The role of noise policy in interpretative frames of aircraft noise

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Samenvatting

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De rol van geluidsbeleid in interpretatieve denkkaders ten aanzien van vliegtuiggeluid

Er is veel onderzoek gedaan naar geluidhinder van vliegtuigen, maar vaak zonder gebruik van een expliciet theoretisch raamwerk. In dit artikel stellen wij een sociaal model van geluidsperceptie voor. De hypothese dat vliegtuiggeluid zinvol is voor mensen binnen een sociaal geproduceerd discours wordt verondersteld en getest. Concreet verwachten wij dat het beleidsdiscours ten aanzien van geluid de perceptie van mensen structureert. Om deze hypothese te onderzoeken wordt Q-methodologie gebruikt, een methode die, naar de kennis van de auteurs, niet eerder op het onderwerp geluidhinder is toepast. Met behulp van deze methode zijn vijf verschillende denkkaders, die omwonenden van Schiphol (n=43) aannemen, inzichtelijk gemaakt: "Lang leve de luchtvaart", "de luchtvaart: een bedreiging voor het milieu", "de luchtvaart en het milieu: een oplosbaar probleem", "vliegtuiggeluid: geen probleem" en "de luchtvaart: een lokaal probleem". Er wordt aangetoond dat de eerste drie denkkaders duidelijk gerelateerd zijn aan het beleidsdiscours rond Schiphol. Gebaseerd op deze observatie beargumenteren wij dat het beleidsdiscours de interpretatieve denkkaders vormt om geluid van vliegtuigen te waarderen en dat het zodoende als mechanisme kan worden beschouwd waardoor het geluid van vliegtuigen wordt omgevormd in hinder.

1. Introduction

Exposure to aircraft noise in residential areas is a prime focus of protests and policy in many countries. In Europe it is estimated that in 2006 2.2 million people were exposed to annual aircraft noise exposure levels of Lden 55 dB(A) or more and 3.0 million Europeans were exposed to night-time noise levels of Lnight 45 dB(A) or more (MPD, 2007). In addition, the population within the Lden 55 dB(A) is expected to increase to 2.3-2.4 in 2010 and to 2.6-2.7 in 2015 (MPD, 2007).

While aviation generally increased over the past decades, noise tolerance seems to decrease. Today less noise is necessary to have an equal portion of highly annoyed people (Guski, 2004; Bröer and Wirth, 2004; Van Kempen and Van Kamp, 2005; Schreckenberg and Meis, 2007). In an updated review of Van Kempen and Van Kamp (2005), Schreckenberg and Meis (2007) show that exposure-response functions of the period 1990-2008 are different from those collected in the period 1965-1992 on which EU policy is based (Miedema and Oudshoorn, 2001; European Communities, 2002). The older "EU-curve" is found to structurally underestimate the negative community response observed presently.

Several explanations for this trend have been provided. One is the change in the structure of the noise load: the average noise load of single events has decreased, but the number of events has increased (Guski, 2004). This change is concealed by annual energy equivalent noise metrics which are generally used and this new structure might be experienced as more annoying. Other explanations focus on changes in individual characteristics (e.g. noise sensitivity) or on changes in attitudes like trust in the noise source authorities which might have come about due to the advent of the risk averse society (Bröer and Wirth, 2004). Guski (2004) provides yet another reason in arguing that recent aircraft noise studies have been done in the context of step changes of noise exposure levels which are known to cause so-called excess negative response on top of the response to be expected from exposure-response curves derived from steady-state situations.

In this study, however, we focus on a different explanation, which has received little attention in previous research. This explanation focuses on the policy discourse at airports. A policy discourse is defined as the way policy actors socially and publicly define and handle problems. We hypothesize that public definitions of aircraft noise are internalized in frames which people adopt to perceive and appraise aircraft noise. For example, if the policy discourse identifies aircraft noise as an important problem we expect that people will internalize this definition, and in doing so, become more annoyed by the noise. The explanation for the trend towards higher annoyance then lies in changes in the policy discourse.

In this article we propose a social model for noise perception. Based on previous work of Bröer (Bröer, 2006) the main hypothesis of the present study is that policy making is a possible mechanism through which the sound of aircrafts is turned into noise annoyance. The main assumptions underlying this hypothesis are that (1) people make use of already existing frames to perceive and appraise an environmental stimulus like aircraft noise (cf. Nijhof, 2003) and (2) the most influential source of these frames is the policy discourse. More specifically, the hypothesis can be decomposed in two distinctive processes: an internalization process of the policy discourse in internal frames of people and secondly, using this internal frame, an appraisal process of aircraft noise. It is assumed that the policy discourse (and subsequently also the internal frame) contains

