO
14N	M	56	Artist/ musician	Yes	16	No	2 years	Yes
15O	F	60	para legal/ family work	NO	15	No	7 months	Yes

(1) calculated until the time of the interview

(2) NRT/Champix/ herbal cig/ Allen carr/ hypnosis

Participants

Thirteen SSA responded to the invitation letters (nine females, four males). Their experience in working at the SSS ranged between seven months and fifteen years. Fifteen interviews were conducted with e-cigarette users (nine males, six females) with five using the SSS at the time. Their mean age was 44 years (range 21 - 67). They smoked cigarettes

for an average 27.4 years (range 5 - 47 years). Duration of e-cigarette use ranged between 4 - 36 months (average 14.6 months); eight were ex-smokers (they were only using e-cigarettes at the time of the study), the rest reported dual use of both e-cigarettes and cigarettes with different use patterns. Fourteen had previous attempts to stop smoking and thirteen used other aids to help them stop. Three of the current SSS users reported currently using other aids besides e-cigarettes. The majority were using e-cigarettes that looked like cigarettes (first and second generations). Table 1 summarises the e-cigarette users' profile. Table 2 summarises the SSA' profile.

***Table 2*. A full list of interviews conducted with stop smoking advisors**

Stop smoking advisors	County (1,2)	Gender	Years of experience
H1	1	Female	10 years
H2	1	Female	1 year
H3	1	Male	7 months
H4	1	Female	4 years
H5	1	Female	1 year
H6	1	Female	15 years
H7	1	Male	5 years
S1	2	Male	3 years
S2	2	Male	7 years
S3	2	Female	3.5 years
S4	2	Female	1 year
S5	2	Female	16 months
S6	2	Female	4 years

RESULTS

The ways in which e-cigarettes have similar and different meanings in the social worlds of e-cigarette users and SSA are explored through discussing two major identified themes: the goals of e-cigarette use and the perceived risk of e-cigarettes.

Theme 1: Goals of e-cigarette use

Through discussing both groups' goals, an analysis was conducted on some of the identified meanings of e-cigarettes in the social worlds of both groups to illustrate the different ways in which e-cigarettes are employed as boundary objects. The section concludes by highlighting the shared attitudes towards e-cigarettes. The analysis shows

that the debate has been mainly constructed around the "good" and "bad" nicotine categorisation.

i) A therapy to stop smoking and nicotine use

In the world of SSA, e-cigarettes were brought into the field of the current public health management of smoking, which promotes the "good" nicotine use and emphasises the elimination of smoking and any source of nicotine. SSA used the term "weaning" to describe their strategy in helping people to end their nicotine use, as the following advisor clarified:

> If someone comes to the clinic ….and they're smoking an e-cigarette, I always discuss with them what kind of level the nicotine is and then we can look at weaning them off the nicotine to low or zero nicotine and products that still use the vape but without the nicotine in it….It's the ultimate goal. (S3)

Some advisors described e-cigarettes as a medicine and a smoking cessation aid, "I would rather view it as a medicine; as an aid to giving up smoking." (H1). One advisor suggested that "a lot of people self-medicate using the e-cigarette because they do not always have the time and motivation and go to see someone routinely every week" (S3). In terms of their efficacy as a smoking cessation aid, most of the advisors perceived e-cigarettes to be as effective as or more effective than NRTs. One advisor explained how e-cigarette users who used their SSS "often they say "it is [the e-cigarette] useful"" and even when the advisor offered them "products… which have been researched fully…they probably choose to continue using e-cigarette because it's working for them" (S1). Others, however, were sceptical about their use due to risk concerns or their similarity to traditional cigarettes. One advisor said he doesn't "recommend e-cigarettes that much "because he believed that e-cigarette users "one day, will go back to normal smoking" (H7).

Nearly all the advisors favoured a medicinal regulation for e-cigarettes to ensure safety and to add them to their prescription list. The majority of them saw e-cigarettes' potential to be another stop smoking aid as one advisor said: "If that has been a licensed product, I would be happy that it is alongside the range because it is an individual choice […] and if it supports them to stop then that's another weapon in the armoury" (H5).

