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Repertoires of information and perception gap

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Abstract: Existing studies test the effect of media and other socio-economic factors on the perception of crime trends. However, many of these studies fail to account for the practical situation of simultaneous engagement with the media and non-media information sources. The purpose of this study is to explore repertoires of information sources and whether these and any other demographic variables relate to the perception of national crime trends for individuals who do not have any prior experience with the criminal justice system. Latent class analysis (LCA) is used to derive a small number of homogeneous groups according to their engagement with various media and non-media sources using the modal class assignment. Further, multinomial regression is used to test the effect of belonging to one of the classes on the perception of national crime trends. LCA indicates the presence of three distinct subgroups in the population corresponding to those who used only media, non-media, and both types of information sources. The study finds that majority of individuals engage with only a few selected information sources. Multinomial regression reveals that the choice of information sources and the perception of national crime trends are not independent. Those with larger repertoires are likely to perceive a high rise in the crime trends nationally and are more pessimistic than those who use selected sources. Engagement with multiple information sources contains behavioural information about our perception. A larger repertoire of information is likely to have a detrimental effect on our perception of national crime trends.

Keywords: Perception gap ; Crime trends ; Repertoires ; Media choice ; Latent class.

Word count: 9,157.

Introduction

Understanding perceptions and worries about crime has been a central focus in the study of crime for long. As the media is a primary source of crime-related information (Dowler, 2003), the past few decades have seen a rise in the studies that explore the effects of media on the fear of crime and the perception of crime trends (Heath and Gilbert, 1996). A number of these studies have established that the media influences audiences' perceptions about crime levels (Baranauskas and Drakulich, 2018; Pfeiffer et al., 2005) and fuels fear of crime (Ditton et al., 2004). What has proved to be even more challenging to decipher is the observation that the public perception of crime trends is generally worse than the actual levels of crime (Roberts and White, 1986; Roberts and Hough, 2005). This phenomenon has been observed consistently across many countries and is termed as the perception gap in the literature (Mohan et al., 2011).

A reason ascribed to this gap is the increased exposure to the media (Stalans, 1993) that frequently covers news in a way that is biased towards sensationalism and violent crimes (Garofalo, 1981). However, this may be contested because several other information sources, which are unknown, may assert their simultaneous influence on perception (Baranauskas and Drakulich, 2018). These sources can belong to the mass media, such as newspapers and television, or can be from individuals' informal networks, such as word-of-mouth messages and the experience of friends and relatives (Stalans, 1993). Ignoring such informal sources and focusing only on the mass media can lead to missing vital information as some sources can have a stronger influence on shaping perceptions than others (Weitzer and Kubrin, 2004). Only a small number of studies have looked at the combined effect of multiple information sources on perception by grouping these into media and non-media sources (see, e.g., Pickett et al. (2015)).

Mass communication research has argued that individuals rely on multiple media sources that they choose based on their preferences and needs (Ahlers, 2006; Katz et al., 1973). These individuals are behaviourally different from those who rely on a smaller number of selected sources (Balmas, 2014; Tsfati and Cappella, 2003). This vital piece of insight, when applied to drawing upon information sources about crime, can provide a clearer understanding as to why people perceive crime trends to be higher than they are. Engaging with multiple sources is essentially a choice that individuals make consciously, and various combinations of these choices potentially contain valuable information about individual behavioural traits. According to Tversky and Kahneman's availability heuristics (Tversky and Kahneman, 1973), more frequently available information can lead to availability bias when judging the prevalence of events (Baranauskas and Drakulich, 2018). This suggests that when individuals gain crime related information from multiple sources repeatedly, they are likely to perceive the likelihood of crime to be more than it is. This happens because of the distorted picture presented by various media (Kemp, 1987) that can increase the perception of risk (Johnson and Tversky, 1983). These 'repertoires' of information sources that individuals develop for their own needs can vary in size and composition (Yuan, 2011) and should thus be used as a factor when understanding how individuals frame their opinions about important issues.

The current study explores the pattern of reliance on multiple information sources about crime levels in the country by identifying individual repertoires and tests whether those with a larger repertoire are more likely to perceive crime levels to be higher than those relying on a smaller repertoire. The study focusses on a subset of individuals who have never had any personal experience of the criminal justice system that could potentially shape their perception.

Literature Review

One of the challenges for policies on crime prevention is to understand why people perceive crime trends to be higher than actual despite overall declining crime rates (Duffy et al., 2008). This difference, also called the perception gap, has been observed primarily in two forms. The first is in the form of the difference between actual and perceived national crime levels, while the second is in the form of the difference between the perceived crime levels at the national and the local level. Several studies have explored these differences theoretically as well as empirically (see, e.g., Duffy et al. (2008) and

Mohan et al.(2011)). Importantly, the perception gap is found to be independent of place and has been observed in many countries.

