

Individuals and Climate Change: Insights from a Q Method Study in Southern British Columbia

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Abstract

Global climate change is considered one of the greatest challenges facing humankind. Scholarly and policy literature suggests responding to climate change by both adapting to its impacts and mitigating future impacts by reducing greenhouse gas emissions. Much of this literature is uninformed by perspectives of individuals. This research uses Q methodology as one of three methods of empirical enquiry into how individuals perceive and respond to climate change. Two case study communities are the basis of the data collection in which 86 participants were interviewed, 38 of whom completed Q sorts. A Q sample of 32 statements was developed from literature, popular sources, and semi-structured interviews, and analysed using PQMethod. Two possible solutions are considered, a four and a two factor solution, and compared with results from interviews and focus groups. The factors of the four factor solution suggest that participating individuals' perceptions of responses to climate change can be further explained by using Q. The method differentiates the results of this research both by supporting some outcomes from interviews and by highlighting important tensions between claims made in interviews and ranking related statements in the Q sorts.

1 Introduction

Climate change continues to be a priority on the global environment and political agendas. It is thought to pose serious challenges to humanity and the ecosystems that support our societies. At present, however, research and decision making on climate change is ill-informed about the perspectives of individuals. This research is centred around individuals' perceptions, knowledge, and attitudes towards climate change. The aim is to inform our understanding of climate change, and responses to it, with perspectives of individuals who form the very basis of our societies. To this effect, the study draws on three distinct methods of data collection, semi-structured interviews with 86 participants, of which 38 completed Q sorts, and two focus group workshops with 6 and 8 participants respectively.

This paper considers how the outcomes generated through Q methodology relate to other results of this research from interviews and focus groups. To this effect, statistically acceptable two factor and four factor solutions are compared to perceptions and views expressed in interviews. On this basis, it is argued that Q methodology both supports and augments results from other methods used in this research.

The paper is structured as follows: The second section illustrates how Q was used in this research, and shows how statements were obtained. The third section maps the two and the four factor solutions, and the fourth section interprets and triangulates these results.

2 Using Q methodology

In this study, Q acts as a complementary methodology used for triangulation of results between the other two methodologies, interviews and focus group workshops. This means that the interviews were meant in part as preparation for the Q sort, but act as a stand-alone empirical component for analysis. The same is true of the focus group workshops. This section will outline how the Q sample was developed, and how the sorts were treated for analysis.

2.1 Development and choice of Q sample statements

All interviews, including all preliminary ones, were reviewed and received one round of coding. This process was completed using NVivo software. As a first step, coding theme categories were developed as free nodes, or independent coding elements. As more interviews were coded, and new themes emerged while others appeared to merge, some of the free nodes were turned into tree nodes in order to represent hierarchy of one category belonging to a larger category.

This process, and the extraction of statements from popular and scientific literature on climate change, yielded a set of 92 statements. Statements from interviews were comprised of direct quotes from interviews, as well as typified and simplified statements. This set of statements was used as a pool which was inspected for obvious redundancy. By comparing statements' intent and content the set was condensed to 57 statements.

An attempt to use a matrix modelled on work by Barry and Proops (2000) resulted in an uneven distribution of statements across matrix cells. This matrix included four discourse elements: ontology, agency, motivation, and affect; and four types of claims, definitive, designative, predictive,

and advocative. After a consultation with a Q expert, a matrix modelled on work by Lasswell and Kaplan (1950) was used to classify the statements. It includes a set of six combinations based on two separate parameters, forces and symbols. The latter includes demand symbols, which illustrate a wish for response or action, identification, which shows the perception of the status quo, and expectation, which identifies anticipated items. The two forces, driving and restraining, represent on one hand the division between positive and negative statements, and on the other hand the difference between promoting and holding back change. Table 1 below shows the initial distribution of 57 statements in this matrix.

