JCOM

Opportunities for poaching: using the public's enjoyment of popular culture to foster dialogues around genetics

Jonathan Roberts, Richard Milne, Anna Middleton, Christine Patch and Katherine Morley

Abstract

Introduction: Engagement, education and communication with public audiences have long been seen as important for maximising the benefits of genetics and genomics. An important challenge is how to structure engagement in such a way that recognises the value and legitimacy of diverse public opinions and voices alongside scientific expertise. In other words, how to operationalise the dialogue model of science communication. In order for diverse public voices to be heard it is important to understand the resources that people have to make sense of science on their own terms. In this paper we provide a framework for how people's resources can be identified in relation to the culture they consume.
Methods: A cross sectional online survey ($n = 1407$) explored the cultural tastes and practices of a representative British public audience. Latent class analysis identified groups with similar cultural practices. Regression analysis was used to explore the relationship between the latent classes and other measures, such beliefs about genetics.
Results: Three latent classes were identified each with distinctive cultural practices and tastes. Some clear relationships were found between the latent classes and familiarity with genetic terminology. However, for more complex beliefs, such as genetic causation, regression analysis yielded null or uncertain results with no clear correlation found.
Discussion: This paper provides an analysis of how people's enjoyment of culture could be a resource for understanding and advancing science communication and engagement. The results are discussed using two complementary theoretical frameworks. Using Bourdieu's concept of cultural capital, the exclusionary power culture can be seen. The work of De Certaeu, on the other hand, shows how this power can be resisted and subverted. While this paper focuses on genetics and genomics we argue that this approach provides a 'proof of concept' that these ideas can be extended for use in wider science engagement contexts.

Keywords Public engagement with science and technology; Science and media; Science communication: theory and models

DOI https://doi.org/10.22323/2.21060401

Submitted: 16th August 2021
Accepted: 11th May 2022
Published: 5th September 2022

Introduction

Decisions about the acceptable use of new genomic science and technology are (and have always been) a societal issue [Prainsack, 2017]. As such public communication about, understanding of, and engagement with genetics and genomics is an enduring and important challenge [Green et al., 2020]. However, there is no consensus on what this engagement should look like.

Often the goal of public engagement is to improve scientific literacy [Vidal, 2018]. From this perspective the aim of science communication is to help people understand science correctly — as it is communicated by the experts. Such 'deficit' models of science communication have had sustained criticism, but alternatives based on dialogue and engagement have been hard to operationalise [Lock, 2008; Vidal, 2018; Roberts, Archer, DeWitt & Middleton, 2019]. Despite policy aims to listen to the public in the form of dialogue, the deficit model still persists in public communication of science [Simis, Madden, Cacciatore & Yeo, 2016] and many engagement projects have not gone beyond the epistemic basis of consensus-formation or measuring public opinion [Kurath & Gisler, 2009; Smallman, 2020] or are, in fact, top-down and short-term exercises [Powell & Colin, 2008].

Some approaches to abandoning deficit theorising have sought to dissolve the lines between expert and non-expert. There is of course truth to Michael's [2002] observation that "there is no easy differentiation between the expert and the popular, between the scientific and the lay, between the factual and fictional" [Michael, 2002, p. 370]. Prior [2003] notes how the popularity of such view can be tracked in the language used in science communication, moving from lay 'beliefs' to lay 'knowledge' to lay 'expertise'.

The position taken in this paper is that there is an important distinction to be made between expert and lay knowledge. This distinction may not be simple or binary, with extremely blurred boundaries. Nevertheless, the distinction can still be useful. Expert knowledge for example, is more likely to be explicitly theorized, systematic and subject to critical reflection, whereas lay knowledge is more likely to be tacit, implicit and directed towards practical ends [Featherstone, Atkinson, Bharadwaj & Clarke, 2006]. Furthermore, understanding how different publics' views do not align with scientists can be appropriate. For example, it is important to know if people believe that global warming is not real, or that the MMR vaccines cause autism.

As such the term *deficit* is not employed here simply as a pejorative signifier. Indeed, as Metcalfe [2019] has demonstrated many science communication activities involves a blend of approaches and objectives. Instead, the view taken is that deficit theorising offers not an incorrect approach, but instead a limited one [Suldovsky, 2016]. There are two important limitations outlined here.

First, deficit models are more likely to view science as a-cultural, value free knowledge [Roberts, 2019]. They operate with what Chalmers [2013] describes as a "common sense" view of science, where facts about the world can be established through the testing of theories by observation. Here, there is a belief in a unique 'scientific method' that provides objective and value-free truths about the natural world, and social and ethical issues can be put aside as "nothing to do with the science", as Smallman [2020] puts it.

Scholarship from the philosophy of science demonstrates that science can be deeply structured by the values and interests of its makers; scientific practice, even at its most rigorous, is not always or automatically self-correcting [Wylie & Nelson, 2007]. Furthermore, science communication — along with scientific knowledge itself — often reflects the shape, values and practices of dominant groups at the expense of the marginalised [Dawson, 2018]. Importantly, questions about whose values, knowledge and culture are reproduced in scientific knowledge and science communication are concealed (or at least minimised) in deficit models if science is simply viewed as the objective truth and nothing more.