Roberts and White(1986) found that people estimated recidivism rates for first-time offenders to be much higher than official estimates in Canada, while Warr(1995) found that, in America, people generally believed crime rates to be increasing nationally. In Australia, Davis and Dossetor(2010) found that a vast majority of people incorrectly believed crime rates to have increased over the past few years and also overestimated the level of violent crimes. Similar results were found consistently over time in the context of the UK (Duffy et al., 2008), New Zealand (Paulin et al., 2003) and South Africa (Govender, 2013).

Explanations of the perception gap

Various sociological and behavioural explanations have been proposed to decipher the ubiquitous perception gap. Early work such as Tyler and Cook(1984) attributed the disconnect between national and personal risk of crime to individuals' societal versus personal-level judgement making. The authors argued that when individuals express concerns regarding the risk of crime in wider society, they do so by judging their society. This argument was in contrast with personal-level judgements which are primarily about personal risk of victimisation. They also proposed that concerns regarding society could be influenced by the media, although the media could influence concerns regarding personal safety only in a limited way. Such influences could thus contribute towards perceiving the aggregate scale of crime to be higher than actual. Similarly, Tyler and Boeckmann(1997) found that personal experience of crime may not influence general attitudes towards crime in the society as much as influencing the outlook towards social conditions. In their study on recidivism, Roberts and White(1986) argued that the overestimation of recidivism rates of first-time offenders might be due to people' attributing' reoffending behaviour to the individuals concerned. The authors further argued that the stereotyping of offenders could result in the overestimation of overall offending levels, thus contributing to a gap in the actual and perceived crime levels. In a similar context, Warr(1995) demonstrated that although individuals perceive national crime rates to be rising, they do not usually attribute high local crime rates to their neighbourhoods but to other unknown places. This behaviour, some scholars argue, could be due to the preference of home town, where people may believe their community to be superior to others (Duffy et al., 2008) or due to having interracial friendships that can worsen one's negative perception of local crime rates (Mears et al., 2009).

A few other explanations have been offered to interpret the perception gap. Some of these argue that the number of recorded crimes is generally smaller than the actual crimes because many crime incidences are not reported (Govender, 2013; Skogan, 1977), thus justifying the public perception of higher crime rates (Duffy et al., 2008). Several demographic variables have also been used to explain the variation in the perception of crime rates. Older people, as well as those who have been victimised previously, have been found to perceive crime rates to be higher than actual, both nationally and locally (Mohan et al., 2011). On the other hand, males and those with higher education have been found to have a more accurate perception of crime trends (Davis and Dossetor, 2010).

The role of media and other information sources

The role of media in fear of crime and presenting a distorted picture of crime trends has been debated for a long time. For someone without any direct experience of the criminal justice system, the media serves as the first source of information regarding crime-related news (Callanan, 2012; Dowler, 2003). Researchers have identified the role of mainstream media such as television in shaping human perception regarding crime. A series of work by Gerbner and colleagues set the foundation of research into the violence in television programmes and proposed the cultivation thesis (Gerbner, 1970; Gerbner and Gross, 1976; Gerbner et al., 1980). After the analysis of television contents and viewing patterns and comparing it with the real-world crime, the researchers argued that the media programmes exaggerate violence that leads to a 'cultivation' of fear and anxiety, especially among 'frequent viewers' (Ditton et al., 2004). There were subsequently several arguments against this theory, mainly suggesting a differential impact across demography and neighbourhood (Doob and Macdonald, 1979; Heath and Gilbert, 1996). This research, nonetheless, paved the way for addressing differential media influence using 'audience effects' (Chiricos et al., 1997). The research on audience effects argues that not everyone is affected in the same way by the media messages and that this effect is moderated

by several other factors, such as the content and subjective interpretation of the message (Ditton et al., 2004).

Apart from the role of media in the fear of crime (Chiricos et al., 1997; Heath and Gilbert, 1996), scholars have also explored its influence on punitiveness (Spiranovic et al., 2012), actual crime rates and worry about crime (Ditton et al., 2004) and the role of traditional and online forms of media in the victimisation risk and the perception of police powers (Roche et al., 2016). Punitiveness refers to the public sentiment of harsher sentences and policies for tackling crime. Spiranovic et al. (2012) found that reading of tabloids and commercial media can have a strong influence on public punitiveness. Similar results have been found in studies such as Kleck and Jackson (2017) and Rosenberger and Callanan (2011). It has been found that the strength of this influence varies by the type of media, e.g., television programmes such as crime drama and reality TV shows have been shown to be more strongly linked with punitive attitudes (Britto and Noga-Styron, 2014). Despite the general agreement on the strong role of the media in shaping punitive attitudes and fear of crime, it is crucial to recognise the pivotal role of accurate information through these media channels. In this context, Wanner and Caputo (1987) argued that inaccurate information through the media about crime rates could heighten fear of crime which, in turn, can influence punitive attitudes.