From the e-cigarette users' perspective, the majority confirmed they used e-cigarettes to help them quit smoking. However, their goals and their ways into achieving their goals differed from those of the advisors. Some e-cigarette users viewed and described e-cigarettes as a treatment: "For me, it's a treatment. It's a way to keep me off tobacco" (14N). Nearly all users described the superiority of e-cigarettes' efficacy over NRTs and some described previous failed attempts to quit using other aids. Several users expressed their desire to stop using nicotine and e-cigarettes eventually:

> My plan will be to stop using them altogether, but I am not going to not have them around the house because the danger would be if I get badly triggered I go buy cigarettes rather than using e-cigarettes. (1A)

Those who were using the SSS were guided by the SSA to help them stop smoking and e-cigarette use:

> I'm still using nicotine. I have got one bottle here with no nicotine and eventually my challenge is to get down through the milligrams, down to twelve and then to six and then stop." (14N)

Others had their own individual plans to manage their e-cigarette use according to their needs, lifestyle and desires without adhering to the regime followed by the SSS. For example, one user switched to e-cigarettes before a surgical procedure to manage his nicotine addiction but revealed his plan to stop their use:

> I am intending to continue using it as substitute at the moment and that is because I am still waiting to finalise my health condition…. once I find my final answer about my back and legs I will totally stop it and that is my end game. (3C)

So, although the therapeutic use of e-cigarettes was the ultimate goal for the advisors and for some e-cigarette users, practices towards achieving this goal were different. The other goal for users was using e-cigarettes as an alternative to smoking. E-cigarette use as an alternative to smoking can be considered a harm reduction practice where smokers who are unable to stop their addiction to nicotine switch to a less harmful source of nicotine. However, such practice can become a new recreational habit as discussed next.

ii) Alternative to smoking

Some advisors believed that people use e-cigarettes as an alternative to smoking rather than a therapy to quit smoking and nicotine:

> For a lot of people, they have transferred their cigarette habit to the e-cigarette. They weren't thinking about quitting, they were looking for a safer alternative and they have chosen a product that's the closest thing to smoking. (S6)

Indeed, several users revealed using e-cigarettes as a replacement:

> The psychological element has been helpful. I don't have to feel I am missing out if I want to go out and stand with people and talk. I've got something I can use, my e-cigarette. (1A)

The ability of e-cigarettes' to be used as a therapy and as an alternative to cigarettes by different actors in different settings enabled them to act as boundary objects. The coexistence of different goals and use patterns reflects the divergent meanings people allocate to e-cigarettes. However, e-cigarettes translated these diverse goals as a result of developing a shared understanding into their value as a harm reduction tool. E-cigarettes' potential to help smokers struggling to quit smoking and avoid relapse was recognised by the advisors:

> For people who are very addicted to the nicotine and very addicted to the habits surrounding the smoking, it could be the e-cigarette is the thing that help them to stop or at least the thing to taking nicotine at a relatively safe level without all the chemicals from tobacco and all the harm from Carbone monoxide. (H5)

> I definitely say, look, if you have an e-cigarette, I'd rather you keep it in your bag and if you are really stuck and you are socialising and you are drinking alcohol, I'd rather you use that than the real cigarette, so in a way that's a harm reduction. (H4)

Here e-cigarettes shift to become a translational and facilitative boundary objects as they facilitate the growth of harm reduction knowledge or the success of harm reduction strategy (Fox, 2011, p. 80). Furthermore, there was evidence of a potential social change towards a socially acceptable recreational use of nicotine that mimics smoking, which shows the role of people in assigning meanings to e-cigarettes and shaping their development. The advisors believed that e-cigarettes are becoming socially acceptable:

> The vaping community [e-cigarette users] is getting bigger, they do seem to want to have an identity […] they are quite proud of themselves that they don't smoke, they are seen as doing something new and exciting [….] their perception is they try to distance themselves. Certainly for people they have been on for a longer time it's not about the smoking, it's about lifestyles (S2)

E-cigarette users revealed using and enjoying e-cigarettes in social occasions. They spoke about the social acceptability, the endorsement and encouragement they get from others for switching from smoking to e-cigarettes. One said: "I could put it down and not

use it at all any more but it's like a big hobby for me. I got a very advanced device and I like going to events and things about them" (9I). Another user shared his experience:

> ....the friends that I have understand that I've made a conscious decision to switch from tobacco to vaping. And most of my friends are intelligent, well in my view they're intelligent, and they know that it's better for me and for them if I'm vaping, not smoking. And it also means often that I can stay with the conversation rather than having to go outside and have a cigarette. (14 M)

The above theme shows how e-cigarettes acquired an ambiguous position between treatment and cigarette replacement. The dual description and use of e-cigarettes as a medication or a substitute for cigarettes show a characteristic of boundary objects which is their ability to function differently in different settings (Carlile, 2002), while maintaining their robustness, as the following quote explains:

> It's 50 50, they [e-cigarettes] can be used in either way because […] I experienced it myself, I started with nicotine to smoke, weaned myself off nicotine till it's nothing and now [….] I use it as a hobby. If you want to quit […] you could wean yourself off nicotine and then get rid of it and if you wanted to continue […] the habit you can get an e-cigarette and continue." (9I, user)

As boundary objects, e-cigarettes can be both a route to the continuation of nicotine dependence and a route to cease nicotine dependence; they exist in between different social worlds where we can see "the dynamic between ill-structured and more tailored uses of the objects" (Star, 2010, p. 206). Although the advisors acknowledged that e-cigarettes can be used recreationally, their main goal was to use e-cigarettes medicinally. The SSA mainly viewed e-cigarettes as another stop smoking aid and wanted them to be part of their "armoury", but there was a shift towards approving e-cigarettes as a harm reduction tool. The users however, placed e-cigarettes in a recreational medicinal continuum where boundaries are blurry and where they tailored their use according to their individual lifestyle, needs and desires. Similar divergent and shared meanings were identified when discussing risk perceptions.

Theme 2: Perceived risk of e-cigarettes

According to Lupton (1999, p. 25) "risks are constructed and negotiated within the networks of interaction and meanings that people hold." The data showed different meanings were held by different participants, but also showed the development of shared understandings which helped to bridge these differences.

i) The divergent perceptions of risk

The following risks were discussed: health and safety risk; nicotine use risk; developing an addiction to e-cigarettes; maintaining nicotine addiction; the gateway use and smoking renormalization. There was no agreement on the seriousness and implications of those risks. Generally, the advisors expressed more negative assumptions with regards to e-cigarettes' risks than users as they referred to lack of evidence based knowledge:

> I wish I could tell them [clients using e-cigarettes] with absolute surety what the safety is and I can't. I wish I can tell them with absolute surety how much nicotine they are getting from the product and I can't. (H6)

They were particularly worried about the unknown long term effect:

> We know that it is effective, but what are the health risks for people inhaling propylene glycol over periods of time? I don't know and that's the bit that worries me a little bit; are we just storing up for other public health issues in years to come? (S2)

Further, the advisors feared the risk of renormalizing smoking due to e-cigarettes' resemblance to cigarettes. It is this imitation of the unique sensory cues or rituals associated with smoking (Fagerström, 2012) that characterizes e-cigarettes. However, the advisors mostly disapproved this characteristic: "I do have reservations about in that it's looking like a cigarette and undoing the work of tobacco control we've done in terms of de-normalizing it" (H6). Such similarity was viewed by some advisors as a hindrance to successful quitting, rather than an aspect of efficacy:

> I will still have the same argument about the psychological bond people can actually create with the e-cigarette and I will never be happy to recommend it' […] they are fooling themselves that they are making a change but psychologically they are not ready to make a change. (H4)

This concern led to the majority of the SSA calling for tighter regulation and a ban on e-cigarette use in public places. Some highlighted a few cases of e-cigarette users approaching the SSS asking for help to stop e-cigarettes.

In the world view of most users, e-cigarettes were not perceived as a hazard. Users were more inclined towards e-cigarettes' ability to replicate the psychsocial elements of smoking. Most users perceived e-cigarettes to be safe products especially when compared to smoking. They mostly drew on their personal experiences and the benefits they gained. Some users described health improvements as a result of switching to e-cigarettes, like

improving their lung function: "I noticed differences in my breathing and my coughing, so to me, whatever any harm it might be doing, I can't see. The benefits I can see." (15O) Only one user expressed worries about the long term effect,

> There's no long-term studies. That kind of worries me….. you don't really know what somebody's lungs look like in their fifties when they've been using them for a lifetime. So it's completely new territory and that kind of makes the risk a little bit less easy to grasp. (12L)

Nicotine was seen as an addictive substance, only two users showed concerns about a negative physical effect of using nicotine as one described it as a "poison". Users highlighted the ability of e-cigarettes to replicate the behavioural rituals and the psychological elements of smoking. For some users, this helped them in their quit attempts:

> In some respect is the hand to mouth and is still seeing the smoke vapour comes out of the mouth, it's like a double trick to the brain, it's like I perceive in some respect of why I am no longer on any nicotine." (3C)

For one user, this characteristic has shifted his addiction to e-cigarettes:

> It's going to be as big a struggle as giving up normal cigarettes. [...] But I suppose, in a sense, they help you stop smoking. […] For me they mimic smoking almost perfectly, so the addiction is almost as bad to these things as it is to cigarettes. (12L)