Second, deficit models do not capture the myriad of interesting and idiosyncratic ways publics can engage with and question science outside of its own terms. When making sense of science, the scientific facts are only one piece of the picture. Deficit models view the communication process as essentially linear. Facts are communicated to publics, who assimilate and understand them, to a lesser or greater degree. However, this is simply not how communication works. The types of knowledge and reasoning that people (including 'experts') use to make sense of science is highly eclectic and syncretic. It is hard to capture these complexities with a deficit model [Suldovsky, 2016].

So, it is important to understand how science can reflect the values of its makers and how people make sense of science on their own terms. However, if you accept that scientific knowledge and expertise has important value in the ability to explain the material world then science communication will involve what Vidal [2018] calls epistemic asymmetry. An important question then emerges. How do you engage in dialogues, valuing diverse voices and opinions ad legitimate, without undermining scientific expertise? It is this question this paper addresses.

In order for diverse public voices to be heard it is important to understand the resources that people have to make sense of science on their own terms [Davies, Halpern, Horst, Kirby & Lewenstein, 2019]. In this paper we provide a framework for considering how people's resources can be identified in relation to the culture they consume. We then discuss this in the context of a theoretic framework which can provide insight into the questions above.

Theoretical tools

A number of key theoretical frameworks inform both our analysis and interpretation of the data. First, this paper draws on a Bourdieusian view of culture and specifically concepts of cultural capital and science capital. Bourdieu [1977, 1984, 1986] conceptualizes capital as the valuable and legitimate resources in a society that can generate forms of social advantage. There is significant scholarship demonstrating how forms of capital can sustain relations of privilege; for example how the middle-classes combine forms of capital to produce academic achievement [Dika & Singh, 2002]. Bourdieu identified four forms of capital: economic (i.e. money) social (i.e. contacts and networks) cultural (i.e. valued knowledge, skills and practices) and symbolic capital (i.e. prestige or recognition).

The focus of this paper is cultural capital. This has been primarily studied in relation to the arts. In Bourdieu's original conception, it was conceived as a familiarity with 'highbrow' culture (e.g. opera or fine arts). This familiarity brought advantages as children would have this 'good taste' that allowed them to excel in educational environments. In *Distinction* Bourdieu [1984] widens his focus from education, exploring the ways in which cultural knowledge benefits different groups in society at large. Bourdieu saw cultural capital as playing a key role in practices of dominance and exclusion, in particular in how privileged groups acquire and maintain status. Bourdieu [1984] highlights how concepts of taste become naturalised, being seen as natural as opposed to the product of privilege. For example, a middle-class child may be taken to galleries, museums, music lessons etc. These activities give them an implicit knowledge and aesthetic taste. These may be considered the result of hard work and deemed morally 'good' but they will also have exchange-value in later life. This is because it will increase their employability or ability to create valuable social networks. In recent years there has been research that extends the concept of cultural capital beyond the arts-based forms that dominated Bourdieu's analysis. For example, Pasquier [2005] has argued that in France there has been a shift, with science culture increasingly valued over 'classical' culture. Similarly, Savage [2010] has argued that in Britain since the Second World War, scientific claims to expertise have become increasingly important as a form of distinction. Prieur and Savage [2013] note that emerging forms of cultural capital, those which include scientific and technical expertise, embody different claims to legitimacy and superiority over previous arts-based forms of capital. However, science-related cultural capital relates to more than just scientific knowledge, or science literacy [Archer, Dawson, DeWitt, Seakins & Wong, 2015]. While science-related cultural capital encompasses aspects such as scientific knowledge, skills and practices, it is also characterized by experiential encounters or consumptions (for example, visits to science museums or watching TV programs about science), science-related artefacts (for example, science-informed books and experiment kits) and qualifications (for example, a science degree).

A number of scholars have pushed this idea further, developing the idea of *science capital* to describe different forms of science related capitals. These forms of science-related cultural participation contribute to science capital as they have "the potential to generate use or exchange value for individuals or groups to support and enhance their attainment, engagement and/or participation in science" [Archer, DeWitt & Willis, 2014, p. 5].

Understanding science capital — as consisting of various forms of science-related capitals — provides a constructive lens for understanding the ways that scientific knowledge and scientific activities are valued and legitimated. This Bourdieusian approach provides an interesting perspective for science and science engagement. This is because Bourdieu designates the value of culture as arbitrary. For Bourdieu, there is no innate value to forms of culture; they have no intrinsic justifications or qualities. Following this, Bourdieu states that "all pedagogic action is… the imposition of a cultural arbitrary by an arbitrary power" [Bourdieu & Passeron, 1990, p. 5]. From a certain interpretation of Bourdieu, then, scientific knowledge is no different to other forms of esoteric knowledge with high symbolic value. Knowing about science is no different from decoding a work of art, understanding Latin or appreciating opera. This view stands in sharp contrast to science communication activities that value science specifically because of its intrinsic value. It is difficult to tell from Bourdieu's writing exactly how much of the value of scientific knowledge he viewed as arbitrary. Bourdieu appears to allow for some non-arbitrary value to knowledge, suggesting that there are, at least in principle, "meanings… from universal principle" yet he asserts "authority plays a part in all pedagogy"

> There is no PA [Pedagogic Agency] which does not inculcate some meanings not deducible from a universal principle (logical reason or biological nature): authority plays a part in all pedagogy, even when the most universal meanings (science or technology) are to be inculcated. There is no power relation, however mechanical and ruthless which does not additionally assert a symbolic effect. [Bourdieu & Passeron, 1990, p. 10]

This paper takes the view that Bourdieu leaves room to value scientific expertise while also understanding the social — and arbitrary — reasons for how this knowledge is valued and boundaries of legitimacy are created. The usefulness of Bourdieu's theory here is that it provides a framework for understanding the ways that scientific knowledge functions as an elite form of culture and the arbitrary values that allow people's perspectives to be deemed (ill)legitimate in a scientific context. Viewing science as another form of elite's culture (as Bourdieu does) allows the limitations of the deficit model outlined above to be seen in clear and useful way.