In the context of the media's role in the perception of crime trends, literature is somewhat limited. Scholars have maintained that the media can influence one's concerns about national levels of crime, although this influence can diminish when it comes to worries about one's safety (Tyler and Cook, 1984). Duffy et al. (2008) argued that people's perceptions of crime trends could be due to biased information obtained through the media. Amongst the various media, television (Davis and Dossetor, 2010) and newspapers (Mohan et al., 2011) are found to have a significant impact on the views about crime trends. More recently, Shi et al. (2019) argued that unobserved individual-level factors may be mediating the relation between media exposure and crime perception.

As the new forms of media have developed, research has explored the roles of other media sources such as various types of newspapers (broadsheets, tabloids, etc.), different forms of technologies and the internet on perception (Roche et al., 2016). These studies have implicitly acknowledged that the effect on crime perception varies by the source of news due to the different styles of presentation, and that such analysis is limited in the literature (Eschholz et al., 2003; Weitzer and Kubrin, 2004). These two streams of research have suggested that the impact on the perception of crime not only varies because of the audience characteristics but also because of the sources of information. These information sources could thus have an impact on one's perception of crime trends (Tyler, 1980). Stalans(1993) found that engaging with interpersonal sources such as peer networks, family members, etc. could not only provide a more accurate picture of crime but could also help to break the stereotypes developed through the influence of mass media.

Further, those relying solely on media sources for crime-related information are more likely to have incorrect information about the criminal justice system and sentencing laws, compared with those who base their information solely on non-media information sources such as family and friends and the internet (Pickett et al., 2015). In practice, however, individuals engage with several media sources simultaneously (Ahlers, 2006), and these are mixed in an intricate pattern to suit the individual's needs and agendas (Yuan, 2011). Recent mass communication research has stressed the importance of exploring 'media repertoires' rather than a single media source to uncover the influence of media combinations on consumption patterns (Kim, 2016). Studies on media repertoires have found that an individual's chosen repertoire depends on several demographic factors such as age, gender and education (Hasebrink and Popp, 2006; Van Rees and Van Eijck, 2003). Further, different repertoires are associated with different types of news and topics (Reagan, 1996; Yuan, 2011). The repertoire approach has also been used to explore newer forms of media such as mobile phones, the internet and video streaming (Taneja et al., 2012).

Drawing upon and extending the 'media repertoire' approach to non-media sources, one could argue that individuals are exposed to several information sources at any time and develop their own' information repertoire', which is a subset of all possible information sources available to them. The combined effect of these repertoires on the perception of crime trends could be complex, especially

when many of these sources provide similar information at any point in time. To add to this complexity, the number of possible combinations of these sources could double with every additional source, making the problem cumbersome.

Exploring what shapes the perception of crime trends is an important policy question as an overly negative perception could result in a demand for a more punitive system and thus a need to allocate more resources towards the criminal justice system (Roberts and Hough, 2005). Although several causes have been attributed to the perception gap, none of the studies has looked at it through the lens of individual information repertoires. Pickett et al. (2015), while not using repertoires, operationalised media reliance using multiple media sources to examine the effect of media reliance on the knowledge of sentencing and punishment laws. They found that reliance on the media for information can create a misunderstanding of crime policy. Beyond the work by Pickett et al. (2015), the current study failed to find any other criminological study that used multiple media to explain crime perception.

This study, therefore, takes on the twin task of extracting information repertoires and studying their effect on crime perception. This strengthens our understanding of the perception gap. It also contributes to the body of research that explores how the media shapes human perceptions in the context of crime as well as to the communication research that explores media repertoires.

The Study

This study explored the pattern of information engagement in the form of most likely information repertoires. Further, the study explored whether different types of repertoires were associated differently with the perception of crime trends. This was done in cases where individuals did not have any prior experience of the criminal justice system because it is known that previous victimisation can have a moderating effect on victim's perception (Callanan, 2012), and can thus bias the results through confounding.

