
Article:
Lovett, JC orcid.org/0000-0002-5839-3770, Takshe, AA and Kamkar, F (2021) Evaluation of Environmental Policy with Q Methodology. Oxford Encyclopedia of Environmental Economics.

https://doi.org/10.1093/acrefore/9780199389414.013.713

Evaluation of Environmental Policy with Q-Methodology

Jon C. Lovett

Aseel A. Takshe

Fatma Kamkar

Summary

Environmental policy is often characterised by differences of opinion and polarised perceptions. This holds for all groups involved in lobbying, creating, implementing, and researching policy. Q-methodology is a technique originally developed by William Stephenson in the 1930s for work in psychology as an alternative to R-methodology, which was dominant at the time. R-methodology involves gathering scores from subjects being analysed, such as those generated by intelligence tests, and then correlating the scores with factors such as gender or ethnicity. Obviously, the scores are heavily dependent on the choice of questions set by the researcher in the tests. In contrast, Q-methodology commonly uses statements generated by the participants of the study, and it is these that the subjects are asked to score. This helps to avoid the type of bias that might result from a researcher formulating the statements presented to the subjects, though it is important to note that researcher bias is also present in Q-methodology through selection of the statements and the type of quantitative analysis used. In studies involving evaluation of environmental policy Q-methodology is typically used to elicit opinions from subjects by scoring participant statements obtained from interviews, or statements from secondary sources such as written reports, news articles or images. These scores are then correlated using factor analysis and statements that group together are compiled to create discourses about different aspects of the environmental policy under evaluation.

Keywords: Q-methodology, environmental policy evaluation, participatory research, mixed-methods, objectivity

Discourses in Environmental Science

There are often strong differences of opinion in environmental policy and the same topic can be framed in multiple ways, sometimes with deep disagreements that result in conflicts. These different framings of opinion are expressed as discourses. Each group will have its own way of expressing a narrative that represents their way of viewing, or framing, a particular topic. These narratives are an important part of defining the group and determining boundaries of group membership. For example, one group may be in favour of fossil fuel exploration and extraction; and another group might advocate leaving fossil fuels 'in the ground'. However, it is also important to bear in mind that the stories which make up the discourses are complex, and are often open to different interpretations. This makes them both fundamental to understanding how to deal with disagreements in environmental policy evaluation, and difficult to analyse.

This can be illustrated with an example. There are fossil oil deposits in the Arctic that are technologically and economically feasible to extract. On one hand this is perceived to be a sensible course of action because it will provide energy to maintain a global economy reliant on fossil fuels, and provide financial income to modernise under-developed Arctic communities. On the other hand, continued fossil fuel use is considered to endanger the Earth's environment through greenhouse gas emissions and foster unsustainable economic development at both local

and global levels (Davies, Van Alstine, & Lovett, 2016). Debate around this topic is highly polarised and some environmental groups have sought to disrupt oil exploration activities in the Arctic by boarding drilling platforms. Uncovering and listening to the different discourses within the different frames of the protagonists is an important part of transforming and resolving conflict. But this can be difficult because positions of the different groups involved are deeply entrenched, so constructive and mutually engaged discussion in open debate is impossible. In consequence a method is needed that will present the discourses of each group as objectively as possible, and also reveal the areas where there is some degree of agreement or commonality. The discourses can then act as points of reference around which debate can occur with each group able to better understand the position of the other, even if they do not agree. The areas where there is some degree of agreement can act as bridges for the groups to communicate, and hopefully resolve and transform their conflicts.

In the example of Arctic oil exploitation, it is clear that different groups hold strongly contrasting discourses derived from frames built on dissimilar scientific and policy structures. But different discourses can also exist within a single group working within a common institutional framework. For example, a study on international environmental regime effectiveness that explored discourses within groups working on implementation of the Mediterranean Action Plan, discovered four distinct discourses within what might be considered to be a homogenous group (Frantzi, Carter, & Lovett, 2009). The Mediterranean Action Plan is an international agreement for improved cooperation of countries bordering the Mediterranean Sea that is designed to increase cooperation between the signatories and reduce pollution and environmental damage. The Barcelona Convention, from which the action plan is derived, is classically regarded as an

example of where the scientific community came together to influence policy makers to create an institutional framework that would provide social, economic and environmentally sustainable outcomes (Haas, 1989). So, at first sight it is perhaps surprising that there are different interpretations of this regime, which was originally devised with a common scientific purpose, with discourses ranging from the primary regime function being to impose scientific standards to that of enabling ongoing diplomatic engagement. Having a suitable method for understanding the nature of these different discourses can contribute to better understanding of how to effectively implement the institutional framework and international regime, and also help to resolve tensions within the group.