Table 1: Matrix adapted from Lasswell and Kaplan (1950) showing the initial distribution of 57 statements

Forces	Symbols				
	Demand		Identification		Expectation
Driving	6	36	2	28	1
	21	38	3	32	10
	22	39	9	43	13
	23	40	12	45	19
	27	42	16	50	56
	29	48	17	52	
Restraining			18		
	26		4	33	14
	47		5	34	20
			7	35	24
			8	44	37
			11	51	41
			15	53	46
			25	54	49
		30	57	55	
		31			

As both driving and restraining identification statements dominated this set, the sample was modified to replace these with restraining demand and expectation statements, and driving expectation statements. This resulted in a distribution within the matrix as shown in Table 2 below.

Table 2: Matrix adapted from Lasswell and Kaplan (1950) showing the initial distribution of 57 statements after replacing driving and restraining identification and driving demand statements.

Forces	Symbols					
	Demand		Identification		Expectation	
Driving	6	38	2	32	1	19
	22	39	9	43	10	23
	27	40	12	45	13	30
	29	42	17	50	16	56
	36	48	28	52	18	
Restraining	3	31	7	44	5	33
	4	47	15	51	8	37
	11	49	25	53	14	41
	21		34	54	20	46
	26		35	57	24	55

Following this, several rounds of cross-comparison of all statements, in consultation with the context of the interviews, were completed in order to refine the statement set according to its content. During this part of the process, it was particularly kept in mind to examine the added information in each statement compared to all others. For example, a statement citing capitalism as one of the primary causes of climate change, and one citing profit-making as a primary cause represent an essentially similar meaning, and hence, one would not learn much more if a participant embraces one *and* the other. This resulted in a Q-sample of 32 statements.

This sample was piloted among 15 non-participants of this study in order to obtain feedback on the clarity of the instructions and the set of statements. A number of valuable comments were made and taken into consideration. These included:

- The majority of pilot participants felt that they had many more statements with which they agreed than with which they did not agree.
- Two statements were not well understood by a number of participants.
- One participant pointed out that four statements considered public policy on climate change, and hence concentrated on government, while no statement represented market mechanisms.

As a result, the set was adjusted again. This included changing driving statements to restraining statements, simplifying the wording of some statements, and replacing a statement about governmental regulation with one about a market-based approach. The final set of statements can be found in Appendix A.

The set was then entered into the same matrix as above to ensure an overall balance. Table 3 below illustrates the distribution of the 32 final statements in the matrix.

Table 3: Distribution of final Q sample statements in the matrix after piloting the set.

Forces	Symbols		
	Demand	Identification	Expectation
Driving	8	7	1
	15	10	13
	22	12	16
	23	19	20
	26	21	28
	32	25	31
Restraining	2	4	11
	3	5	17
	14	6	18
	27	9	24
		29	
		30	

The results of the pilot were entered into PQMethod software in order to complete first, a principal component factor analysis; second, a varimax rotation; and finally use the programme to analyse the resulting factors. As part of this, the programme lists “consensus statements” which do not distinguish between any of the emerging factors. This means that none of the sorts differ significantly in the ranking of these statements and hence, consensus exists among all sorts on them. This list of statements was examined very carefully and compared to the statements that were changed as a result of the feedback of the pilot so as not to change only statements that did not promise to be significant in distinguishing factors.

The Q sort was completed by 39 of the interview participants between April and June 2005. All sorts but one were entered into PQMethod for analysis. One participant expressed that she felt unable to match her choices to the given sorting grid, and as a result this sort was omitted from the analysis. The analysis outlined in the next section is thus based on 38 individual sorts.

2.2 Analysis of the Q Sort

Using PQMethod, the Q sorts were first factor analysed with principal component factor analysis (PCA). The resultant eight factors generated by the programme were evaluated based on six criteria:

1. Eigenvalue of each unrotated factor > 1 (Brown 1980)
2. Scree plot of all eight factors against their eigenvalues (Brown 1980)
3. Number of significant factor loadings > 2 (Brown 1980)
4. Humphrey’s rule: $2x(SE_r) = 0.35$ or $1x(SE_r) = 0.17$ (Brown 1980)
5. Number of defining sorts > 4 (after rotation) (Sexton *et al.* 1998)
6. Content analysis of factors (after rotation) (Schlinger 1969)