Data and Measures

Data for the study came from the 2015/16 Crime Survey for England and Wales (CSEW), accessed through UK Data Services (Office for National Statistics, 2017). The CSEW is an annual crime and victimisation survey in England and Wales and uses a stratified multi-stage random sample (Tilley and Tseloni, 2016). It measures risk, perception, and experience of crime and anti-social behaviour of individuals in randomly chosen households (Office for National Statistics, 2015). The survey asks participants about their view of national crime trends and whether this has 'gone up a lot', 'gone up a little', 'stayed about the same', 'gone down a little' or 'gone down a lot' over a few years. Subsequently, it asks about the source of such information on trends, which can be one or more of the media (broadsheet/tabloid/local newspapers, documentaries on TV, news programmes on radio/TV), or non-media sources (friends experience, word of mouth or the internet). It is to be noted here that CSEW uses the term "internet" to broadly refer to websites, blogs, online news articles, forms of online communication etc. Disaggregation of this term, although substantively interesting, was not possible because of this limitation.

In all, 512 patterns of engagement were possible for nine information sources and analysing each of these separately could become cumbersome. These patterns corresponded to all the possible information repertoires in the context of this study. As such, a method that found a smaller number of homogenous subgroups that could be used for the analysis was required for this situation. Latent class analysis is a method that deals with such multivariate binary data.

The latent class model was used to derive discrete groups that could explain the interrelation of engaging with various media and non-media sources. The method assumes that the joint distribution of several observed binary variables (engaging/ not engaging with a particular information source in the context of the current study) can be expressed as a weighted mixture of conditionally independent binary variables (Lazarsfeld and Henry, 1968). The model can be denoted as (Bartholomew et al., 2011):

$$p(\boldsymbol{y}_i) = \sum_{k=1}^{K} \pi_k p_k(\boldsymbol{y}_i|\theta_k)$$

where each individual is denoted by *i* and responds to a set of survey questions as yes/no. These questions are denoted by the vector $\mathrm{y_i}$ in the equation. $p(\boldsymbol{y}_i)$ refers to the joint density of the response vector. In a latent class model, this density can be represented as a mixture of K densities $\mathrm{p_k}(\mathbf{y_i}|\theta_\mathrm{k})$, with θ_k being the parameter of the joint probability density. $\mathrm{p_k}(.)$ can also be understood as the joint probability of responding 'yes' to the set of questions, when the individual *i* belongs to the class k. Further, all the variables in the response vector are assumed to be mutually independent, given that they belong to one of the *K* classes. Thus, each binary variable in each class has its own parameter that is to be estimated. These parameters are called item response probabilities, while the proportions in which they combine (π_k) are known as class probabilities. A brief introduction to the latent class models is provided in Yan (2017) while more technical coverage can be found in McCutcheon (1987) and Hagenaars and McCutcheon (2002). Based on the results from latent class analysis, one can derive K probabilities, for each individual, corresponding to the chances of belonging to each of the K classes. These classes corresponded to the repertoires in the current study. With the help of these probabilities, the individuals were assigned to their most likely latent class/repertoire (Collins and Lanza, 2010).

After deriving the most likely repertoire for each individual in the sample, the current study then compared the perception of national crime trends with this repertoire. It was hypothesised that the individuals who had a larger repertoire and engaged with more information sources were likely to be the ones who were more pessimistic about national crime trends compared with those who had a smaller repertoire. This hypothesis was tested using multinomial regression between the modal assignment of repertoires and the perception of national crime trends.

Analysis strategy

R package *poLCA* (Linzer and Lewis, 2011) was used to fit the latent class model, while the model selection was carried out using the Bayesian Information Criterion (BIC) (Schwarz, 1978). Since the parameters in LCA were estimated via maximisation of the likelihood function, often using the EM algorithm (Dempster et al., 1977), it was important to be wary of solutions corresponding to local maximum or those lying on the boundary of parameter space i.e., on the boundary of the interval [0,1]. In terms of the model equation, this would mean that one of the components of θ_k is estimated to be either 0 or 1. An estimate at the boundary of parameter space in maximum likelihood estimation may not correspond to the true maximum, thus giving false positive estimates. Additionally, this can indicate an overly complex or overfitted model (Garre and Vermunt, 2006). The model can be simplified by reducing the number of classes used in the model. In the current study, boundary value solutions were dealt with by rejecting models that had parameter estimates as 0 or 1 and refitting the model with the lower number of classes. To ensure the global maximum was attained, ten different starting values were used to arrive at the same solution (Hagenaars and McCutcheon, 2002). After the final LCA model was arrived at, individuals were assigned to the modal class, which was subsequently used as a predictor of the perception of national crime trends, along with other control variables. For this, a multinomial regression model was used through the R package nnet (Venables and Ripley, 2002).