This paper also draws on the French cultural theorist Michel de Certeau. His book *The Practice of Everyday Life* [1984] is concerned the question of what it is to be a consumer of cultural products. De Certeau's was interested in creative acts, tactics, and behaviours of people using a range of cultural forms. He makes for very different read to Bourdieu and the cynicism of Bourdieu's analysis of culture. Skeggs [2004] highlights the way that 'capital logic' has come to dominate Bourdieusian analysis. In this analysis, the value of culture is its symbolic or exchange value. Culture becomes a kind of strategic game. In stark contrast, there is much optimism to be found when viewing culture from within De Certeau's analytical framework. This is because, as he shows, consumption is itself a creative act. De Certeau employs the metaphor of "poaching" — being on someone else's territory and taking something for yourself. He explores the tactics of cultural poachers: the readers who make their own sense of texts; the pedestrians who construct their own sense of the city; and the story tellers who make new narratives within established forms. For De Certeau, people cannot just have meaning imposed on them through culture. They make meaning themselves through the act of consumption.

Methods

To explore the cultural resources people have available to make sense of science, a cross-sectional, hypothesis-generating, exploratory survey was designed. Comprising 24 questions (see supplementary material, appendix 1), the survey aimed to capture participants' cultural tastes and interests in the first 9 questions by asking participants to name films, TV shows and books they liked, leisure activities they enjoyed and their interests. The next 7 questions asked about attitudes and beliefs about genetics and the final questions asked about participant demographics. An online third-party polling company was used to recruit a representative British public audience into the survey, who received a small financial reward for completion. Due to the use of this method, there are no details on non-response rate as we only received completed surveys.

Analysis

Latent class analysis (LCA) was used to analyse the data regarding cultural consumption. LCA is a statistical technique for the analysis of multivariate categorical data. It can be used to investigate underlying subgroups (that is, *latent classes*) in a population. This method facilitated an understanding of underlying patterns in the data regarding cultural tastes.

Respondents were asked about their enjoyment of different types of culture. For this analysis these were amalgamated into 6 categories: Science Related Cultural Capital (e.g. liking popular science books, reading science fiction); Factual media (e.g. documentaries, new programs); 'Legitimate' culture (e.g. art galleries, museums); 'non-legitimate' culture (e.g. soap operas, watching TV); familiarity with genetics in fiction (labelled 'popgenetics' in Figure 1); and interest in health.

The terms 'legitimate' and 'illegitimate' are used here in recognition that these contain value judgments. The judgements here reflect wider judgements about legitimacy rather than those of the authors. Evidence of the 'legitimacy' of certain culture comes from patterns of cultural participation, where powerful class divisions in cultural practices remain. For example, Bennett et al. [2009] use multiple correspondence analysis to assess the value attributed to 'highbrow' and 'lowbrow' culture in the United Kingdom. They provide empirical evidence that, while the ability to consume a wide range of culture has become a form of distinction (the "cultural omnivore"), this does not mean all culture is regarded as equal. 'Elite' practices — going to museums, opera and art galleries, liking classical music and reading more — are still primarily the preserve of those from higher socio-economic class. In our view, terms such as 'highbrow' and 'lowbrow' may suggest an innate value to the culture. Instead, the terms legitimate and illegitimate are used within a Bourdieusian framework where what is legitimately exists but this does not reflect an innate value of one culture over another.

A full description of how these variables were generated can be found in supplementary material, appendix 2.

To determine the number of mutually exclusive latent classes, a series of LCA models were fitted with increasing numbers of classes (from 1 to 6). The best-fitting model was chosen by examining the model fit statistic (the Bayesian information criterion), the interpretability of the classes and the proportion of the sample in each class.

R version 3.5.1 was used for all analyses; the poLCA package was used (version 1.4.1) for the latent class analysis and multinomial regression analysis.

The platform *Smart Survey was* used to deliver the survey. This is a platform similar to survey monkey. However, as the data would be stored in the U.K. it would be GDPR compliant. The third part company One-poll directed their participants to the survey. Data was collected over the course of one week. Ethics approval for the study was gained from King's College London Research ethics department.

Results

Sample characteristics

The total survey response was 1407. Basic demographics of the participants samples is described in Table 1.

Table 1. Demographic characteristics of participants.

Variable	*Value*	*Number*	*Percentage*
Sex	Male	872	62
	Female	520	37
	Transgender	15	1
Age	<20	36	3
	>20–30	222	16
	>30–40	306	22
	>40–50	262	19
	>50–60	280	20
	>60–70	221	15
	>70	80	5
Employment	Higher managerial, administrative & professional	84	6%
	occupations	246	17.5%
	Lower managerial, administrative & professional	126	9%
	occupations	79	5.5%
	Intermediate occupations*	84	6%
	Small employers and own account workers	176	12.5%
	Lower supervisory and technical occupations	56	4%
	Semi-routine occupations*	260	18.3%
	Routine occupations*	197	14%
	Unemployed	42	3%
	Full time education	57	4%
	Retired		
	Not provided		
Highest level of education	Postgraduate degree	211	15%
	Undergraduate degree	394	28%
	Professional qualification	338	24%
	Apprenticeship	10	7%
	School qualifications (GCSE, A-levels)	154	11%
	No answered	211	15%

* Intermediate, routine and semi routine definitions are taken from the NS-SEC classification. Intermediate is defined as:

> Positions in clerical, sales, service and intermediate technical occupations that do not involve general planning or supervisory powers.