Users however, did not agree on regulating e-cigarettes as a medicine or a ban on their use in public places. They highlighted a lack of evidence of harm caused by e-cigarettes compared to those caused by cigarettes. This different stance towards e-cigarettes as well as the heterogeneity of risk perceptions among both groups enabled e-cigarettes to act as boundary objects as they allowed divergent meanings of risk to coexist. However, the data next shows how the emergence of a shared understanding among both groups shifted e-cigarettes to become a translational and facilitative boundary objects.

ii) The shared understanding towards e-cigarettes' risk

Participants from both groups agreed on e-cigarettes' relative safety compared to traditional cigarettes. The divergent opinions about the nature, level and seriousness of e-cigarettes' risk, along with the different goals of using e-cigarettes, as discussed earlier, enabled the formation of e-cigarettes as boundary objects. However, the belief that e-cigarettes are safer than smoking served to minimise the seriousness of potential risk and enabled the construction of e-cigarettes as a "clean" delivery nicotine systems. This, the

article argues, has paved the way for accepting e-cigarette use in spite of inconclusive safety evidence. So, e-cigarettes have transformed from an anchor of difference into a bridge of similarity (Star & Griesemer, 1989, p. 392), and functioned as translational boundary objects.

By negotiating e-cigarettes as boundary objects, different actors could each retain their own interpretations and goals. However, the data demonstrated how as a consequence of e-cigarettes, different social worlds were brought together by agreeing on the relative safety and value of e-cigarettes but without consensus. By producing e-cigarettes as boundary objects, the negotiation over the possibility of their use therapeutically and recreationally emerged. There were different ways of dealing with and managing e-cigarette use by different actors. Some users followed a "weaning" regime similar to those applied at the SSS. Some advisors saw the value of e-cigarettes for some cohorts as a smoking substitute, departing from the current "weaning" regime. E-cigarettes have reconciled the meanings of methods and concepts across the social worlds of e-cigarette users and the advisors (Star & Griesemer, 1989, p. 388). E-cigarettes, this article argues facilitated the acceptance of harm reduction practices by some SSA. As facilitative boundary objects, e-cigarettes played a major role in accepting the use of an effective form of nicotine as a cigarette substitute (RCP, 2007). This, this article suggests, is reforming the boundaries between the "good" and "bad" nicotine.

DISCUSSION

A large body of studies have explored the use of e-cigarettes. This is a sociological study that links e-cigarettes to the boundary objects theory. Similar concerns and disagreement with regards to the efficacy, status and risks associated with e-cigarettes were found in other studies (e.g. Pepper & Brewer, 2013; Hiscock et al., 2014; Beard, Brose, Brown, West, & McEwen., 2014; Sherratt, Newson, Marcus, Field, & Robinson, 2015; Sherratt, Marcus, Robinson, Newson, & Field, 2015; Rooke, Cunningham-Burley, & Amos, 2015).

As a qualitative study, it can be criticised for the lack of generalisability, but it was purposely a small study and the findings cannot be generalised, especially outside the UK where there are different stances towards e-cigarettes. A potential limitation is using two different interview methods; however, there was a high degree of thematic commonality provided via both approaches. Validity was addressed by recording and transcribing interviews. Participants' direct quotes were used and themes were continuously revised and verified with two academic researchers. Another limitation is not looking into how different sociocultural factors such as gender, age and social class may have contributed to the construction of different perceptions. The study also did not explore how the use of

different generations of e-cigarettes, brands, models, flavours or nicotine concentrations would have contributed to the formation of different perceptions.

This paper describes some of the ways in which e-cigarettes act as boundary objects that can help differentiate the worlds of the SSA and e-cigarette users and yet act as a bridge between these two worlds (a world that focuses on a medicinal use of nicotine and a world that incorporates both a recreational and medicinal use). Throughout the paper, it was argued that e-cigarettes function as boundary objects which help to maintain the differences in perceptions, goals and practices in both groups. The ambiguity of e-cigarettes allowed for allocating different meanings to the device. The e-cigarette was represented as a safe product; a safer alternative to smoking; a therapeutic product; a clean nicotine delivery device; an innovation with potential long-term threats and as a potential risky object. It was also seen as a device that can create addiction; maintain nicotine addiction; a gateway to smoking; and a gateway from smoking simultaneously. E-cigarettes act like anchors "which help moor participants within different social worlds" (Williams et al., 2008, p. 16). Hence, the article argues that the coexistence of these different meanings enabled the formation of e-cigarettes as boundary objects (Star & Griesemer, 1989).