Control variables

Confounding is a phenomenon where a factor is correlated with both explanatory and response variables (Grimes and Schulz, 2002). This results in a spurious relationship between the two variables and can be problematic if a study is aiming to establish a cause-effect relationship (McNamee, 2005; Weisburd, 2010). To deal with this issue, it is vital to reduce the effect of confounders by using an appropriate statistical technique (Pourhoseingholi et al., 2012). One of the objectives of the current study was to establish a relationship between the latent classes of media engagement and the perception of crime trends. Previous research has shown that media exposure was related to age, gender and ethnicity (Tsfati and Cappella, 2003). Additionally, studies on media repertoire have shown that the choice of repertoires is contingent upon an individual's age and gender (Taneja et al., 2012; Van Rees and Van Eijck, 2003). Similarly, the perception of crime trends is also related to these variables (Mohan et al., 2011). Consequently, these variables were potential confounders to the association

between perception and information repertoires and needed to be accounted for. Several techniques have been proposed to overcome confounding, such as score matching and randomisation (Jager et al., 2008). In an observational study, confounding can be limited by including potential confounders as additional explanatory variables in a linear/logistic regression model (Pourhoseingholi et al., 2012). The current study thus included age, gender and ethnicity as potential confounders in the relation of information repertoires and the perception of national crime trends.

Results

Descriptive statistics are presented in Table 1. It can be seen that the majority of respondents draw upon TV/radio news programmes as their source of information for crime, which is not surprising, given that several studies have stressed the role of mainstream media in shaping perceptions (Doob and Macdonald, 1979; Gerbner and Gross, 1976). Non-traditional forms of information sources such as the internet are used as a source of information about crime only moderately. This concurs with the previous studies where the internet news has not been found to moderate anxieties regarding victimisation (Roche et al., 2016). When it came to the perception of crime trends, the highest number of respondents perceived crime to have gone up only a little nationally. This could be seen in conjunction with the statistics on using family and friends' experience to view crime rates. Only a small proportion of individuals had family and friends as their information source for crime trends. Noteworthy was that these were individuals who did not have any criminal justice experience. Both personal and close family networks could have a detrimental effect on the perception of crime, especially if these experiences were negative (Roberts and Hough, 2005). Nonetheless, only a very small proportion of individuals saw crime trends to have gone down a lot.

Variable	Mean/proportion (SD)
Friends' experience	0.125
Word of mouth	0.271
Internet	0.292
Broadsheet newspaper	0.239
Tabloid newspaper	0.323
Local newspaper	0.30
TV documentaries	0.272
TV/radio news programmes	0.713
Radio programmes	0.202
Age	53.3 (18.7)
Being non-white	0.08
Male	0.435
Perception of national crime rates	
Gone up a lot	32.88%
Gone up a little	33.03%
Stayed about the same	23.63%
Gone down a little	9.67%
Gone down a lot	0.79%
Sample size	10581

Table 1: Descriptive statistics

What informs people?

The sample contained nine different sources of information distributed between media and non-media sources. However, a substantive question arose as to which combination of these sources did individuals use most often. Table 2 suggests that the majority of individuals used only TV/radio news programmes as their source of information regarding crime trends, with tabloid and TV/radio news

programmes being the second most popular source. The third most popular source of information regarding crime trends was word of mouth and information from others. This was important as it indicated the extent to which people relied on information sources that may or may not be authentic. Non-traditional and digital forms of information sources, such as the internet, were also popular combinations of information sources, in conjunction with traditional media sources.

	Friends	WoM	Internet	Broadsheet	Tabloid	Local newspaper	TV documentaries	TV/ radio news	Radio programmes	Proportion
Gr 1	0	0	0	0	0	0	0	1	0	11.06%
Gr 2	0	0	0	0	1	0	0	1	0	4.52%
Gr 3	0	1	0	0	0	0	0	0	0	2.67%
Gr 4	0	0	1	0	0	0	0	1	0	2.63%
Gr 5	0	0	0	0	0	1	0	1	0	2.57%
										1= "yes"; 0=" no"

Table 2: Five most frequently used combinations of information sources

Overall, the table shows that individuals accessed a mix of various media and non-media information sources that shaped their perceptions of crime trends.

Results of latent class analysis

Table 4 and 5 present the results of latent class analysis, clustering individuals based on their choice of information source into a smaller number of homogenous subgroups. To arrive at the final model with three classes, various models with an increasing number of classes were fit, starting from two. It was not long before the final model was arrived at as very soon the models ran into boundary value problems. Such models were ignored in favour of a simpler one. BIC statistics are presented in Table 3.