"feeling rules" (Hochschild, 1979): it legitimizes or de-legitimizes concerns, complaints or fears. This can be modeled like this: the policy discourse treats aircraft noise as a problem and (de)legitimizes annoyance → cognition and feeling rules are internalized by people around the airport → people feel annoyed by aircraft noise.
Focusing on the criterion of association the present article will investigate this hypothesis. To that effect the following approach is adopted. First, the policy discourse at one airport, namely Amsterdam Schiphol, is characterized. This particular airport is chosen for two reasons. Firstly, the policy discourse at Amsterdam Schiphol explicitly defines aircraft noise annoyance as a problem, a necessary condition if the aim is to investigate whether this definition resonates in the internal frames of people. And secondly, sufficient previous research is already available to provide a satisfactorily description of the policy discourse. Via application of Q-methodology, a method not used for aircraft noise so far, the frames people adopt to qualify aircraft noise will be described and related to the policy discourse. Lastly, the noise annoyance response within the frames will be assessed.
The rationale behind the approach described here is that if (1) a resemblance is found between the internal frames and the policy discourse (at a single moment in time) and (2) noise annoyance response is found to be intrinsically related to the revealed internal frames, there will be sufficient evidence to (preliminary) support the present hypothesis. The former finding would indicate that the relationship between the policy discourse and internal frames satisfies one of the three statistical criteria necessary to qualify a causal relationship, namely the one of association. The latter finding would indicate that the internal frame indeed legitimizes or delegitimizes annoyance response.
The remainder of this paper is structured as follows. In section 2 we will provide a description of the policy discourse at Amsterdam Schiphol. In section 3 Q-methodology and its application to our case will be discussed. Section 4 describes the outcome of the analysis: five typical ways of thinking about aircraft noise. For each frame we discuss the noise annoyance response within the frame and how the frame relates to the policy discourse we have identified in section 2. The concluding section summarizes the main findings.

2. Noise policy discourse at Amsterdam Schiphol

Hajer (1995, p. 264) defines a discourse as "an ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices". Hence, a policy discourse can be regarded as the way policy actors (socially) define and handle public problems. Useful elements to guide these definitions are policy concepts, story-lines and metaphors. In addition, although multiple discourses surrounding an issue can be identified, only one of those is (usually) dominant. Hajer (2006) defines dominance using two criteria, namely discourse structuration and discourse institutionalization. The former relates to the degree a particular discourse dominates a given social unit (e.g. a policy domain). It refers to the degree a discourse is shared among multiple actors, the so-called discourse coalition. The latter relates to the degree a discourse is institutionalized in policy processes and policy measures. When both conditions are satisfied a discourse is said to be dominant. The current description of the policy discourse will only focus on the dominant discourse. Although alternative discourses can be identified, this focus is

justified by the argument that this discourse is most visible to residents around the airport.

The present description of the policy discourse related to the issue of aircraft at Amsterdam Schiphol is based on several existing studies (Dierikx and Bouwens, 1997; Van Eeten, 1999; 2001; Abma, 2001; Donicie, 2003; Wagenaar and Cook, 2003; Bröer, 2006). It is meant to identify the dominant policy discourse for noise annoyance in the Netherlands.

Before aircrafts became a problem of noise annoyance, aviation had been introduced to the Netherlands as an economic asset and as a part of national development since 1919. In policy documents Schiphol airport and aviation were placed in a historical perspective, relating them to the image of the Netherlands as a successful seafaring nation in the golden age. Based on this analogy the airport should be regarded as something to be trusted and accepted and the government should strive to develop an airport that plays a role on a global scale.

In the mid 1950's aircraft noise was first identified as a (potential) problem. In the following decades this problem was, in line with the physical expansion of the airport, treated as a spatial planning problem. The fundament of the noise policy was to fit the airport, with its noise footprints, in the residential environment surrounding the airport, such that the flight routes avoided living areas. Other (implicit) assumptions followed from this central planning perspective. First, human response to aircraft noise was expected to be uniform. The physical noise level therefore became the central outcome of interest for policy regulation. Second, since spatial planning was a matter of centralistic control a major role was given to national governmental bodies and (acoustical) experts in the development of the airport, while residents surrounding the airport were assumed to be passive. Third, planning and noise policy focused on long term developments, which were expressed in statistics, maps (showing noise contours) and scenarios. And lastly, (perceived) solutions to solve the noise problem were spatial and technocratic in nature (e.g., repositioning runways or flight routes, improving aircraft engines, restrictive land-use policies and relocation of the airport to the sea).

However, the planning discourse failed because flight operations and housing more and more overlapped. From the 1960's onwards, therefore, policy makers accepted noise pollution in residential areas. Citizens around Amsterdam Schiphol, however, following the discourse's own premise that aircraft noise is an important problem, did not settle in their role as passive receivers. In the period between 1965 and 1995 the history of Schiphol knows many citizens' protests. In these protests the disciplinary effect of the policy discourse can be observed. Although citizens oppose the policy they still express themselves in terms of the planning discourse by advocating for solutions like the repositioning of runways and relocation of the airport. The unsolvable conflict caused by the planning discourse (i.e. "noise is an avoidable problem" versus "some noise needs to be accepted") as well as the (resulting) protests lead to a deadlock. To escape it a new (international) story-line was introduced in the 1990's, called "ecological modernization" (Weale, 1992; Mol and Spaargaren, 1993; Hajer, 1995). The combination of this story-line with the existing discourse has lead to the policy discourse that exists to the present day, which Bröer (2006) termed the "mainport and environmental discourse".