Routine defined as:

> Positions with a basic labour contract, in which employees are engaged in routine occupations.

Semi-routine defined as:

> Positions with a slightly modified labour contract, in which employees are engaged in semi-routine occupations.

Latent class analysis

Six latent class models (one to six classes) were fitted. In this analysis, a three-class model was preferable. There were two main reasons for this. First, a three-class model had the lowest Bayesian information criterion. Second, models that used over four classes generated classes containing few participants (i.e. $<$ 10% of the total sample). With $n = 1407$, this meant that the absolute number of participants in these groups would be small, and it would therefore be difficult to determine whether the findings were meaningful. Figure 1 below depicts the three latent classes generated. There are named:

Uncaptured = 45% (Red)

Omnivore = 27% (Green)

Parsivore = 28% (Blue)

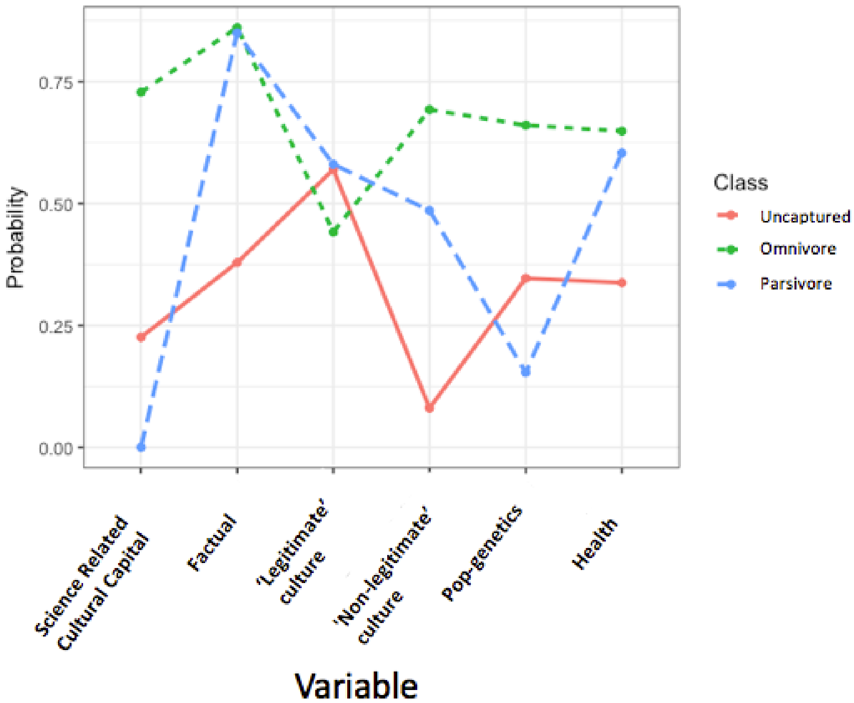

Figure 1. Item response probability for the three-class LCA model.

The X axis lists the categories used to generate the latent classes. The position on the Y axis represents the probability of participants in that class indicating they have a high interest in the measured variable. So, for example, the chance that a participant in the Uncaptured class (red) has a high interest in *science-related cultural capital* (e.g. popular science books etc.) is 24%, and the chance of having a high interest in *'non-legitimate' culture* (such as soap operas) is 56%.

Participants in the red class were termed Uncaptured and represented 45% of participants.[1] They had the lowest probability of indicating an interest in the variables used in the LCA. The class represented in green was termed *Omnivore*

[1]This term was chosen to avoid pejorative terms such as *disengaged*. In their work on class and cultural participation, Bennett et al. [2009] explored patterns of cultural participation and the ways in which these patterns structured class relations in the United Kingdom. They found that on their measures of 'legitimate' forms of culture, participants appeared to be disengaged. However, during interviews, they found that participants had rich social lives and engaged in various forms of cultural participation that were not captured through the survey. Building on this observation, the term *Uncaptured* was chosen to describe this class.

and comprised 27% of participants. Finally, the class in blue was termed *Parsivore* and represented 28% of participants. The term stems from *omnivore*, as *omni* means 'all' and *pars* means 'partial' in Latin. Participants who were Parsivores had low levels of *science-related cultural capital*, and their enjoyment of 'elite' or 'legitimate' capital was not as high as the omnivores. However, the Parsivores had higher levels of elite capital than the Uncaptured and also enjoyed reading; in particular, they enjoyed factual genres (e.g. documentaries and nonfiction books). The most striking feature of this class was that they rated their enjoyment of *factual media*, such as documentaries, extremely highly, in stark comparison with a very low rating of *science-related cultural capital*. The term *science related cultural capital* reflects the Bourdieusian idea the value and legitimacy of culture is not innate but arbitrary. As such, saying that a group has low levels of science-related cultural capital is not the same as saying they are not interested in science (as the enjoyment of factual media might indicate). However, the low levels science-related cultural capital does indicated this group may not engage with science in ways that are viewed as legitimate.