No. of classes	BIC
2	105525.6
3	104454
4*	104373.3
5*	104269.7
6*	104240.3
7*	104197.8
**model contained more than one parameter estimated at boundary value*	

Table 3: BIC values and number of classes

Table 3 shows that although BIC statistics decreased marginally after the model with three classes, these models ran into boundary value problems, indicating numerical issues with the model, along with other practical difficulties in model testing (Samuelsen and Dayton, 2019). Models with more than three classes were thus rejected, and a three-class model was chosen as the final model. Interpretability of the latent classes was also taken care of, as the three-class model corresponded to three groups: the first who drew upon media sources only, the second who drew upon non-media sources only and the third who drew upon on a mix of these sources, as shown in Table 5. For the purpose of this study, these corresponded to media, non-media and mixed repertoires, respectively.

Classes (repertoires)	**1 (media)**	**2 (non-media)**	**3 (mixed)**
Estimated Class weights	61.23%	27.97%	10.79%

Table 4: Estimated class (repertoire) prevalence in the population

Table 4 contains the results of the chosen three-class latent class model. Three classes (repertoires) corresponded to approximately 61%, 28% and 11% of the population. Table 5 presents the response probabilities of each question, given that the individual belongs to one of the three repertoires.

Classes (repertoires)	**1 (media)**	**2 (non-media)**	**3 (mixed)**
Friends' experience	0.026	0.305	0.217
Word of mouth	0.081	**0.62**	0.446
Internet	0.225	0.308	**0.631**
Broadsheet newspaper	0.235	0.106	**0.609**
Tabloid newspaper	0.33	0.182	**0.643**
Local newspaper	0.237	0.308	**0.634**
TV documentaries	0.25	0.158	**0.699**
TV/ radio news programmes	**0.802**	0.454	**0.881**
Radio programmes	0.185	0.099	**0.569**

Table 5: Response probabilities in each repertoire

For the ease of interpretation of response probabilities in each class, values above 0.5 were considered to be representing the class. It was found that the most popular repertoire was of individuals who accessed media sources only and, primarily, the news programmes on TV and radio. For this group of people, access to other media and non-media sources was very limited. The second group (repertoire) consisted of individuals who relied primarily on word of mouth and information from other people to shape their perception of national crime trends. Again, for this group of people, other information sources did not matter to a great extent. The third group was of people who relied on modern forms of information such as the internet and several other media sources. This group accessed all the possible media sources as well as the internet and, to a lesser extent, relied on word-of-mouth information. As such, their perception was shaped by a mix of information sources. The latent class model thus indicated that the population consisted primarily of the three most common repertoires: media, non-media and mixed repertoires. It was also observed that, probabilistically, the most popular information repertoire was also the smallest while, on the other hand, the least popular repertoire was the largest.

The model also estimated, for each individual in the sample, the vector of probabilities for belonging to each of the three latent classes, based on the response. With this vector, everyone was assigned to the most likely latent class, or repertoire, based on modal class assignment (Nagin, 2005). This assignment was tabulated against five categories of perception of national crime trends and was tested to find whether holding a particular repertoire is independent of the perception of national crime levels. A chi-square test of independence was carried out on this contingency table to show that the repertoire and perception were not independent, with the null hypothesis of independence being rejected (chi-square test statistic=167.52, df=8, $p<0.001$). This information was subsequently used to assess the relationship of repertoire with the perception of national crime trends, in the presence of other control variables, using multinomial regression.

Results of multinomial regression

Table 6 presents the results from multinomial regression. The coefficients in the table refer to the log-odds of belonging to a particular category of perception compared with the base category, with every unit change in the explanatory variable. Since, according to the descriptive statistics in Table 1, the majority of the sample chose the 'gone up a little' category, the study used this as a base category for multinomial regression.

	Intercept	Class 2 (non-media)	Class 3 (mixed)	Age	Male	Non-white
Gone up a lot	0.335 (1.09)*	1.13 (1.06)*	1.74 (1.09)*	1 (1.00)*	0.66 (1.05)*	1.05 (1.10)

Stayed about the same	0.841 (1.09)*	0.98 (1.06)*	0.61 (1.11)*	1 (1.00)*	1.3 (1.05)*	0.94 (1.1)
Gone down a little	0.26 (1.13)*	0.55 (1.1)*	0.43 (1.18)*	1 (1.00)	1.93 (1.08)*	1.19 (1.13)
Gone down a lot	0.013 (1.48)*	0.6 (1.35)*	0.61 (1.6)*	1 (1.01)	1.78 (1.25)*	1.77 (1.40)
Reference category for perception of crime: "Gone up a little" *Reference category for covariate of class: Class 1 (media repertoire)* **significance at 5% alpha level (std errors in brackets)*						