The basic assumption of this new story-line was that economy and environment could be developed at the same time; the attainment of both economical and ecological goals should be regarded as a positive-sum game. The promise of ecological modernization relied strongly on developments in science and technology and market-based policy

instruments (e.g. environmental taxes). Related to Amsterdam Schiphol the economic benefits of aviation became known under the umbrella of the "mainport", which was considered a vital entity to the Netherlands if it was to play a role in the globalizing economy. Schiphol should be seen as an "engine of the economy". The ecological negative externalities, most notably noise, but also risk and pollution, became known under the umbrella of the "environment". From 1990's the mainport and environment discourse was spread among citizens through extended participatory processes. Repeatedly, citizens were called upon to be alert, to be informed and to express their interests. In 1995, the mainport and environment discourse was institutionalized, when the decision was made to construct Schiphol's fifth runway (mainport) and to implement noise contours (environment).
Although the principle of ecological modernization seems to have provided a viable new perspective, it can actually be seen as an explicit reformulation of the existing problem conceptualization (i.e. the planning discourse) in modern (neo-liberal) terms. Policy makers seek to accommodate growth of the airport while trying to avoid its negative effects on the environment via traditional planning instruments. The only difference is the explicit acknowledgement of both economical and the environmental effects/values.
As mentioned previously, we expect the dominant policy discourse to be present in peoples' frames on noise around Schiphol. The next section describes the particular methodology to reveal these frames and how it is applied to our case.

3. Method

3.1 Q-methodology

To reveal the internal frames of people Q-methodology is used. This method has been shown to be effective in eliciting people's viewpoints on a wide range of topics (Brown, 1980) and is therefore regarded as a promising way to achieve the aim of the present study. The basic idea of Q-methodology as opposed to traditional (psychological) research is that one correlates persons instead of traits. When two persons are shown to correlate, they are said to share a similar internal frame. Subsequently, by factor-analyzing a correlation matrix of NxN persons, shared frames among people can be extracted. In the following the operational procedures of Q-methodology and the more abstract theoretical underpinnings behind these procedures will be briefly described.
The Q-method works as follows. Based on the research question at hand a specific concourse is defined. This is the whole of existing subjective communicability, i.e. statements of opinion, related to a certain topic which can be found among members of a social group (Stephenson, 1978; Brown, 1980). For practical reasons a representative set of statements is selected from this concourse. This is called the Q-set or Q-sample and typically consists of 40 to 80 statements (Watts and Stenner, 2005). Next, participants (called the P-set) are asked to rank-order these statements according to a specific condition of instruction (e.g., "do you agree/disagree with the following statements?"). These rank-orderings are termed Q-sorts. Typically, subjects are not asked to rank-order all statements, but instead to place the statements in a quasi-normal distribution (Watts and Stenner, 2005) like the one depicted in Figure 1. The forced distribution is to encourage subjects to consider the items more systematically than they would do voluntarily (Brown, 1980; McKeown and Thomas, 1988). Its shape reflects the

assumption that in general people have less extreme positions than neutral ones in relation to a topic.
Next, correlations between Q-sorts can be computed. These correlations indicate to which extent any two persons share a similar arrangement of statements. Since participants are actively involved in the construction of their final statement array a correlation between Q-sorts can be interpreted as the degree in which two persons share a similar viewpoint or frame, i.e. a construction of their subjective reality. Through factor-analysis of the correlation matrix of NxN Q-sorts (each related to one subject), common factors can be extracted, which aim to account for as much of the variability in the correlation matrix as possible. Since these factors are shared by multiple people they can be regarded as common viewpoints. Rotation methods like varimax or quartimax can be employed to approximate simple structure, i.e. to produce Q-sorts with high-loadings on one factor and near-zero loadings on the others, which enhances interpretation (McKeown and Thomas, 1988). The resulting factors represent the different viewpoints, as expressed by the subjects, in relation to the topic of the study.
To be able to interpret the factors the defining Q-sorts of a factor, i.e. those that significantly and solely load on a given factor, are merged into one factor array. Through this merger specificities of individuals are cancelled out (Brown, 1980) and the resulting factor arrays represent idealized or model Q-sorts (McKeown and Thomas, 1988). These model Q-sorts can be interpreted as a "snapshot" of existing perspectives in relation to a certain topic.