Regression analysis

National statistics socio-economic classification

To gain a better understanding of these classes, multinomial logistic regression was used to test whether the classes were associated with other variables measured in the survey. The results of three variables are presented here. There are National Statistics Socio-economic Classification (NS-SEC) classification, education, and familiarity with genetic terminology. A description of how this familiarity was measure can be found in supplementary material, appendix 2.

Tables for regression analysis are presented below.

Regression analysis: National Statistics Socio-economic Classification.

Reference class: Members of both Uncaptured and NS-SEC Lower.

Table 2. Regression analysis — NS-SEC: table of odds ratios, confidence intervals and p values.

NS-SEC	*Omnivore*	*Parsivore*
Lower	Ref.	Ref.
NS-SEC Higher	OR 1.8 95% CI 1.3–2.3 $p = 0.035$	OR 2.6 95% CI 1.84–3.36 $p = 0.019$
NS-SEC Intermediate	OR 1.9 95% CI 1.37–2.43 $p = 0.031$	OR 2.7 95% CI 1.92–3.48 $p = 0.015$
NS-SEC Unemployed	OR 0.8 95% CI 0.25–1.35 $p = 0.1$	OR 2.2 95% CI 1.48–2.92 $p = 0.038$
Full Time Education	OR 0.8 95% CI 0.26–1.36 $p = 0.5$	OR 0.7 95% CI -0.2–1.6 $p = 0.5$

Education

Reference class: Uncaptured: Left school <18.

Table 3. Regression analysis — Education: table of odds ratios, confidence intervals and p values.

Education	*Omnivore*	*Parsivore*
Left school <18	Ref	Ref
School	OR 0.7 95% CI 0.04–1.16 $p = 0.1$	OR 0.7 95% CI −0.01–1.3 $p = 0.2$
Graduate	OR 2.1 95% CI 1.38–2.48 $p = 0.015$	OR .96 95% CI 0.22–1.7 $p = 0.9$
Postgraduate	OR 5.2 95% CI 4.48–5.92 $p = 0.001$	OR 4.0 95% CI 3.21–4.79 $p = 0.002$

Familiarity with genetics terminology

Reference class: Uncaptured: Low familiarity.

Table 4. Regression analysis — Familiarity with genetic terminology: table of odds ratios, confidence intervals and p values.

Familiarity with Genetics	*Omnivore*	*Parsivore*
Low	Ref	Ref
High Familiarity	OR 19.5 95% CI 18.8–20.1 $p = 0.0001$	OR 3.3 95% CI 2.63–3.93 $p = 0.001$
Medium Familiarity	OR 2.6 95% CI 1.96–3.24 $p = 0.005$	OR 1.7 95% CI 1.17–2.23 $p = 0.041$

Compared to the Uncaptured class those in the Omnivore class had almost two-fold greater odds of being in the NS-SEC Higher group or the NS-SEC Intermediate group (OR 1.8 95% CI 1.3–2.3; OR 1.9 95% CI 1.37–2.43, respectively).

Compared to the Uncaptured class members of the Parsivore class had over two-fold greater odds of being in the NS-SEC Higher category (OR 2.6 95% CI 1.84–3.36) or the Intermediate category (OR 2.7 95% CI 1.92–3.48). Curiously, the Parisvore class had twice the odds of being unemployed than the reference class (OR 2.2 95% CI 1.48–2.92).

Regarding education, the clearest finding from the regression analysis is that the Omnivore class has twice the odds of being graduates (OR 2.1 95% CI 1.38–2.48) and over five times the odds of having a postgraduate degree (OR 5.2 95% CI 4.48–5.92) than the reference class. To some extent, similar findings can be seen with members of the Parsivore class, who were four times as likely to have a postgraduate qualification (OR 4.0 95% CI 3.21–4.79) than the reference class. While this is true, in the logistic regression exploring education levels (except in relation to postgraduate education), the p-values were not significant for the Parsivore class. When taken in conjunction with the analysis which suggests that Parsivores were more likely to be in a higher NS-SEC class but also more likely to be unemployed, the data suggests that the Parsivores represent demographically a somewhat heterogeneous group.

The heterogeneity of the group also highlights one problem that scholars have raised regarding Bourdieu (or at least a lot of Bourdiesian analysis) namely, that culture is too often seen as a set of classed practices — focusing on tastes between different classes [Longhurst & Savage, 1997]. As this analysis shows, people can be similar patterns of cultural consumption but come from disparate backgrounds.

Members of the *Omnivore* class had a significantly increased chance of being more familiar with genetic terminology than the reference class. They had almost 20 times the odds (OR 19.6 95% CI 18.8–20.1) of having a high familiarity with genetic terminology than the reference class (Uncaptured). A similar, if smaller, effect was found with members of the *Parsivore* class, who were over three times as likely (OR 3.3 95% CI 2.63–3.93) to have a higher familiarity with genetic terminology than the reference class.

Limitations

Data from the survey was collected from a third party (OnePoll). OnePoll has its own panel of members from who they collect data. The survey was sent to a representative British public. However, the survey respondents still retain some imbalances. In particular, regarding different ethnicities, the survey is still predominantly white. The survey was only available in English, meaning that people with English as an additional language were unlikely to complete the survey. This means that there are limitations regarding the generalisability of the findings from the survey.