The factor loadings were examined for significance based on the following formula assuming a 99% confidence interval:

$$2.58 \times SE_r = 2.58 \times \frac{1}{\sqrt{N}} = 2.58 \times \frac{1}{\sqrt{32}} = 0.456$$

The six criteria pointed to three different answers in so far as how many factors should be retained. Criterion 1 revealed that all eight factors had eigenvalues in excess of 1, and thus, while indicating at least one factor could be retained, showed no indication as to how many factors to eliminate. Criterion 2 showed a significant change in slope between factor 2 and 3, pointing to retaining two factors. Counting the number of significant loadings for criterion 3 showed that 4 factors should be retained. Criterion 4 is fulfilled by two factors for 2x(SE_r) and by four factors for 1x(SE_r). Criterion 5 points to retaining two factors if only pure sorts are considered as defining sorts, and to retaining three if non-pure sorts are considered as defining sorts. As for criterion 6, the paragraphs below are dedicated to explaining the details involved.

As Schlinger (1969) points out, statistical and numeric criteria for selecting factors should merely provide a guideline to the researcher in answering how many factors to retain. To allow for the most meaningful and useful interpretation of data, the researcher is to employ empirical judgement to select which criteria to apply for factor selection.

Following the varimax rotation, only those with significant loadings on one factor were marked as defining sorts for the factors. This helps further define the factors by eliminating ‘noise’ added from sorts that load significantly on more than one factor, and thus distinctly define none.

When retaining four factors, and using pure loadings, only three of four factors have three or more pure significant defining sorts, the third factor is defined by only one sort. In addition, 17 sorts load significantly on more than one factor. The variance explained by four factors is 69% (32+9+7+21). Six statements are consensus statements among the four factors. Between factors 1 and 2 one statement at +3 is shared, between factors 2 and 4 one statement at -3 shared. Factors 1 and 4 share four statements between -2 and -3. This explains in part the correlation between the factors, which is shown in table 4 below.

Table 4: Factor correlation of the four factor solution

Factor 1	Factor 1		
Factor 2	0.2814	Factor 2	
Factor 3	-0.3716	0.2013	Factor 3
Factor 4	0.6371	0.2583	0.2828

Retaining two factors, 21 and 5 sorts respectively define factors one and two with pure loadings. Nine sorts load significantly on both factors. The variance explained is 59% (41+18). 14 statements are consensus statements between the two factors. One of two statements ranked -3 takes the same position in both factors, and much of the middle ranks between +/-2 are shared. The two factors have a correlation of 0.46.

3 Results

In order to illuminate how the two solutions of four factors and two factors relate to the results from interviews and focus groups in this study, we will consider which attitudes these factors represent. The following sections will outline first the two factor and then the four factor solution by illustrating the content of those statements ranked at -3 and +3, as well as those at -2 and +2 which act as distinguishing statements between factors.

3.1 Two factor solution

Factor 1: The Activist – Focus our energies

The first factor describes an attitude of urgency to act on climate change supported by a belief in current climate science. Climate change is considered to be amongst the most pressing global problems, and a sense of doom can be felt if action is not taken now. To this effect, the factor refuses to wait for additional proof in support of anthropogenic climate change before acting on it. Further, a belief is expressed that the economy can be decoupled from fossil fuel use pointing to room for a solution. Financial mechanisms, such as a tax on gas-guzzling vehicles and subsidised alternative energy generation are seen as ways to reduce emissions. An ecocentric attitude can be detected in that climate change should be stopped to save natural ecosystems from extinction. Impacts of climate change are seen as real, such as the melting of the polar ice caps which is causing sea level rise.

Factor 2: The Systemist – Disperse our energies

Here, climate change is seen as only one symptom of a systematic flaw in how human societies work. Consequently, it is believed that there are other more pressing global problems than climate change that need to be solved. The second factor expresses a belief that we shouldn't wait for proof of anthropogenic climate change before acting on it. The living standards of industrialised nations are blamed for climate change.

The highly ranked statements, both at -3 and +3, that distinguish the two factors from each other, with a factor score difference of at least 2, point to the importance and urgency of acting on climate change for factor one. For factor two, climate change is seen as only one of many problems humanity is facing, and which demand action.