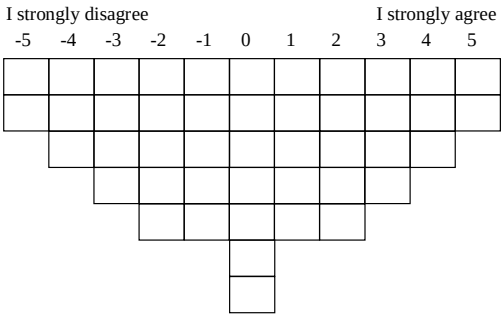

Figure 1. Example of a quasi-normal distribution (n=48)

3.2 Application of the Q-method

The Q-sample
In this study the concourse is defined as all subjective communicability expressed by residents living in the vicinity of Schiphol Airport related to the topic of aircraft noise. Based on previous research of Bröer (Bröer, 2006) statements were gathered from four sources: thematically structured interviews with residents living in Amsterdam Osdorp related to the topic of aircraft noise (n=47), lodged complaints with the Commission Regional Dialogue Schiphol (CROS) (n=130), letters to the editor from residents around Schiphol published in three national newspapers (Volkskrant, NRC Handelsblad and De Telegraaf) (n=71) and statements from residents during public inquiry procedures (n=18). The data collection procedure was meant to maximize the possibility that different kinds of noise annoyance are included, following the procedure of theoretical sampling. The analysis, based on grounded theory procedure, led to approximately 240 different statements about aircraft noise (Glaser and Strauss, 1967; Charmaz, 2006).

In Q-methodological research the role of theory is different than the one in traditional psychological research. Instead of using it to explain the studied phenomenon in a hypothetic-deductive way, it functions as a point of departure, a lens to view the issue. More specifically, it is typically used to guide the selection of a representative sample of statements. This approach is also adopted in the present study. First, we used academic literature to identify three key themes to structure the total list of statements: (1) perceptions of and psychological reactions to aircraft noise (covering statements related to hearing aircrafts, being disturbed by aircrafts, fear of aircraft crashes, noise annoyance, etc.), (2) non-acoustical factors (covering statements related to trust in noise source authorities, perceived control, future expectations, concern about health effects, preventability beliefs, etc.), and (3) policy story-lines (covering statements related to economic benefits and ecological costs of aviation, complaining and complainants, modernity, etc.). In addition, a fourth theme was identified to categorize those statements that did not relate to any of the three themes, and hence, for which no existing theoretical foundation was present. The distribution of all statements (N=240) over these four themes was approximately 25%, 40%, 30% and 5%. Next, within each theme subcategories were identified to further structure the set of statements. In order to arrive at a representative sample, statements within each category were selected until all categories were adequately covered in the sample. Lastly, attention was paid to the clear expression of the statements and the balance of statements in the overall sample (Watts and Stenner, 2005). The final Q-set consisted out of 48 statements and can be found in Table 1 (section 4).

The adopted approach led to a naturalistic and structured Q-sample. Naturalistic in the sense that the statements were not selected by the researcher but instead derived from participants' own communications about aircraft noise, thereby avoiding the risk of missing the respondents' meanings or confusing these with meanings from an external frame of reference (McKeown and Thomas, 1988). And structured in the sense that theoretical (sub)themes were used to categorize the concourse which ensured coverage of all relevant issues related to aircraft noise in the final sample, thereby avoiding the risk that certain components of the concourse were under- or oversampled (McKeown and Thomas, 1988).

Procedures and data

To control for the effect of the physical level of aircraft noise exposure subjects were sampled in one neighborhood only, namely Amsterdam Osdorp. This particular neighborhood was selected to ensure that the concourse represented in the Q-sample matched the language of the participants (preliminary interviews were also held here). The average noise level in this neighborhood, calculated over the period of a year, is approximately Lden 53 dB(A) (Bröer, 2007). It is located approximately 5 kilometers from the center of Amsterdam Schiphol.

Q-methodology aims to reveal the main frames or viewpoints on an issue. It does this most effectively with a participant group containing 40 to 60 subjects (Watts and Stenner, 2005). In addition, to reveal those viewpoints it is essential that subjects are not randomly but strategically sampled. The main idea is to include those persons who are theoretically relevant to the problem under consideration (Brown, 1980). Based on research of Bröer (Bröer, 2006), who showed that different frames of subjects are correlated with their score on a standardized noise annoyance scale (Fields et al., 2001), this was considered to be the most relevant dimension. Therefore, we made sure that

subjects are spread over the whole continuum of this dimension. A large part of the interviews were gathered by two student assistants under close supervision of the authors.

The data were collected in the period March-April 2008. Members of the research team visited respondents at their home address and administered the Q-sorting interviews in a face-to-face fashion. In total 43 respondents completed the Q-sorting task and participated in a short interview afterwards. During the Q-sorting task subjects were asked to rank-order the 48 statements following the forced quasi-normal distribution depicted in Figure 1 based on the following condition of instruction: "to which extent do you agree/disagree with the following statements?". The scale ranged from -5 (most disagree) to +5 (most agree). Due to the controversial nature of the topic (Van Eeten, 2001), we expected that people would hold relatively more extreme positions. Therefore, a relatively flat distribution was chosen. To facilitate the ordering process, respondents were given 48 cards with the statements printed on them and a large sheet with the quasi-normal distribution.