However, there are several methodological problems associated with revealing discourses. By their very nature, discourses are notoriously subjective as they represent people's 'viewpoints' and so are grounded in cultural perspectives derived from an individual's lived experience through their upbringing and education. This subjectivity is not only within the group members who are expressing their views through the lens of their different discourse frames. It also exists in the researcher investigating the discourses, who might claim to be a dispassionate objective scientist, but in reality, might be operating within their own frame of bias. In the example of Arctic oil exploration, the researcher might have gained environmental qualifications and so will interpret and highlight statements from within the perspective of environmental conservation rather than economic development. Conversely, they might have an engineering background and so favour technical and extractive interventions. So, the first methodological problem is researcher bias.

Secondly, there is a problem of power inequalities. The more politically and economically powerful group may be able to dominate the discourse to the exclusion of less powerful, but deeply affected, groups. For example, a multi-national oil company, or a large international non-governmental conservation organisation, will have the resources and political influence to dictate and control discourses. Indeed, it is part of their operational policies to spend a lot of money and effort doing this. In contrast, an indigenous fisherman with a subsistence livelihood in an area affected by oil exploration and extraction, will have little or no voice.

Thirdly, there is the problem of reproducibility. Scientific investigations are usually designed in such a way that a hypothesis can be tested and another researcher can replicate the methodological approach used in an experiment or observation in order to ascertain if the results can be reproduced. One way that researchers attempt to conduct scientific investigations is to measure particular attributes of individuals and then correlate these attributes with other variables. In some fields this is known as 'R-methodology'. When applied to analysis of discourses a researcher might develop a questionnaire containing a statement such as 'do you object to drilling for oil in the Arctic' with a yes or no answer, and include other questions about characteristics such as a respondent's age, family-status, gender, ethnicity, income, occupation or proxies of these characteristics such as what type of newspaper they read. A sufficiently large sample will then produce a statistic that indicates if perceptions about drilling for oil are correlated with other factors, such as income. Whilst this approach might be replicable – the gathering of questionnaire data can be done again, or the original data re-analysed – it does not bring together the subtle and complex nuances that comprise the way an individual interprets or expresses a discourse about a particular environmental topic.

A technique known as ‘Q-methodology’ is often used in an attempt to overcome at least some of these methodological problems. Originally developed for use in psychological research as an alternative to ‘R-methodology’ approaches, the method gathers statements from individuals’ representatives of the different groups who are stakeholders in the topic under investigation or from secondary sources such as documents, different forms of media or images. A set of these statements is then presented back to the individuals and they are asked to agree or disagree with the statements. The level of agreement is scored and used as a weighting in a factor analysis that is then the basis of a matrix of correlation between the statements. Statements that are associated with each other in the factor analysis can then be aggregated to build discourses. The use of statements derived from the subjects of research, rather than those created by the researcher, helps to overcome a component of researcher bias. Reproducibility is possible because the database used can be reanalysed or additional ranking data can be gathered using the same set of statements. Power inequalities can be addressed by including statements from a range of stakeholders including marginalised groups as well as powerful groups.

The following sections first explore the history of the development of Q-methodology and the theoretical basis that underpins it. This is followed by a brief description of how to apply Q-methodology and some examples of its application. Q-methodology can be used in many different ways and contexts. The ‘Suggested Reading’ section contains some examples of books with detailed information on how to apply Q-methodology and references to case studies in different geographical contexts.

History of the development of Q- methodology

The history of Q-methodology helps to reveal why it has become popular as a technique to analyse the complex, nuanced and often polarised discourses found in environmental policy. Research can be embedded in particular ways of thinking, called 'paradigms' and the way that questions are asked and research is framed reflects internal logic within the paradigm. For example, in the early to mid-20th century many scientists considered there was a correlation between race and intelligence. Their methodology, the so-called R-methodology in which intelligence tests were applied to the subjects, was used to demonstrate these correlations. Q-methodology was developed as an alternative analytical methodology where the subjects did the scaling of the tests.

William Stephenson, a British physicist and psychologist with an interest in psychometrics, is credited with development of Q-methodology. By all accounts he was a remarkable person. His first PhD was in physics from Durham in 1926 at a time when quantum theory was a subject of major discussion. Here he met the German psychologist Kurt Koffka who was working on the concept of 'Gestalt' psychology in which it was considered that the brain sees compiled patterns of individual components instead of the components themselves (Brown, 1991). This idea will be familiar to bird watchers who are able to identify a bird from its overall characteristics of call, shape and movement, which they call the 'jizz of it', a colloquial term thought to derive from the word 'gestalt'.