There are also limitations regarding the number of participants recruited, which limited statistical power. Given the survey size ($n = 1407$), analysis that generated more than three classes led to classes that contained very small numbers. As such the data was only powered up to a point. This constrained the analysis to on fewer latent classes. It is possible that a more detailed subgroups exists within my three classes; for example, a proportion of the 'omnivores' might have very high levels of science capital, similar to those described by Archer et al. [2015] and DeWitt, Archer and Mau [2016]. However, given the limitations of the respondents it was not possible to ascertain this with accuracy.

The latent class analysis seeks to find patterns in the data that explain how the participants engage with the cultural items measured in the survey. The three classes generated in the modelling should not be thought of as representative. Instead they represent an exploratory analysis of the ways that cultural preferences are patterned in the data. In this sense, the work is hypothesis-generating; the classes of Omnivore, Parsivore and Un-captured represented three potentially useful classifications of the ways that people engage with different forms of culture.

Discussion

Deficit models of science communication have received sustained criticism. This has reached the point where it would be difficult to find many people arguing in favour of a deficit model (if indeed there ever were). However, deficit assumptions in science engagement have proved ingrained.

A specific challenge is presented by the epistemic asymmetry [Vidal, 2018] that exists in science communication. This asymmetry is established in the relationship between formal scientific knowledge, which is more likely to be codified, systematic and subject to critical reflection, and lay knowledge that is more often tacit, implicit and directed towards practical ends [Featherstone et al., 2006]. It represents a challenge for creating spaces or 'hybrid forums' where diverse social actors can be engaged in dialogues without diluting or undermining the concept of scientific expertise, or dismissing or invalidating lay perspectives.

This research approaches this problem by identifying the resources that people have to make sense of science on their own terms. This was done by determining different latent classes that exist in the participants. This approach has some communalities with other research that looks towards audience segmentation. Segmentation analysis has garnered increasingly attention in the field of science communication in recent years [Besley, 2018]. The research presented here is distinctive in that is pursues this form of analysis with the aim of identifying resources — what we call poaching territory — that can be used to structure science engagement with different publics.

In de Certeau's [1984] *The Practice of Everyday Life* he draws attention to the creative and often subversive ways that people use and appropriate cultural products such as TV, books and film. De Certeau called this 'poaching' to described a kind of unauthorised appropriation of different forms of culture. Extending this metaphor, we argue that the latent classes identified in the analysis can be thought of participant's *poaching territory*; the cultural spaces to which they can go in order to take what they need to make sense of genetics. Understanding this poaching territory provides a way of structing engagement activities to create hybrid spaces where disparate knowledges and understandings can be shared.

In particular, we argue that those in position of power must recognise the publics' poaching territory, allowing them to take what they need from it rather than playing gamekeeper, thereby restricting the opportunities for meaningful dialogue. This is where Bourdieu and de Certeau's perspectives — the cynic and the optimist — can be complementary. Bourdieu shows us how arbitrary value can be imposed. De Certaeu shows us how this can be resisted and subverted.

As such we use de Certeau's metaphor of *poaching* in part because this implies entering somewhere forbidden to take what you need. This is particularly apt when popular culture can be seen as an illegitimate or inaccurate source for knowledge for people to use to make sense of science. It has implications for the role of science communicators, suggesting that they should not play 'gamekeeper'. We can use Bourdieu's work to flesh out what this *gamekeeping* means. Culture's ability to exclude steams from sets of arbitrary rules; knowledge of aesthetic taste as well as a sense of the 'rules of the game', tacit knowledge of social practices. A view of science as culture — from a Bourdieusian perspective — allows us to see that gamekeeping may involve subtle displays that *you know the rules* and someone else doesn't. For example, know the right rotation of DNA helix. However, pointing this out may service as an act of gamekeeping.

Many people engaged in science communication believe in the special status of science. However, while the technical content of science may be less familiar, social implications are not. These are familiar to people from their lived experience and through popular culture. One-way gamekeeping can happen is that science communication can focus on the technical aspects of correctness of science. There is a danger here that this implies that the *rules of the game* are that one cannot make meaning from science without these technical aspects, using resources from your own poaching territory. The analysis outlined above is designed to show the value of assessing people's enjoyment of culture so as to maximise their ability poach.

As an example, when discussing a genetic test performed on new-born babies for diagnostic purposes an individual might say "I don't like idea of genetic testing at birth, that's like GATTACA". It would be tempting here to point out that the genetic test being proposed is not like those used in GATTACA, or to highlight the scientific inaccuracies of the film. Through a Bourdieusian lens we can see this is simply correcting scientific inaccuracies and imposing arbitrary cultural power. This is obviously not to say that scientific inaccuracy should never be corrected. However, this view — of science as culture — allows for a better appreciate of how power dynamics come into play in science communication. Those working in science communication must resist the urge to play gamekeeper, instead allowing people to poach what they need.

To show how these latent classes can be useful here, we will discuss the ideas presented above in reference to one of the latent classes from the analysis; the *uncaptured* class. If one were structuring engagement activates with these participants, one important factor to note would be that there is a significant number of participants — the uncaptured class — who have less *poaching territory* than others. This may represent researcher bias in what was asked in the survey, so it is perhaps more accurate to say their poaching territory *as we know it* is smaller. There were other demographic characteristics that are predictive of participants being in the uncaptured latent class. These include coming from a lower socioeconomic class, having a lower education level and having less familiarity with genetic terminology. It is important to resist forms of reductionist thinking. The primary aim of our analysis is to identify resources, rather than supposed deficits that are barriers to engagement. However, it is of relevance as people from socio-economically disadvantaged backgrounds are less likely to participate in science communication activities [Dawson, 2014, 2017]. This may be because science engagement often reflects the shape, values and practices of dominant groups, at the expense of the marginalised [Dawson, 2018].