The main aim of the interview afterwards was to gain insight in the particular reasons behind respondents' arrangements of the statements, which is, in line with standard Q-methodological practice, used to facilitate interpretation of the extracted factors. Additionally, a question was included as to whether all topics, considered relevant by the respondent to the subject at hand, were included in the sample of statements. The answers to this question indicated that no topic was structurally overlooked. Lastly, to assess the position of noise annoyance within the internal frames the first item of the standardized noise annoyance scale developed by Fields et al. (Fields et al., 2001), was included. This question is formulated as follows: "Thinking about the last 12 months or so, what number from zero to ten best shows how much you are bothered, disturbed, or annoyed by aircraft noise?".

Analysis

To identify similarly patterned Q-sorts, a correlation matrix of NxN Q-sorts (N=43) was calculated and factor analyzed using the method of centroid factor analysis (Brown, 1980). The PQmethod software (Schmolck, 2002) was used for this purpose. In line with Brown's recommendation (Brown, 1980), 7 factors were initially extracted. Next the varimax rotation method was used to approximate simple structure. In line with standard Q-methodological practice only factors with two or more significant loadings were considered acceptable. After rotation it was found that two factors did not satisfy this criterion. These were therefore disregarded from further analyses.

Next factor exemplars to compute the composite factor array for each factor needed to be identified. These are participants' q-sorts that significantly and solely load on a factor. Via the formula $2.58(1/\sqrt{n})$ and with n=48 it can be calculated that loadings greater than +0.37 are significant at the 0.01 level. However, following the approach described by Watts and Stenner (2005), the confounding of participants (i.e. the number of participants that load on two or more factors) is minimized by raising this level to +0.40. At this level 37 participants load solely on one factor, 3 participants load on two factors and 3 participants load on none of the factor. Hence, 86% of the data is used in the final analysis of the factors.

Lastly, the composite factor arrays are computed. This is done by multiplying the raw scores of each factor exemplar by a weight which based on their factor loading. Next, the outcomes of these computations are summated for each statement. These summated

scores are then standardized. To ease the interpretation the resulting z-scores are 'rounded' to fit the used quasi-normal distribution (Figure 1). In our case those two z-scores with the highest score are assigned a value of +5, the next three highest z-scores receive the value +4, etc.

4. Results

4.1 Frames of residents around Schiphol

In the following the five extracted and rotated factors will be interpreted based on the computed composite factor scores (see Table 1). For each factor, we indicate its relation to the noise policy discourse. Central to the first three factors is their relation to the mainport and environment policy discourse. In line with our theoretical argument, the factors are called frames below.