Stephenson then moved to University College London to study for a second PhD in psychology with the statisticians Charles Spearman, a name familiar in undergraduate statistics courses

through his commonly used Spearman's rank correlation coefficient; and Cyril Burt who worked on inherited intelligence and popularised 'IQ tests'. As a historical note, and an example of researcher-bias, it's perhaps interesting that both of these men subsequently suffered from a degree of academic ignominy: Burt for falsifying data about inherited intelligence in his studies on twins, and Spearman for his association with the generally discredited theory of eugenics, which was a subject of scientific research in the 19th to mid-20th century. Nonetheless, they provided the grounding in factor analysis and concerns about use of 'R-methodology' that started Stephenson's journey into Q-methodology. He introduced the methodological approach in a letter to the journal Nature in 1935 describing application of factor analysis in which:

"Instead of the usual procedure with a selected group of n individuals each of whom has been measured in m tests, we may invert the technique and begin with a population of n different tests each of which is measured or scaled by m individuals." (Stephenson, 1935)

In this early paper in Nature he considered the technique to be "especially valuable in experimental aesthetics and educational psychology" and subsequently wrote a detailed account of the Q-method in a book published in 1953 whilst at the University of Chicago (Stephenson, 1953). The potent interdisciplinary mix of ideas from psychiatry, factor analysis and physics that underpin Q-methodology was described by Stephenson in an article published in 1993, originally written in 1985 but not published until after his death in 1989 (Stephenson, 1993). In this paper, amongst many other influences, he details how Freud's pleasure/ pain principle was included in the Q-sort step in the method and the relevance of relativity, quantum mechanics and uncertainty.

When applying Q-methodology its useful to be aware of these wider theoretical underpinnings as they help in a 'gestalt' interpretation of the results.

Despite being first conceived in the 1930s, it was some time for Q-methodology to be widely used. In the field of environmental policy, it's use took off after the demonstration by Barry and Proops (1999) that Q- methodology was an appropriate technique to analyse sustainability discourses. It is interesting to note that the co-author of this article, John Proops started his academic career as a physicist, as did Stephenson, and moved to environmental economics with his PhD study on "Energy, entropy and economic structure'. Application of the technique is now well supported by discussion of methodological application (Watts & Stenner, 2012) and there is a general recognition that R methodology is not appropriate for adequately presenting the combined perspectives of specific individuals. Returning to Stephenson's original theoretical concept, what is needed to present the complexity is a 'Gestalt' of characteristics derived from the subjects themselves. For example, this can be achieved as discourses derived by compiling and correlating statements generated and scored by the subjects of the analysis as described in the introductory section.

Mathematically, Q methodology is a relatively simple adaptation of factor analysis (Watts & Stenner, 2012) which Stephenson used to explore his interest in finding a way to quantitatively elucidate the subjective aspect of human behaviour from the perspective of the subjects. This contrasts with R-analysis, which focused on the external measures of human behaviour (Brown, 1980; Stephenson, 1953; Ramlo, 2016). In other words, Q-methodology provides a conceptual framework and procedures that lead to a scientific foundation to the phenomena of subjectivity

(Brown, 1993) by creating a set of reproducible quantitative characteristics of the subjects (Ramlo, 2016).

Stephenson's creation of Q methodology sparked controversy among scholars and academics at the time due to his use of both quantitative and qualitative data in his methodology, leading to a series of debates within the research community. On publication of his 1953 book, Stephenson received peer criticism about the value of single case-studies and accusations of excessive claims. The root of the Q methodology controversy had its basis in critics looking at the methodology's specific features from a quantitative standpoint instead of taking the trouble to understand it from a philosophical point of view. Ramlo (2016) considers that the faulty assumptions made by the critics led to misunderstandings about Q methodology's focus, which was to obtain a better way of analysing subjectivity with a technique that used both qualitative and quantitative features. For instance, Watts and Stenner (2005) state that conducting factor analysis on different data; using Q-sorts for gathered data; and using only one part of the Q methodology, is enough to cause confusion about the methodology as a whole. However, it is also thought that the prolonged uncertainty surrounding the Q methodology and the debates that took place until Stephenson's death helped form the methodology into a robust technique (Ramlo, 2016).