Table 6: Multinomial regression of class membership on perception (on odds scale)

Results from Table 6 show that for individuals switching from a media repertoire to a mixed repertoire (or expanding their information repertoire), the odds of perceiving crime going up a lot increased by 1.74 compared with perceiving crime going up a little. For those with a non-media repertoire, this odds value was 1.13, indicating that individuals who relied primarily on word of mouth and the experience of others were likely to perceive crime to go up compared with those who relied mostly on media sources. Results on the variable 'male' showed that males were only 0.66 times more likely than females to see crime going up a lot than going up a little. Other results for this variable showed that males were generally less likely to see crime going up a lot compared with females. Older people were more likely to perceive crime to go up a lot, rather than going up a little. Results of the variable on ethnicity were non-significant, indicating that ethnicity had little relation to the perception of crime trends in the presence of one's information repertoire.

Discussion and Conclusion

In criminology, studies have argued that the presence of several non-media sources which individuals can access may play a role in shaping perceptions about crime (Stalans, 1993). The literature review also suggested that studies on the relationship between crime and media have focussed extensively on the fear of crime (Hale, 1996) and have not given enough attention to exploring the perception of crime trends. It has been found that people generally overestimate national and local crime trends. This phenomenon, called the perception gap, has been observed in several countries (Mohan et al., 2011; Roberts and Hough, 2005). Meanwhile, communications research has stressed the influence of media repertoires in the individual media-exposure patterns (Reagan, 1996) and that these repertoires, rather than the individual media, should be used to study consumption patterns (Kim, 2016). The current study adopted an information repertoire-based approach and extracted the most common repertoires from a combination of information sources, and subsequently looked at the effect of this latent information on perceptions of national crime trends.

The results from the latent class model suggested the existence of three distinct information repertoires. The first was of individuals who primarily sought information from TV/radio programmes and was the most popular repertoire, with around 61% of the population engaging with it. In this repertoire, other information sources did not play a significant role. This was not surprising as traditional sources such as TV and radio, despite having been criticised for spreading anxiety and 'moral panics' (Cohen, 2002; Critcher, 2003) still constituted popular repertoires for information regarding crime, along with newspapers (Chermak, 1997). Ideally, this repertoire should have also included newspapers (broadsheet/ tabloid/local) as other traditional sources in the repertoire. Nonetheless, if one added the likelihood of using broadsheet, tabloid and local newspapers together, 'newspapers' do formed a part of this popular repertoire, thus in line with previous studies (Van Rees and Van Eijck, 2003; Yuan, 2011). This repertoire was named as 'media repertoire' as media sources are its primary constituent.

The second repertoire, although smaller but still held by a sizeable population (28%), was composed of word of mouth or information from other people who were not family members or friends, as the

primary source of information. It is well known that information from others is a medium through which individuals gather information about crime (Shrum and Bischak, 2001) and through which crime news and the fear of crime spreads (Shotland and Goodstein, 1984). For people with this repertoire, it was the most important source of information for national crime trends. Other information sources were less likely to be included, although TV/news media sources were somewhat popular in this repertoire. This repertoire was termed as 'non-media repertoire' in the study. Together with the first repertoire, it was held by around 89% of the population. These repertoires, nonetheless, had fewer sources, thus suggesting that small repertoires were likely to be more popular ones too. It also demonstrated that the majority of individuals access only a small number of information sources.

The third group, corresponding to the third repertoire, was the least popular one amongst all three repertoires and was adopted by around 11% of the population. This repertoire consisted of multiple information sources for obtaining information about crime trends. It consisted of all the traditional forms of media, along with the internet, but did not have word of mouth as a likely source of information. The use of digital media as a source of information about crime trends was an interesting addition as communication research on repertoires has found that the internet is becoming a popular media source (Van Rees and Van Eijck, 2003; Yuan, 2011) although the internet was not found to be explicitly related to anxieties about crime in previous research (Roche et al., 2016). It was notable that this repertoire had more traditional than non-traditional media sources, reinforcing the popularity of the former. Interestingly, information from friends/ family members did not form part of any of the three repertoires. This indicated that, compared with other media sources, information from friends/family members on crime trends was not a common occurrence.