Table 1. Factor arrays of the five rotated factors

No.	Statement	A	B	C	D	E
1	It is convenient to live near Schiphol.	3	-1	1	-1	-1
2	Schiphol should be allowed to stay: long live aviation!	4	-1	0	2	0
3	I regularly hear aircrafts.	3	4	3	-2	5
4	I fear that aircraft noise will increase.	-1	2	1	-4	5
5	I have the feeling that aircraft noise is forced upon me.	-2	4	-3	-3	-4
6	The sound of aircrafts belongs to this day and age.	3	-2	0	2	1
7	If you cannot stand aircraft noise, you should go and live somewhere else.	1	-3	0	-3	-4
8	It is acceptable that people are disturbed by aircraft noise in their dwelling.	0	-5	-4	-2	-3
9	It is acceptable that people have to interrupt a conversation due to aircraft noise.	-2	-5	-2	0	-1
10	I am annoyed by aircraft noise.	-5	2	-1	-4	2
11	Air traffic is a hazard for public health.	-2	1	1	0	3
12	The growth of Schiphol goes at the expense of the quality of life of many citizens.	-1	5	-3	-1	2
13	I cannot control the noise and this makes me feel angry and powerless.	-4	0	-2	-3	-3
14	If you do not pay attention to it (i.e. the noise) then you will not be bothered by it.	3	-4	1	0	-3
15	I can do something against the noise.	1	-2	-1	-2	-5
16	If I could I would move to a quiet neighborhood.	-4	-1	-4	-1	4
17	I am afraid that one day an aircraft will crash nearby.	-2	-1	-5	1	-3
18	As citizen you are powerless against Schiphol.	-3	1	0	3	-2
19	It does not help to complain about aircraft noise.	-1	0	-1	3	0
20	There is sufficient consideration for residents around Schiphol.	2	-4	-2	3	0
21	Citizens should collectively move up against aircraft noise.	-1	0	-3	-4	2
22	If people complain about aircraft noise they mainly serve their self-interest. They do not realize how important Schiphol is to the Netherlands.	1	-3	-2	5	2
23	There is too much attention for a small group of complainants around Schiphol.	0	-3	1	2	0
24	You cannot solve the "annoyance" problem. Schiphol has been around for a long time and this is something we have to deal with.	2	-1	-1	3	0
25	Flying is too cheap.	-4	0	-3	-1	-5
26	More technology will be developed that will reduce the noise.	4	1	3	0	3
27	Schiphol acts as a free state making its own rules and regulations.	-1	1	-5	0	-4
28	I believe that Schiphol always gets his way.	-3	3	0	0	2
29	Schiphol does enough to reduce the noise.	0	-4	-2	-1	-2
30	The government does enough to reduce the noise.	0	-3	-1	-5	-2
31	The government does not live up to her promise to reduce the noise.	-1	1	-4	3	1
32	It is a good thing that the environmental movement and local action groups stand up for residents living around Schiphol.	1	3	2	-1	3
33	They always expand the airport first, and then raise the norms for the allowed levels of noise.	0	2	0	2	1
34	Schiphol is an engine of the economy.	5	0	5	1	0
35	We should be proud of our national airport.	4	0	2	1	-2
36	Aviation is important for the employment.	5	3	5	1	1
37	Noise annoyance from aircrafts is an important problem.	0	4	2	-3	-1
38	Aviation is a threat to the environment.	0	5	2	1	1
39	The government should strive for reducing noise annoyance.	2	2	3	0	4
40	The government should strive for growth of Schiphol.	1	-2	-1	-5	-1
41	Economic interests are more important than reducing the level of noise annoyance.	1	-2	2	-2	0
42	Schiphol is big enough and should not be allowed to grow any further.	-3	1	3	4	-1
43	The double-sided aim (more growth but not more annoyance) of the government has failed. In the end the choice is always made to accommodate growth.	2	2	1	4	0
44	People have the right for silence.	0	3	4	2	4
45	Aircraft noise is "meaningless" (Dutch: zinloos) noise.	-3	-1	0	0	-1
46	I think it is a good idea to have an "aircraft-free-Sunday" every now and then.	-2	-2	4	0	3
47	Schiphol should be relocated to the sea.	-5	0	4	-2	-2
48	Further away from Schiphol aircraft noise is not really a problem.	2	0	0	5	1

4.1.1 Frame A: Long live aviation! (the economic stance)

This frame is shared by 14 subjects and can account for 17% of the total variance of the correlation matrix. In line with the policy discourse it strongly emphasizes the economic benefits of Schiphol airport (34: 5; read: statement 34, score 5) and of aviation in general (36: 5). According to this account we should be proud of our national airport (35: 4) and be cheerful about it (2: 4). Schiphol should grow (42: -3) and certainly not be relocated to the sea (47: -5). In this frame, one is optimistic about the future: technology will reduce aircraft noise (26: 4) and aircraft noise will not increase (4: -1).

While this frame strongly subscribes to the economic argument of the noise policy, it plays down the ecological arguments: aviation is not considered a threat to the environment (38: 0) and noise annoyance is not considered a major problem (37: 0). Subjects tend to disagree with statements that aircraft noise is a hazard to public health (11: -2) and that the growth of Schiphol reduces the quality of life (12: -1).

In line with playing down the ecological arguments, complaining about noise is not supported: subjects weakly agree with the statement that those who complain about noise are selfish and do not see the bigger picture (22: 1). They believe that residents around the airport receive sufficient consideration (20: 2) and they have no intention to engage in a collective action to address the noise problem and even weakly refrain from such action (21: -1).

Given the support for economic reasoning, subjects are indifferent about the efforts of the government and Schiphol to reduce the noise (30: 0 and 31: 0). The relationship with the noise source authorities is mildly positive to neutral. Subjects do not believe Schiphol always gets his way (28: -3) or makes its own rules and regulations (27: -1). In addition, subjects weakly disagree with the statement that the government does not live up to her promise to reduce the noise (31: -1).

In this frame, the aim of the government to combine economic growth and ecology has failed (43: 2). But this does not go together with an overall negative attitude towards authorities.

Subjects subscribing to this frame do not consider themselves to be annoyed by the aircraft noise (10: -5), although they do regularly hear aircrafts (3: 3). In addition, they have no intention of moving to a quieter place (16: -4).

Lastly, the frame acknowledges that we live in modern times: the sound of aircrafts belongs to this day and age (6: 3) and aviation is just something we need to deal with (24: 2). This is typical for a "go with the flow" attitude towards modernity.

Altogether, frame A has a clear structure: it strongly favors economic arguments and plays down everything related to ecology.