What makes Q unique as a form of discourse analysis

The reason behind Stephenson's success to effectively make subjectivity his primary focus is the functional combination of the Q sort and the Q factor analysis (Watts & Stenner, 2005). A focus

on either aspect alone can result in ineffective usage of the Q methodology as a whole (Ramlo & Newman, 2011). This combination of qualitative and quantitative data is an example of what is known as 'mixed-methods' and it is this rationale that makes Q distinctive as a form of discourse analysis. Even though Stephenson's concept was initially presented in 1935, the concept of mixed-methods in research really only started to be used by researchers in the 1980s, making Stephenson's inception of Q methodology an innovation ahead of its time (Ramlo & Newman, 2011). According to Ramlo (2016), mixed-method research is a sophisticated type of research since the qualitative and the quantitative aspects need to be constantly interacting with one another. Q methodology is a qualitative-dominant mixed method where the qualitative data is the primary focus of the method and the quantitative data serves as the supplementary tool to organise the qualitative data. This type of interaction and integration can give researchers a greater vision and opportunity to better identify research questions and objectives (Ramlo & Newman, 2011). In other words, the Q method allows researchers to explore the diversity of expressed voices, instead of estimating population statistics or the number of individuals with the voices expressed.

Q methodology versus narrative analysis

Unlike other forms of discursive analysis, the Q method constrains the subject matter from getting assorted into a sequence of themes, and instead demonstrates interconnection between the expressed themes and so has similarities to narrative analysis (Watts & Stenner, 2005). However, there are three ways in which the Q method differs from narrative analysis. Firstly, Q

methodology allows the participants to take part by getting them to relate to various topics previously selected. The second difference is that, unlike narrative analysis, Q methodology is not concerned with existing within the context of the specific time of gathering the narratives. The third and final difference is that Q methodology looks for patterns in the range of opinions and voices expressed by the participants. In contrast, narrative analysis is mainly concerned with the individualistic views of the participants. Ultimately, these differences make Q methodology a more holistic approach to revealing diversity in the ranges of voices expressed by groups of individuals.

Applying Q in practice

Identifying attitudes and revealing distinct perspectives are often considered to be complex and difficult, but Q methodology can be a powerful and relatively simple tool to explore them. Q methodology is essentially an explanatory technique, so it can present coherence to questions exploring complex answers, but it cannot prove hypotheses (Watts & Stenner, 2005). For that reason, these characteristics of Q methodology allow researchers to decide whether it's the right tool to use for their questions. In order to apply the Q method, several phases need to be followed. Each phase consists of several procedures.

The first phase of the Q methodology deals with identifying and creating a concourse and formulating the appropriate statements or items for the subject matter selected (Lien, Ruyle, & Lopez Hoffman, 2018). The concourse can take a variety of forms, for example it could be transcripts from interviews about the subject matter, or documents relating to the subject; or even

a set of images as in the analysis of feelings generated by viewing imagery of climate impacts (O'Neill et al., 2013). Before starting the study, a clear research question is crucial (Watts & Stenner, 2005). Prior knowledge about the topic chosen by the researcher is essential and will aid in the creation of the concourse and subsequent selection of the statements, called the Q-set, selected from the concourse. Selection and framing of the research question, creation of the concourse and selection of the Q-set statements are in the hands of the researcher, and so are inevitably influenced by the scientific paradigm the researcher is working within and individual bias of the researcher themselves. Despite the potential for researcher bias, the method is considered to be rigorous and means by which the researcher can surrender some control of the research process to the subjects (Robbins & Krueger, 2000). The concourse can be wide-ranging and include a variety of sources, so there may be doubt about its boundaries and when it is complete. For example, a complete concourse could be defined as when it reaches 'saturation point' and statements or materials are being repeated (Eden, Donaldson & Walker 2005). The extensive nature of the concourse makes it a useful source of information beyond the selection of Q-statements as it can also be analysed more traditional methods of discourse analysis in which the researcher compiles selected statements to construct a narrative to elucidate a research question. This approach can be used to provide additional dimensions of interpretation to results of the Q-method analysis.

The research question provides a framework for the Q-set of statements, and these will later be sorted by the respondents in a specific manner, typically on a Likert scale ranging from strongly agree to disagree, known as the Q-sorts. Watts and Stenner (2005) describe the Q-set as a collection of heterogeneous statements or items which may have many potential possibilities.

Several hundred statements are usually initially derived from the concourse and the Q-set is selected from these. Watts and Stenner (2005) consider that the required number of statements in a Q-set range between 40 to 80 statements, and any number below the minimum may cause an improper coverage of the subject matter. The statements selected for use in the Q-set need to be representative of the different elements of discourses expressed in the concourse and should be filtered according to the different types of claim made (Table 1) so that there is adequate coverage of both elements and claims. This process helps to counter the potential for researcher-bias in selection of statements for the Q-set, though it is perhaps impossible to completely eliminate some degree of bias. An example of the spread of statements selected in a filtering process is given in Table 2.