As such, findings from this study suggest if one was developing science engagement activities or resources for these participants, the uncaptured latent class would need to be considered carefully. Although we know less about their poaching territory, we know enough to suggest that it would be useful to provide opportunities for poaching by bringing in reference from pop culture. Furthermore, it would be important to be alert to how one might respond — to avoid playing gamekeeper — when someone uses a reference that may be inaccurate. This is where it is important to remember that science is culture, and Bourdieu's insight that the arbitrary values of culture are hidden so it instead appears as an intrinsic good. As such, if someone from the uncaptured class used a reference from culture they are familiar with, it would be important to focus on *what they are telling you*, rather than how you educate them.

Facilitating *poaching* in this way can allow different voices into the dialogue. It adds playfulness to imagined conversation with publics. It suggests an orientation which in which they often know more than we. As with most science communication there is an assumption that those coming from an expert position have something interesting to impart to them. However, this approach also assumes that publics will make sense of science is ways we never imagined. This type of engagement can be used to created *hybrid spaces*, sites of competing discourses with tensions and competing powers [Bhabha, 1994].

Conclusions

An important component in creating dialogues for science engagement is to understand the resources to which people have access. The latent classes identified in the analysis provide a *proof of concept* that a cultural approach is a potentially useful approach for thinking about science engagement. The analysis we have presented here can provide those developing science engagement activities with a map of participants' *poaching territory*. This is a starting point when creating hybrid spaces, where people can begin to make sense of genetics using their own resources and on their own terms. This research starts to provide a framework for how this can be done and suggest ways that science communication practitioners can operationalise a dialogue model of science communication.

References

Archer, L., Dawson, E., DeWitt, J., Seakins, A. & Wong, B. (2015). "Science capital": a conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts. *Journal of Research in Science Teaching 52* (7), 922–948. doi:10.1002/tea.21227

Archer, L., Dawson, E., Seakins, A., DeWitt, J., Godec, S. & Whitby, C. (2016). "I'm being a man here": urban boys' performances of masculinity and engagement with science during a science museum visit. *Journal of the Learning Sciences 25* (3), 438–485. doi:10.1080/10508406.2016.1187147

Archer, L., DeWitt, J. & Willis, B. (2014). Adolescent boys' science aspirations: masculinity, capital, and power. *Journal of Research in Science Teaching 51* (1), 1–30. doi:10.1002/tea.21122

Bennett, T., Savage, M., Silva, E. B., Warde, A., Gayo-Cal, M. & Wright, D. (2009). *Culture, class, distinction*. doi:10.4324/9780203930571

Besley, J. C. (2018). Audiences for science communication in the United States. *Environmental Communication 12* (8), 1005–1022. doi:10.1080/17524032.2018.1457067

Bhabha, H. K. (1994). *The location of culture*. doi:10.4324/9780203820551

Bourdieu, P. (1977). Cultural reproduction and social reproduction. In J. Karabel & A. H. Halsey (Eds.), *Power and ideology in education* (pp. 487–511). New York, NY, U.S.A.: Oxford University Press.

Bourdieu, P. (1984). *Distinction: a social critique of the judgement of taste*. Cambridge, MA, U.S.A.: Harvard University Press.

Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). New York, NY, U.S.A.: Greenwood.

Bourdieu, P. & Passeron, J.-C. (1990). *Reproduction in education, society and culture*. London, U.K.: SAGE Publications.

Chalmers, A. F. (2013). *What is this thing called science?* Indianapolis, IN, U.S.A.: Hackett Publishing Company.