4.1.2 Frame B: Aviation: An ecological threat (the environmental stance)

This frame is shared by 15 subjects and can explain 18% of the total variance. In contrast to frame A, this frame emphasizes that aviation is an environmental threat (38: 5), that growth of Schiphol goes at the expense of the quality of life of many citizens (12: 5), that disturbance by noise is completely unacceptable (8: 5, 9: 5) and that aircraft noise annoyance is an important problem (37: 4) which cannot be ignored (14: -4). In line with the policy discourse, this account subscribes to the conceptualization of aviation as an important environmental problem.

While the frame stresses "ecology" it is less supportive of "economy". Subjects neither confirm nor disconfirm that Schiphol is an engine of the economy (34: 0). Aviation, however, is considered to be important for employment (36: 3). Compared to frame A,

there is a strong support for one half of the policy discourse, but less criticism towards the other half.
Like subjects in frame A, subjects in frame B agree with the statement that the double-sided aim has failed and that in the end the government always chooses to accommodate growth (43: 2). But, different from frame A, in frame B this is combined with an elaborate negative attitude towards authorities. One believes that there is insufficient consideration for residents around Schiphol (20: -4) and that the government and Schiphol are not putting in enough effort to reduce the noise (29: -4 and 30: -3). Subjects believe Schiphol always gets his way (28: 3) and weakly agree with the statement that it acts as a free-state (27: 1). Subjects believe that the noise norms are purposively manipulated following expansion of the airport (33: 2). Consequently and in contrast to all other frames, subjects feel that aircraft noise is forced upon them (5: 4). Something which is net undesirable (38: 5 versus 34: 0 and 36: 3) is unwillingly/forcefully and unasked (20: -4) being imposed upon them. Policy has failed in the sense that noise annoyance is out of control. It is only in this frame that subjects do not think that aviation belongs to this day and age (6: -2). Instead, it's a runaway train which threatens citizens and the environment.
Within the account people support complaining (22: -3) (23: -3) and environmental movements (32: 3). This support is stronger than in all other frames. This is of course in line with the ecological stance. It might also be interpreted as a way to counter the criticism often raised against complainants in The Netherlands.
Subjects within this frame consider themselves moderately annoyed by aircraft noise (10: 2) and claim they regularly hear aircrafts (3: 4).
Altogether, frame B has a clear structure: it strongly favors ecology, puts less emphasis on economy, is strikingly critical about noise policy and portrays noise as an uncontrolled ecological threat. It is almost antithetical to frame A.

4.1.3 Frame C: Aviation and the environment: A solvable problem (the technocratic stance)

This frame is shared by 3 subjects and can explain 5% of the total variance. This particular frame closely resembles the policy discourse with regard to Schiphol. It underlines the benefits of aviation for the economy (34: 5) and employment (36: 5), but also mildly agrees with the statements that aviation is a threat to the environment (38: 2) and that noise annoyance is an important problem (37: 2). Environmental pressure groups are viewed positively (32: 2).
Complaining, in this frame, is necessary and useful in general (19: -1, 22: -2), but there too much attention for a small group of serial complainers (23: 1).
This frame accurately reproduces the dominant policy and supports the government's policy stronger than any other frame. Subjects disagree with the statement that the government does not live up to her promise to reduce the noise (31: -4) and with the statement that Schiphol acts as a "free-state" (27: -5). Subjects do not feel powerless (13: -2) and do not have the idea that the sound is forced upon them (5: -3). Still, subjects (weakly) disagree with the statements that the government and Schiphol do enough to reduce the noise (29: -2 and 30: -1 respectively). So again, even in this frame subjects weakly acknowledge that the government has failed to achieve this aim (43: 1).
It seems as if in this frame, subjects have internalized the dominant policy, but feel disappointed with the results. Subjects strongly agree with statements that Schiphol should be relocated to the sea (47: 4) and that it would be a good idea to have an

"aircraft-free-Sunday" every now and then (46: 4). The first measure has been debated since the nineteen-sixties; the second one is in no way part of the dominant policy discourse.
In addition, subjects have faith in technology to reduce to noise (26: 3) as well as in technology in general. This latter remark is supported by the fact that subjects within the frame are least fearful of a nearby aircraft crash (17: -5). It is therefore plausible that the acknowledged failure of the double-sided aim does not lie in subjects' belief that this is a wrong aim to strive for but probably lies in subjects' belief that wrong or too few solutions are being implemented.
Lastly, although subjects do regularly hear aircrafts (3: 3), they are not particularly annoyed by aircraft noise (10: -1). They do, however, find it unacceptable that people are disturbed by aircraft noise in their dwelling (8: -4) or that people have to interrupt a conversation due to the noise (9: -2).
The structure of this frame closely resembles the dominant policy. In this frame, a "technological fix" is the prime solution for the still existing tension between economy and ecology.