Table 1. Discourse elements and type of claim for filtering the statements as defined by Dryzek & Berejikian (1993) and applied by many researchers (e.g. Takshe et al., 2010; Astari & Lovett, 2019).

Discourse elements	Ontology	Reflects set of entities such as states, nations, individuals, classes, genes, and interests.
	Agency	Reflects various degrees of agency attributed to these entities.
	Motivation	Reflects agents' recognized or denied motivation such as self-interest, public-spiritedness, civic virtue, impartially, and survival.
	Relationships	Reflects natural or unnatural political relationships mainly taken for granted such as hierarchies based on age, education, birth, gender, wealth, social class.

Type of claim	Definitive	Reflects the meaning of terms (definitions)
	Designative	Reflects concerning issues of fact
	Evaluative	Reflects something of the worth of something that does or could exist.
	Advocative	Reflects something that should or should not exist.

Table 2. Example of statement categorization before and after reduction process into manageable numbers (from Astari & Lovett, 2019). The original number of statements selected from the concourse was 474 and the quantity selected for the Q-set was 54.

Category	Ontology		Agency		Motivation		Relationships	
	Before	After	Before	After	Before	After	Before	After
Definitive	2	1	5	0	1	0	0	0
Designative	29	2	82	4	63	4	40	3
Evaluative	16	5	51	8	83	9	37	5
Advocative	2	1	24	5	30	5	9	2

The second phase of the Q methodology involves selecting the participants, and since Q methodology primarily focuses on extracting major perspectives, having a big sample is not necessary (Watts & Stenner, 2005). Unlike quantitative methods, the number of participants in Q methodology is not controlled by ensuring coverage of representative statistical variation

because it does not aim to conduct a superficial analysis using a large sample, but rather an in-depth analysis on a small sample. A sample size ranging between 40 to 60 participants is considered to be sufficient to achieve effective results; however, that number is only a rule-of-thumb (Watts & Stenner, 2005). Normally, selection of the participants would be preceded by a stakeholder analysis (Reed et al., 2009), which in turn would be shaped and bounded by the research question being investigated. For example, as discussed in the introduction, the participants might be drawn from stakeholder groups with divergent interests, or they might be all part of what could be initially perceived as a homogenous group.

The third phase of the Q methodology is concerned with the gathering and collecting of data. This phase has a unique feature of Q methodology; the Q technique, or most commonly known as the Q-sort. The selected participants are required to sort the statements made available to them according to their subjective opinions with minimal or without any external interference (Thomas & Watson, 2002). The items that need to be sorted however may not necessarily be in the form of statements, but could also be in other forms, for example Stephenson suggested using artworks and sculptures, and researchers have used a variety of images (Davis & Michelle, 2011). If the initial concourse was created from interview transcripts, then ideally the participants for the Q-sort should also include as many as possible of the stakeholders interviewed. For example, in a study on discourses about the Indonesian Sustainable Palm Oil policy, during interviews to create the concourse a total of 36 stakeholders were interviewed. In the subsequent Q-sorting phase a total 27 participants made statement sorts, of which 15 participants were the same stakeholders who had been interviewed in the first phase (Astari & Lovett, 2019). In the Q-sort the participants can simply rank the statements or images using a

Likert scale of agreement/ disagreement or like/ not like and the scores can then be used in the subsequent factor analysis; or the scoring can be constrained by the use of a Q-grid. In designing grid, Brown (1980) advocated an 11 point scale (-5 to 5) for Q sets containing 40-60 statements and 13 point scale (-6 to 6) for larger Q sets of more than 60 statements. For example Astari & Lovett (2019) used an 11 point scale Q-grid used for a Q-set of 54 statements. The shape of the Q-grid is chosen to reflect the extent of the participants knowledge about the topic. A steep distribution is used if the participants do not know the topic well, as this reduces anxiety when making choices, and a shallower distribution when the participants are well informed. In the case study being followed in this section, Astari & Lovett (2019), a shallow distribution was used because the participants were all stakeholders who knew the topic of oil palm production and sustainability in Indonesia well. The sorting process can provide a valuable additional source of information because the participants will often talk aloud to themselves about the reasons for their choices as they rank the statements. This intrapersonal communication during the sorting process can help interpret the final discourses extracted.