3.2 Four factor solution

Factor 1: The Individualist – Everyone's responsibility

In this factor, resource conservation is part of being a responsible citizen. At the same time, climate change is only one symptom of a systematic flaw of how human societies work. A sense of intergenerational justice is important so as not to burden future generations with the problem of

climate change. It insists that we shouldn't wait for government to act on climate change. Environmental activists have to 'awaken' the mainstream of society to the threats of climate change. Urgency is driving towards individual actions, claiming that if we don't act now climate change will lead us to disaster.

Factor 2: The Systemist – Larger forces are at work

In this viewpoint, climate change is only one symptom of a systemic flaw in how human societies work, and there are other more pressing global problems than climate change that need to be solved. Living standards in industrialised countries are blamed for climate change, and low faith in technological innovation indicates it will not provide a solution to climate change. The media is not seen as doing a poor job in conveying climate change to the public.

Factor 3: The Sceptic – Proof before action

For the sceptic, climate change science must be made much more precise before it can be used as a basis for making decisions, and before any action on climate change is taken, it has to be proven that climate change is caused by people. The impacts of climate change, such as melting ice sheets on the poles and sea level rise, and the mountain pine beetle problem and forest fires, are seen as unreal, or unrelated to climate change. As a result, any preparatory action, such as additional home owners insurance to protect from damage from flooding and landslides, is seen as an unnecessary expense. Similarly, buying local products is not considered good way to reduce emissions. Further, the individual is not seen as the increment of change, such that conserving resources is not part of being a responsible citizen.

Factor 4: The Economist – Market mechanisms, carrots, and sticks

The economist's premise is that we shouldn't wait with action on climate change until further proof of anthropogenic causes is obtained. Climate change science is viewed as precise enough to use as a basis for decision making. In terms of what should be done, financial incentives are seen necessary to prevent industry from emitting. To curb emissions, it is felt that we need taxes on gas guzzling vehicles and subsidised alternative energy generation. The living standards of industrialised nations are to blame for climate change, though it is believed that only if every country makes an effort can climate change be stopped.

4 Interpretation

This section will first map the two solutions generated from the Q sorts against the background of interviews and focus groups, and then show how Q methodology contributes to the outcomes of this research.

4.1 Two solutions – Which one works best?

Upon closer inspection, and when drawing out the key attitudes from the two factor solution, it becomes clear that this solution omits two key aspects of attitudes that are present in almost all interviews. The first is the notion of individual responsibility both for causing climate change and acting to ameliorate its consequences. The second aspect is a belief that people respond well to financial incentives in order to change behaviour. Hence, while all the embedded views and opinions

exist in interviews, the two factors are each a coarse aggregate of these opinions, missing two key issues. Further, the interviews demonstrate that the majority of participants do not identify with what they believe represents the mainstream in their society and claim that much of this mainstream is sceptical about climate change. To them, this is a crucial understanding because it distinguishes their own views from those they consider to be mainstream, and this helps to maintain their understanding of their own identity. In the two factor solution, one participant fails to load significantly on either one of the two factors. We will see later that this participant holds the 'mainstream' views described by other participants in interviews, and the four factor solution includes a factor accounting for such views. Consequently, we can say that the two factor solution poorly differentiates people's beliefs and attitudes compared to interviews, and does not provide distinct insights into the complexity of views behind the factors.

When comparing the factors generated between the two and four factor solution, we can detect that at least one additional factor is contained in the two factor solution that emerges in the four factor solution. Evidence for this can be found primarily in the ranking of statements 12 and 15 on +3 and 13 and 14 on -3 in the second factor of the two factor solution. In the four factor solution, the former two statements represent factor 2, also ranked at +3, and the latter statements represent factor 4, also ranked at -3. This effectively splits the single factor from the one factor solution into two new factors for the four factor solution. In the process, the fourth factor also takes on statements 22 and 26 at +3, which prove to be of great importance to understanding beliefs about how to respond to ameliorate future climate change.