Davies, S. R., Halpern, M., Horst, M., Kirby, D. A. & Lewenstein, B. (2019). Science stories as culture: experience, identity, narrative and emotion in public communication of science. *JCOM 18* (05), A01. doi:10.22323/2.18050201
Dawson, E. (2014). Reframing social exclusion from science communication: moving away from 'barriers' towards a more complex perspective. *JCOM 13* (02), C02. doi:10.22323/2.13020302
Dawson, E. (2016). When science is someone else's world. In L. Avraamidou & W.-M. Roth (Eds.), *Intersections of formal and informal science* (pp. 82–92). doi:10.4324/9781315668413-16
Dawson, E. (2017). Social justice and out-of-school science learning: exploring equity in science television, science clubs and maker spaces. *Science Education 101* (4), 539–547. doi:10.1002/sce.21288
Dawson, E. (2018). Reimagining publics and (non) participation: exploring exclusion from science communication through the experiences of low-income, minority ethnic groups. *Public Understanding of Science 27* (7), 772–786. doi:10.1177/0963662517750072
de Certeau, M. (1984). *The practice of everyday life* (S. Rendall, Trans.). Berkeley, CA, U.S.A.: University of California Press.
DeWitt, J., Archer, L. & Mau, A. (2016). Dimensions of science capital: exploring its potential for understanding students' science participation. *International Journal of Science Education 38* (16), 2431–2449. doi:10.1080/09500693.2016.1248520
Dika, S. L. & Singh, K. (2002). Applications of social capital in educational literature: a critical synthesis. *Review of Educational Research 72* (1), 31–60. doi:10.3102/00346543072001031
Featherstone, K., Atkinson, P., Bharadwaj, A. & Clarke, A. (2006). *Risky relations: family, kinship and the new genetics*. doi:10.4324/9781003086574
Green, E. D., Gunter, C., Biesecker, L. G., Di Francesco, V., Easter, C. L., Feingold, E. A., … Manolio, T. A. (2020). Strategic vision for improving human health at The Forefront of Genomics. *Nature 586* (7831), 683–692. doi:10.1038/s41586-020-2817-4
Kurath, M. & Gisler, P. (2009). Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. *Public Understanding of Science 18* (5), 559–573. doi:10.1177/0963662509104723
Lock, S. J. (2008). *Lost in translations: discourses, boundaries and legitimacy in the public understanding of science in the UK* (Ph.D. thesis, University of London, London, U.K.).
Longhurst, B. & Savage, M. (1997). Social class, consumption and the influence of Bourdieu: some critical issues. *The Sociological Review 44* (1_suppl), 274–301. doi:10.1111/j.1467-954x.1996.tb03445.x
Metcalfe, J. (2019). Comparing science communication theory with practice: an assessment and critique using Australian data. *Public Understanding of Science 28* (4), 382–400. doi:10.1177/0963662518821022
Michael, M. (2002). Comprehension, apprehension, prehension: heterogeneity and the public understanding of science. *Science, Technology, & Human Values 27* (3), 357–378. doi:10.1177/016224390202700302
Pasquier, D. (2005). *Cultures lycéennes: la tyrannie de la majorité*. doi:10.3917/autre.pasqu.2005.01
Powell, M. C. & Colin, M. (2008). Meaningful citizen engagement in science and technology: what would it really take? *Science Communication 30* (1), 126–136. doi:10.1177/1075547008320520

Prainsack, B. (2017). *Personalized medicine: empowered patients in the 21st century?* doi:10.18574/nyu/9781479814879.001.0001

Prieur, A. & Savage, M. (2013). Emerging forms of cultural capital. *European Societies 15* (2), 246–267. doi:10.1080/14616696.2012.748930

Prior, L. (2003). Belief, knowledge and expertise: the emergence of the lay expert in medical sociology. *Sociology of Health & Illness 25* (3), 41–57. doi:10.1111/1467-9566.00339

Roberts, J. (2019). *Science capital and funds of knowledge: new perspectives on science communication and genetics* (Ph.D. thesis, King's College London, London, U.K.).

Roberts, J., Archer, L., DeWitt, J. & Middleton, A. (2019). Popular culture and genetics; friend, foe or something more complex? *European Journal of Medical Genetics 62* (5), 368–375. doi:10.1016/j.ejmg.2018.12.005

Savage, M. (2010). *Identities and social change in Britain since 1940: the politics of method*. New York, NY, U.S.A.: Oxford University Press.

Simis, M. J., Madden, H., Cacciatore, M. A. & Yeo, S. K. (2016). The lure of rationality: why does the deficit model persist in science communication? *Public Understanding of Science 25* (4), 400–414. doi:10.1177/0963662516629749

Skeggs, B. (2004). Exchange, value and affect: Bourdieu and 'the self'. *The Sociological Review 52* (2_suppl), 75–95. doi:10.1111/j.1467-954x.2005.00525.x

Smallman, M. (2020). 'Nothing to do with the science': how an elite sociotechnical imaginary cements policy resistance to public perspectives on science and technology through the machinery of government. *Social Studies of Science 50* (4), 589–608. doi:10.1177/0306312719879768

Suldovsky, B. (2016). In science communication, why does the idea of the public deficit always return? Exploring key influences. *Public Understanding of Science 25* (4), 415–426. doi:10.1177/0963662516629750

Vidal, F. (2018). Introduction: from "The popularization of science through film" to "The public understanding of science". *Science in Context 31* (1), 1–14. doi:10.1017/s026988971800008x

Wylie, A. & Nelson, L. H. (2007). Coming to terms with the values of science: insights from feminist science studies scholarship. In H. Kincaid, J. Dupré & A. Wylie (Eds.), *Value-free science? Ideals and illusions* (pp. 58–86). doi:10.1093/acprof:oso/9780195308969.003.0005

Authors

Jonathan Roberts is genetic counsellor and postdoctoral researcher in the Society and Ethics Research Group at the Wellcome Genome Campus.

Jonathan.Roberts@addenbrookes.nhs.uk.

Richard Milne is a senior social scientist in the Society and Ethics Research Group at the Wellcome Genome Campus.

richard.milne@wellcomeconnectingscience.org.

Anna Middleton. Head of the Society and Ethics Research Group at the Wellcome Genome Campus.

anna.middleton@wellcomeconnectingscience.org.

Christine Patch is a principal staff scientist in the Society and Ethics Research Group at the Wellcome Genome Campus.

christine.patch@wellcomeconnectingscience.org.

Katherine Morley is a research leader at RAND Europe in Innovation, Health, and Science.

kmorley@randeurope.org.

How to cite

Roberts, J., Milne, R., Middleton, A., Patch, C. and Morley, K. (2022). 'Opportunities for poaching: using the public's enjoyment of popular culture to foster dialogues around genetics'. *JCOM* 21 (06), Y01. https://doi.org/10.22323/2.21060401.

Supplementary material

Available at https://doi.org/10.22323/2.21060401
Appendix 1. Survey, final copy
Appendix 2. Calculating the classes the LCA analysis
Appendix 3. Familiarity with genetics terminology

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it