The fourth phase of the methodology deals with data analysis and interpretation. The Q-sorts are often analysed through the amalgamation of theoretical and computational methods (Eden, et al., 2005). The factor analysis can be conducted using specialized computer software called PQMethod, which is a program specifically designed for the needs of Q studies and uses factor analysis to analyse the input data. Once factor analysis is completed, qualitative analysis of the idealized statement sorts reflecting the factor groups is then conducted to explore patterns across groups (Lien et al., 2018).

An example of the correlations between factor scores is given in Table 3 (Astari & Lovett, 2019). The results produced by the respondents' sorting of the items can be intercorrelated and factors analysed (Watts & Stenner, 2005) to give a weighting to the relationship of each of the Q sort statements to each other so that they can be associated into groups on the basis of factor scores. The statistical significance at a level of $P < 0.01$ of each factor loading is determined using the equation $2.58(1/\sqrt{N})$ where N equals the number of statements used (Brown, 1980, p. 283). For example, if there were 54 statements then a significant factor loading would be equal to or greater than $2.58\ (1/\sqrt{54}) = \pm 0.351$. In this case the five factors extracted (labelled A-E in Table 3) are considered to represent common patterns of responses across the participants. The Q-sort statements associated with each factor can then be compiled into narrative discourses. If the statements are unique or strongly associated with one of the factors then they are regarded as distinguishing statements for that discourse. Other statements may be common to two or more factors and these can be regarded as bridging statements.

Table 3. Correlation matrix between factors and number of sorts loading on each factor (from Astari & Lovett, 2019). Correlations are from 0 (no correlation) to 1 (complete correlation). The percentage of variance explained by each of the factors and number of respondents with a significant factor loading coefficient > 0.351 are also given.

Factor	**A**	**B**	**C**	**D**	**E**	**% of variance explained**	**# coefficients > 0.351**

A	1.000	0.0353	0.2858	0.1032	0.4699	15	9
B		1.000	-0.0363	0.0064	-0.0586	7	5
C			1.000	0.1985	0.0104	9	5
D				1.000	0.059	8	4
E					1.000	9	5

It is also possible to determine the factor to which each participant in different stakeholder groups is associated. For example, Astari & Lovett (2019) were able to identify which discourses were associated with the different stakeholder groups knowledgeable about the Indonesian sustainable palm oil policy (ISPO). In this study the following names were given to each of the discourses associated with the factors A-E: Discourse A: Sovereignty as a main trigger for ISPO creation; Discourse B: The need to strengthen local sectors; Discourse C: Challenges and suggestions for ISPO implementation; Discourse D: Scepticism about the ISPO; Discourse E: Financial aspects and conservation value debates. For example, government stakeholders loaded on to factors used to create discourses A and E. The Palm Oil Association loaded on to discourse A. Non-governmental organisations loaded on to discourses B, C and D; and Palm Oil Companies loaded on to discourses A, C and D. From a policy perspective, the overlap between the Palm Oil Company and non-governmental organisation stakeholders in Discourses C and D could be used to pave the way to constructive dialogue between two stakeholder groups who tend to publicly disagree.

Conclusions

Q methodology has been used in many different disciplines. Most commonly it is used to reflect patterns of perspectives and attitudes towards social objects such as in health-related fields. Additionally, it has appeared in fields of research such as tourism, management information systems, psychology, social work and political decision-making. In health informatics it was used to explore opinions of medical students and primary care physicians regarding their acceptance or resistance to information technologies in the professional field of healthcare (Valenta & Wigger, 1997). In robotics it was used to shed light on healthcare workers' perspectives towards the introduction of service robotics in the field of healthcare where it revealed that most participants shared a common belief that humans are more reliable than robots and that service robots will increase the hospital's flexibility with minimal impacts on the hospital's strategy (Mettler, Sprenger, & Winter, 2017). Q methodology is considered to be valuable research tool research in counselling especially for its ability to provide a connection between behaviour and subjectivity of individuals (Stickl, Wester, & Wachter Morris, 2019).

Some examples of its use in environmental sciences have already been given, including public perceptions of sustainability (Barry & Proops, 1999); drilling for oil in the Arctic (Davies, Van Alstine, & Lovett, 2016); regime effectiveness in the Mediterranean Action Plan (Frantzi, Carter, & Lovett, 2009); and the effect of transnational governance on sovereignty in the Indonesian Sustainable Oil Palm policy (Astari & Lovett, 2019). Other examples include fire management in Australia (Ockwell, 2008); bombing of the Jiyyeh power plant in Lebanon (Takshe, et al., 2010); cultural ecosystem services in coastal Canada and the UK (Pike et al., 2015); the science-policy interface for climate adaptation in Cameroon (Nkiaka & Lovett, 2019); and urban green spaces

in Lahore (Alam & Lovett, 2019). It can also be used as a methodological tool for refining selection of stakeholder groups with similar characteristics for inclusion in dialogues (Cuppen et al., 2010). Additional examples from a range of different fields of study are given in the suggested reading section.