The four factor solution provides a more differentiated account of people's opinions and is therefore more congruent with interview results. The first factor represents the views of the majority of interviewees, and Q participants, and highlights one of the most important findings of both interviews and focus groups, the notion of individual responsibility for causing climate change and for acting to mitigate its impacts. The second factor represents a pattern of deeper thinking amongst some participants who feel that climate change constitutes only part of a larger and systemic flaw in human societies. This is evident in interviews in which participants question human-environment interactions fundamentally. In this case, participants also consider other problems humanity is facing with concern, such that climate change is no longer the main nor the only priority. The third factor of the four factor solution is defined by only one participant, the same participant who fails to load significantly on either one of the factors in the two factor solution. This factor can be detected in interviews as what most participants feel represents 'the sceptics' thinking on climate change, and is associated with the mainstream of society. The fourth factor highlights a viewpoint centred around financial incentives as a response to climate change, while also acknowledging the shared global responsibility for climate change. To this effect, the viewpoint portrayed in the factor apparently emphasises the need for a common accountability that spans the globe, rather than a responsibility of industrialised countries. Several participants' interviews support this view.

4.2 Q's contribution to this research

Q contributes in three key ways to this research. First, Q is most useful to triangulate a specific outcome of interviews and focus group workshops, individual responsibility. Using the four factor solution shows four distinct types of responses – in the broadest sense – to the problem of climate change. The views embedded in the 'individualist' factor are prominent throughout the majority of

interviews. Participants emphasise that “everyone” is responsible for being part of the causes of climate change, and that “we all” have to contribute to alleviate the problem. The +3 ranking of the statement linking resource conservation to being a good citizen, and the –3 ranking of the statement claiming to wait for government to act on climate change, show a type of empowerment of the individual that participants also express in their interviews. This is further supported by outcomes of the focus group where participants demonstrate their associations with the notion of responsibility emerging from interviews on mental model maps. They focus on intergenerational equity, but also on North/South equity. In the ‘individualist’ factor, this can be seen in the +2 ranking of the statement claiming that it is not fair to leave climate change to future generations. As a result, a commonly felt shared responsibility of individuals underlies the behaviour of many participants in this research, and Q is crucial to assembling a specific argument to this effect.

The second key contribution of Q is in demonstrating that while individual responsibility is a dominant theme here, many participants point to market mechanisms to help change people’s behaviour. This finding is interesting for two reasons: First, it illustrates that underlying the beliefs of a group of participants who feel changing behaviour is best induced with market mechanisms, is an understanding that it is the lifestyles and living standards in the north who are at fault. In pointing to this, rather than to an individual responsibility, the Q sorts show how nuanced the notion of what is to blame for climate change ultimately is. And second, it highlights tensions between the idea of individual responsibility linked to personal empowerment as a core *attitude* or belief, and how participants feel *behaviour* can be changed most effectively (*cf.* Dobson 2005). Hence, in the absence of a change in consciousness and attitude toward climate change, such mechanisms are viewed as a crucial tool in bringing about societal change. Seen against the theoretical backdrop of literature on citizenship and the environment (*cf.* Dobson 2003), this has important implications because it provides empirical evidence that a responsibility of a type of civic duty is felt by many participants.

Finally, the third key contribution relates to tensions found between statements made in interviews that crucially influenced the Q sample, which subsequently were not ranked significantly by those who suggested them. The third factor points to a lack of precision and accuracy in climate change science, rejects anthropogenic causes of climate change, and holds that no action should be taken on it, because there is no perceived problem that human beings could influence. The two statements driving this view (3, 13) were drawn from an interview with a participant who exhibited very strong views, and then ranked both relevant statements at –2, expressing his relative disagreement. Instead, a participant sceptical about climate change ranked them to match the views expressed in the original interview from which they were taken. Important is here that the statements as they are worded represent the most sceptical view about anthropogenic climate change and the perception that any action on the issue is entirely premature for lack of scientific evidence precise enough to support making decisions. Only four participants’ interviews exhibit such or similar views and Q helped shape a factor that outlines a potential prototype of ‘the sceptic’.