In contrast, it is argued that e-cigarettes act as translational boundary objects. The article illustrated the task of e-cigarettes to reconcile the diverse meanings across different social worlds (Star & Griesemer, 1989, p. 388). E-cigarettes enabled a shared context, understanding and practices between the advisors who want to use e-cigarettes as a cure following their NRTs regime and e-cigarette users who have a multifaceted use of e-cigarettes. E-cigarettes were transformed from an anchor of difference into a bridge of similarity, yet, the resulting coherence does not mean creating consensus; rather, "representations, or inscriptions, contain at every stage the traces of multiple viewpoints, translations and incomplete battles" (Star & Griesemer, 1989, p. 413). For example, some advisors, who perceived e-cigarettes as risky objects and showed uncertainty, acknowledged their relative safety compared to smoking and saw their potential to be a "piece in their armoury". They were able to work with clients who used and perceived e-cigarettes differently and were able to see their benefits to some cohorts as a harm reduction tool. These shared contexts have mediated boundaries between both groups (Star, 1989; Lee, 2010).

Following Fox's argument, this article argues that e-cigarettes function as facilitative boundary objects for accepting practices of harm reduction. E-cigarettes have ignited the debate of harm reduction and enabled practices of tobacco harm reduction to be promoted and adopted. In 2016, guidance for the SSA was issued and emphasised that the service is not a "stop nicotine service" but encouraged SSA to listen to e-cigarette users' experiences and acknowledge the usefulness of e-cigarettes in helping them to stay off tobacco (NCSCT, 2016:11). This provides a useful exemplar for the work of Fox (2011) who states:

> Boundary objects thus have the potential to both analyse and facilitate adoption of an innovative idea, product or technique. If the potential success of technology adoption, embedding or roll-out across organizations depends on the presence of a boundary object […..], then those promoting a technology can enhance its adoption by seeking out or developing such an object. (p. 72)

The data and analysis illustrate how different actors who held different perceptions of e-cigarettes' safety, efficacy, status and goals shared the understanding that e-cigarettes are less harmful than smoking and can help smokers stop smoking, thus enabling different social worlds to communicate. Secondly, e-cigarettes function as a bridge that links the two different forms of nicotine (i.e. medicinal and recreational). Hence, e-cigarettes, this article proposes, function as a translational and facilitative boundary objects because of their ability to reconcile differences in views with regards to e-cigarettes and to influence key actors in the field of tobacco, such as the SSS, into accepting and practising harm reduction knowledge.

Moreover, this article argues that due to smoking denormalisation policies in the West, the categorisation of "good" (medicinal) and "bad" (recreational) have become to some extent naturalized in spite of its ambiguity (Bowker & Star, 2009). E-cigarettes not only exposed "the artificial boundaries placed upon "good" and "bad" nicotine" (Bell & Keane, 2012, p. 246), but also allowed for the emergence of a new social phenomenon where the boundaries between medicinal and recreational nicotine are restructured (Fox, 2011). Hence, the formation of e-cigarettes as boundary objects should be seen as official and "durable arrangements among communities of practice" and "not just temporary solutions to disagreements about anomalies" (Bowker & Star, 2009, p. 307). The emergence of e-cigarettes as translational and facilitative boundary objects enabled the formation of a new arena in the field of addiction. This article perceives e-cigarette as "an effective boundary object" that could bring "harmony to a dissensus, or peace to the "conflicted situation"" (Fox, 2011, p. 80) of "good" and "bad" nicotine and could lead to a socially acceptable recreational use of nicotine that mimics smoking.

To illustrate the potential social change, there are two other broader examples worth mentioning. Firstly, new links emerged between Big Tobacco, who started manufacturing and marketing e-cigarettes, and health services (ASH, 2015). Secondly, the new e-cigarette regulations in the UK (ASH, 2016a) which allow for both recreational and medicinal forms of e-cigarettes to coexist. These regulations are important changes in the history of UK tobacco control. They indicate the acceptance of e-cigarettes as harm reduction products by UK regulators. They also indicate a move towards accepting the non-medicinal/recreational use of a device that resembles smoking and contains nicotine.

To conclude, this paper provides an insight into how heterogeneity and cooperation exist when new technologies such as e-cigarettes emerge. It outlines how e-cigarettes challenge

the contemporary social meanings of nicotine addiction and how new innovations can prompt wider social and political change.

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