Application of Q methodology provides an opportunity for researchers to have an insight into the complex and nuanced interactions of discourses within people's inner thoughts. Each perspective and opinion expressed by the participants are considered valid, and no external criterion is involved to validate or invalidate their opinions (Valenta & Wigger 1997). It is a methodology that is neither fully qualitative nor entirely quantitative, thereby enabling researchers to look into the subjectivity of individuals and evaluate the relative importance of subjectivity.

Humans are the reflection of the consciousness they generate and there are areas of human complexity that cannot be addressed through traditional quantitative R methodologies. In addition to the basic steps outlined here, Q methodology can also be modified in a way to suit the needs of researchers when evaluating a particular topic enabling the exploration of questions that might otherwise be difficult to answer.

Suggested Readings

Armatas, C. A., Venn, T. J., & Watson, A. E. (2014). Applying Q-methodology to select and define attributes for non-market valuation: a case study from Northwest Wyoming, United States. *Ecological Economics*, *107*, 447–456.

Barry, J., & Proops, J. (1999). Seeking sustainability discourses with Q methodology. *Ecological Economics*, *28*, 337–345.

Bischoff-Mattson, Z., Lynch, A. H., & Joachim, L. (2018). Justice, science, or collaboration: divergent perspectives on indigenous cultural water in Australia's Murray-Darling basin. *Water Policy*, *20*, 235–251.

Díaz, P., Adler, C. E., & Patt, A. (2017). Do stakeholders' perspectives on renewable energy infrastructure pose a risk to energy policy implementation? A case of a hydropower plant in Switzerland. *Energy Policy*, *108*, 21–28.

Farrell, D., Carr, L. M., & Fahy, F. (2017). On the subject of typology: how Irish coastal communities' subjectivities reveal intrinsic values towards coastal environments. *Ocean and Coastal Management*, *146*, 135–143.

McKeown, B., & Thomas, D. B. (2013). *Q Methodology*. SAGE Publications.

Rodríguez-Piñeros, S., Martínez-Cortés, O., Villarraga-Flórez, L. F., & Ruíz-Díaz, A. (2018). Timber market actors' values on forest legislation: a case study from Colombia. *Forest Policy and Economics, 88*, 1–10.

Setiawan, A. D., & Cuppen, E. (2013). Stakeholder perspectives on carbon capture and storage in Indonesia. *Energy Policy*, *61*, 1188–1199.

Sneegas, G., Beckner, S., Brannstrom, C., Jepson, W., Lee, K., & Seghezzo, L. (2021). Using Q-methodology in environmental sustainability research: A bibliometric analysis and systematic review. *Ecological Economics*, 10.1016/j.ecolecon.2020.106864, 180, (106864).

Vela-Almeida, D., Kolinjivadi, V., & Kosoy, N. (2018). The building of mining discourses and the politics of scale in Ecuador. *World Development*, *103*, 188–198.

Watts, S., & Stenner, P. (2012). Doing Q Methodological Research Theory, Method & Interpretation. London, UK: SAGE Publications, pp. 1–248.

References

Alam, R., & Lovett, J.C. (2019). Prospects of Public Participation in the Planning and Management of Urban Green Spaces in Lahore: A Discourse Analysis. *Sustainability, 11*(12), 3387.

Astari, A. J., & Lovett, J.C. (2019). Does the rise of transnational governance 'hollow-out' the state? Discourse analysis of the mandatory Indonesian Sustainable Palm Oil policy. *World Development*, *117*, 1–12.

Barry, J., & Proops, J. (1999). Seeking sustainability discourses with Q methodology. *Ecological Economics*, *28*, 337–345.

Brown, S. R. (1980). Political Subjectivity. New Haven and London: Yale University Press.

Brown, S. R. (1991). William Stephenson (1902–1989): Obituary. *American Psychologist, 46*(3), 244. doi:10.1037/0003-066X.46.3.244

Brown, S. R. (1993). A Primer on Q Methodology. *Operant Subjectivity*, *16*(3/4), 91–138. doi:10.15133/j.os.1993.002

Cuppen, E., Breukers, S., Hisschemöller, M., & Bergsma, E. (2010). Q methodology to select participants for a stakeholder dialogue on energy options from biomass in the Netherlands. *Ecological Economics*, *69*, 579–591.