Q methodology proved to be useful to further illustrate the themes from interviews. Its utility here lies particularly in highlighting the areas where participants show an emphasis in their perceptions and views about climate change – which is difficult to extract from interviews where the relative importance of statements made is often hidden. As a result, this study suggests that using Q can be helpful in furthering our understanding of people’s views about climate change, and in combination

with interviews and focus groups, can act as a means with which to augment and further differentiate views obtained through other methods.

5 Conclusions

This paper examined the results of a study that involved Q method as part of the data collection. In summary, 38 Q sorts were analysed using PQMethod, which involved applying a PCA, six criteria for selecting factor for rotation, which was followed by a varimax rotation. This routine was applied to a two and a four factor solution, both of which were then related to outcomes from interviews and focus groups.

The empirical portion of this study is enlightened by Q in important ways. In mapping the factors of both solutions, the comparison to interview results showed a greater differentiation of participants' views through the four factor solution. Through their focus on specific statements in each of the four factors, they are useful to illustrate core perceptions about climate change and responses to it. The first factor, 'the individualist', explains much about the most commonly held views about individual responsibility, and provides evidence for a link between this responsibility and citizenship. The second factor, 'the systemist', represents a more systemic viewpoint also found in interviews, which claims that climate change is symptom of a larger problem, which exhibits other symptoms that pose important challenges to mankind. The third factor, 'the sceptic', holds that anthropogenic climate change does not exist as portrayed by the majority of scientists, and that climate science is too imprecise to provide a foundation for decision making. Without this factor, this research would likely have provided only marginal evidence for what was described to be a mainstream perception – scepticism. The fourth factor, 'the economist', points to market based mechanisms as a solution to curb emissions, and hence to alleviate climate change. Considering all of the above, these results highlight the importance of how participants understand their own attitudes and behaviours, and what they feel will cause others to change their behaviour. It also contributes to the recently discussed means with which to further sustainability, changed attitudes or changed behaviour, by highlighting how this distinction holds up in the factors generated. For these reasons, Q method was useful in supporting and further augmenting the outcomes of this study.

References

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Appendix

A. List of Q Statements

1. Continued population growth is unrelated to climate change.
2. When it comes to the changing climate, I'd rather we're safe than sorry.
3. Climate change science must be made much more precise before we use it as a basis for making decisions.
4. Overcoming laziness rather than a lack of knowledge will help stop climate change.
5. We should wait for government to act on climate change.
6. I feel guilty about my contribution to climate change.
7. Without financial incentives industry will keep emitting and driving climate change.
8. When it comes to climate change impacts here, municipalities will have to prepare for floods, droughts, and summer water shortages.
9. We have to stop climate change to save natural ecosystems.
10. Only when people feel affected by climate change will they act.
11. It is not fair to leave the climate in a mess for future generations.
12. We have to realise that climate change is only one symptom of a systematic flaw in how human societies work.
13. Before we do anything, it has to be proven that climate change is caused by people.
14. The industrialised nations' living standards shouldn't be blamed for climate change.
15. There are other much more pressing global problems than climate change that need to be solved.
16. We should simply adjust to the changes in climate as they occur.
17. The arctic permafrost and our glaciers are melting and cause sea levels to rise because of climate change.
18. The media does a poor job at conveying the effects of climate change to the public.
19. Only if every country makes an effort can climate change be stopped.
20. When schools include climate change in their curriculum our kids will know what to do differently.
21. We need to spend fossil fuels on transport and energy to keep our economy running.
22. To curb emissions we need a hefty tax on gas-guzzling vehicles and subsidised alternative energy generation.
23. Technological advances will discover a solution to the problem of climate change.
24. I don't like seeing people suffer from the consequences of climate change on TV, but there is nothing I can do.
25. Buying local products is a good way to reduce greenhouse gas emissions and our reliance on transportation.
26. If we don't act now climate change will lead us to disaster.
27. If it gets a little warmer our tourist industry might boom.
28. Forest fires and the mountain pine beetle problem have little to do with climate change.
29. Home owners will need insurance to pay for damage from flooding and landslides.
30. Cutting down my energy and water consumption is part of being a responsible citizen.
31. Environmental activists must stop scaring the public with talk of climate change.
32. Businesses will use new technology to become more efficient and help stop climate change.