All respondents were assigned to their most likely latent repertoire based on the latent class model. A crosstab of individual repertoires with the perception of national crime trends was used to test whether the perception was independent of repertoires. A chi-square test suggested that the posterior modal assignment of individuals to the repertoires was not independent of the perception of national crime trends. This was one of the key findings of this study and asserted the importance of repertoires in perception research in criminology. For those with larger repertoires, consisting of a mix of traditional media and the internet, the odds of perceiving crime trends to have risen a lot was very high compared with the odds of people with a smaller repertoire. Although some of the previous research has demonstrated that newspapers such as tabloids negatively influence the perception of national crime trends (Mohan et al., 2011), current results showed that, in addition to the tabloid newspapers, other traditional sources also contributed to negative perceptions. The role of the internet in this repertoire was also noteworthy. As an extension to some of the previous results (Roche et al., 2016), the inclusion of the internet in the information repertoire could aggravate people's negative perception about crime trends. In conjunction with the existing communication research, this result demonstrated that individuals having such a repertoire were generally more sceptical towards the mainstream media, although they were still likely to have more mainstream than non-mainstream sources in their repertoire (Tsfati and Cappella, 2003). Whether their scepticism towards the media also extends to their scepticism towards crime trends is a question that warrants further exploration.

For individuals having just the word-of-mouth information source in their repertoire, although crime trends rose a lot, this rise was not as much as for those with a mixed repertoire. This concurred with some of the previous research establishing a connection between word-of-mouth information and the prevalence of crime, in that information becomes distorted as it is passed on (Shotland and Goodstein, 1984). Nonetheless, word of mouth turned out to be a relatively more accurate information source than a mix of sources. These results also demonstrated that those with a simple information repertoire, consisting primarily of traditional radio/TV news programmes, were less likely to see crime to be rising a lot. This also echoed previous research suggesting that individuals generally trust mainstream media more than any other form of information source and hence have higher exposure to this source (Tsfati and Cappella, 2003). Further, a combined population with non-media and mixed repertoires (around 38%) contributed towards a widening perception gap. This finding was relevant as this group of the population has influenced many policies in the criminal justice system and has prompted research measuring attitudes and perception (Duffy et al., 2008; Roberts and Hough, 2005). Additionally, improved perception has also shown to be enhancing societal welfare by increasing life satisfaction (Ambrey et al., 2014).

The analysis of the relationship between information repertoires and the perception gap suggested that those having larger repertoires, comprising a mix of information sources, were likely to be more pessimistic about national crime trends. Although this result was surprising, it could be understood through Tversky and Kahneman's theory on availability bias (Tversky and Kahneman, 1973). According to this theory on how people make judgments, individuals overestimate the 'frequency of occurrence of an event' if the information available to them is easy to recall because it is available frequently. In the context of a mixed information repertoire, it may be assumed that this information was available more frequently through a number of information sources (Baranauskas and Drakulich, 2018), although with different levels of sensationalism (Heath and Gilbert, 1996), and made people believe the rates of crime had risen over the past few years.

The study has contributed theoretically as well as methodologically to the research on the crime perception gap. First, the question of understanding perception gap is important as it has a significant relationship with demands for more punitive measures in society (Spiranovic et al., 2012), needing more independent reviews of crime trends from the government (Duffy et al., 2008) or clearer communication from agencies (Chris et al., 2006). The study has provided an insight into the research on the perception of crime trends by looking at the repertoires of information sources that included traditional as well as non-traditional information sources. Until now, most other studies have only looked at the influence of individual media sources. The study has thus asserted the importance of including other sources when looking at the influence of the media. The study has also derived the most common repertoires of information sources, a concept drawn from communications research but extended to include non-media sources. It has also contributed to repertoire research in communication studies by exploring the impact of repertoires on perception. Further, the latent class methodology has been used for the first time to derive information repertoires to explore their influence on crime trends.

This study was not without limitations, but these can be overcome with further research. First, the study explored the perception gap in terms of the overestimation of national crime trends. However, this was only one constituent of the perception gap and the study ignored the perception of local crime trends as well as the gap between perceived national and local crime trends. Second, the study used cross-sectional data in the context of the UK. Whether this relationship holds over time and in other countries is a topic that can be explored by collecting longitudinal data from other countries. Third, the study concentrated on individuals who did not have any experience of the criminal justice system. Current results can be compared with information repertoires of victims to obtain a deeper understanding of how victimisation influences one's perception as well as the choice of repertoires. Fourth, additional demographic variables can be included as antecedents of choosing repertoires to improve the validity of the findings. Some of the possibilities include the measure of deprivation, income and education. Fifth, the study used the posterior model classification of individuals to derive their most likely repertoire. Using this posterior classification for predicting perceived crime trends treats repertoires as non-random, ignoring uncertainty inherent in this classification (Lanza et al., 2013). Using one model to derive latent classes as well as predicting perception in a single step may provide different results.

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