Davies, W., Van Alstine, J., & Lovett, J. C. (2016). 'Frame Conflicts' in Natural Resource Use: Exploring Framings Around Arctic Offshore Petroleum Using Q-Methodology. *Environmental Governance and Policy, 26*, 482–497.

Davis, C. H., & Michelle, C. (2011). Q methodology in audience research: Bridging the qualitative/quantitative 'divide'. Participations: *Journal of Audience and Reception Studies*, *8*(2), 559–593.

Dryzek, J. S., & Berejikian, J. (1993). Reconstructive Democratic Theory. *The American Political Science Review*, *87*(1), 48–60.

Eden, S., Donaldson, A., & Walker, G. (2005). Structuring subjectivities? Using Q methodology in human geography. *Area*, *37*, 413–422.

Frantzi, S., Carter, N. T., & Lovett, J. C. (2009). Exploring discourses on international environmental regime effectiveness with Q methodology: A case study of the Mediterranean Action Plan. *Journal of Environmental Management*, *90*(1), 177–186.

Haas, P. M. (1989). Do Regimes Matter? Epistemic Communities and Mediterranean Pollution Control. *International Organization*, *43*, 337–403.

Lien, A. M., Ruyle, G. B., & López-Hoffman, L. (2018). Q Methodology: A method for understanding complex viewpoints in communities served by extension. *Journal of Extension*, *56*(2), [# 2IAW4].

Mettler, T., Sprenger, M., & Winter, R. (2017). Service robots in hospitals: new perspectives on niche evolution and technology affordances. *European Journal of Information Systems*, *26*(5*)*, 451–468.

Nkiaka, E., & Lovett, J.C. (2019). Strengthening the science-policy interface for climate adaptation: stakeholder perceptions in Cameroon. *Regional Environmental Change, 19*, 1047–1057.

Ockwell, D. (2008). 'Opening up' policy to reflexive appraisal: a role for Q Methodology? A case study of fire management in Cape York, Australia. *Policy Sciences, 41*, 263–292.

O'Neill, S. J., Boykoff, M., Niemeyer, S., & Dayd, S.A. (2013). On the use of imagery for climate change management. *Global Environmental Change*, *23*, 413–421.

Pike, K., Wright, P., Wink, B., & Fletcher, S. (2015). The assessment of cultural ecosystem services in the marine environment using Q methodology. *Journal of Coastal Conservation, 19*, 667–675.

Ramlo, S. (2016). Mixed method lessons learned from 80 years of Q methodology. *Journal of Mixed Methods Research*, *10*(1), 28–45.

Ramlo, S. E., & Newman, I. (2011). Q methodology and its position in the mixed methods continuum. *Operant Subjectivity*, *34*(3), 172–191.

Reed, M. S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C. H., & Stringer, L.C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, *90*, 1933–1949.

Robbins, P., & Krueger, R. (2000) Beyond bias? The promise and limits of Q method in human geography. *Professional Geographer*, *52*, 636–648.

Stephenson, W. (1935). Technique of factor analysis. *Nature*, *136*, 297.

Stephenson, W. (1953). The study of behavior; Q-technique and its methodology. University of Chicago Press.

Stephenson, W. (1993). Introduction to Q-methodology. *Operant Subjectivity*, *17*(1/2), 1–13.

Stickl, J. E., Wester, K. L., & Wachter Morris, C. A. (2019). Making sense of subjectivity: Q methodology in counseling research. *Counseling Outcome Research and Evaluation*, *10*(2), 106–118.

Takshe, A. A., Huby, M., Frantzi, S., & Lovett, J. C. (2010). Dealing with pollution from conflict: Analysis of discourses around the 2006 Lebanon oil spill. *Journal of Environmental Management*, *91*(4), 887–896.

Thomas, D. M., & Watson, R. T. (2002). Q-sorting and MIS research: A primer. *Communications of the Association for information Systems*, *8*(1), 9.

Valenta, A. L., & Wigger, U. (1997). Q-methodology: Definition and Application in Health Care Informatics. *Journal of the American Medical Informatics Association, 4*(6), 501–510. doi:10.1136/jamia.1997.0040501

Watts, S., & Stenner, P. (2005). Doing Q methodology: theory, method and interpretation. *Qualitative Research in Psychology*, *2*(1), 67–91.

Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research Theory, Method & Interpretation.* London, UK: SAGE Publications pp. 1–248.