4.1.4 Frame D: Noise is not a problem (the anti-government stance)

This frame is shared by 2 subjects and can explain 4% of the total variance. This account neither strongly concurs with the policy discourse's propagation of aviation as an important driver of the economy (35: 1 and 36: 1), nor with its propagation of aviation as an important environmental threat (38: 1). Moreover, subjects even disagree with the statement that noise annoyance is an important problem (37: -3). The denial of aircraft noise as an important problem also becomes apparent from other statements: subjects are not annoyed by aircraft noise (10: -4), they do not believe that the government should strive for reducing noise annoyance (39: 0), nor do they fear that aircraft noise will increase (4: -4) and they strongly agree with the statement that further away from Schiphol aircraft noise is not really a problem (48: 5). In addition, subjects in this frame do not regularly hear aircrafts (3: -2) in contrast to the other frames in which subjects all agree to this statement.
The attitude that aircraft noise is not a problem is consistent with the strong non-complaining attitude present in this frame. Subjects strongly agree with the statement that people who complain about aircraft noise only serve their self-interest and wrongfully neglect the importance of Schiphol to the Netherlands (22: 5). In addition, they do not believe that citizens should move up collectively against the noise (21: -4) and agree with the statement that there is sufficient consideration for residents around Schiphol (20: 3).
Still, subjects believe that the government does not do enough to reduce the noise (30: -5), that the double-sided aim of the government has failed (43: 4), and that the government does not live up to her promise to reduce the noise (31: 3). Since subjects in this frame do not subscribe to the ecological or the economic arguments, their dissatisfaction is derived from a different argument. In this frame, subjects' most strongly state that government should not strive for growth of the airport (40: -5) and that Schiphol is big enough and should not be allowed to grow any further (42: 4). Subject probably fear the growth of the airport for which they blame politicians, not the industry. They do not believe Schiphol always gets his way (28: 0) or that it acts as a free-state (27: 0).

As mentioned earlier, subjects adhering to this frame do not find themselves annoyed by aircraft noise (10: -4), nor do they regularly hear aircrafts (3: -2). As in frame A, subjects in frame D are rather indifferent about the acceptability of being disturbed by aircraft noise (8: -2 and 9: 0).
This frame is structured around the idea that the physical growth of the airport is insufficiently controlled by politicians, but this problem is not connected to either environmental or economic arguments. It might relate to a conservative anti-government frame in which the airport as such is big enough.

4.1.5 Frame E: Aviation, a local problem (the a-political stance)

This frame is shared by 3 subjects and can explain 5% of the total variance. Subjects in frame E are, similar to those in frame D, not very concerned with the positive economic effects (34: 0 and 36: 1) or the negative environmental effects (38: -1 and 39: 1) of the airport. Instead the consistent theme in this frame is that subjects evaluate the statements in terms of the direct consequences they hold to their personal situations. Therefore, subjects do not take a strong position in the wider public controversy related to the economy-ecology conflict, but instead react with strong agreement to the statements like "I fear aircraft noise will increase" (4: 5) and "Air traffic is a hazard for public health" (11: 3).
The most striking feature of frame E is the subjects' desire to move to a quieter neighborhood (16: 4). In addition, subjects strongly disagree with the statement "I can do something about the noise" (15: -5). Only in this frame, people do not think that one should be proud of the airport (34: -2).
Subjects strongly believe that the government should strive for noise reduction (39: 4) and deny that noise annoyance is an important problem at the same time. They weakly believe that the government does not live up to the promise to reduce the noise (31: 1), that the government and Schiphol are not putting in enough effort to reduce noise (30: -2 and 31: -2) and that Schiphol always gets his way (28: 2). They support an "aircraft-free-Sunday" (46: 3), but relocation of the airport is not considered a good idea (47: -2). Although such a measure would of course result in direct positive effects (i.e. no more aircraft noise) it also has its direct disadvantages, for it would probably raise the prize for air travel. This goes against subjects' desire to travel by air, which can be inferred from subjects' strong disagreement with the statement that flying is too cheap (25: -5).
Similar to subjects in frame B, subjects within this frame consider themselves to be moderately annoyed by aircraft noise (10: 2) and subjects regularly hear aircrafts (3: 5). Lastly, they find it unacceptable to be disturbed by aircraft noise (7: -4 and 8: -3).
The line of reasoning in this frame is difficult to interpret. It does not resemble the dominant policy and seems inherently contradictory. What seems to stand out is a fear of personal damage, a desire to move away from the neighborhood and no identification with the airport. This might be seen as an a-political stance. The ecology-economy conflict is turned into a local and personal problem which can be solved with a local solution, i.e. moving to a quieter place.

4.2 The relation between the policy discourse and internal frames

We expected that the ways people approach aircraft noise (described in the previous paragraph) are related to the way this noise is approached in policy discourse (section 2). Based on the results it can be concluded that the first three frames are clearly related

to the policy discourse. Frame A follows the economic argument, and frame B and C follow both the economic and environmental arguments. Moreover, none of the frames deny the economic or environmental trains of thought. Frame A, the economic frame, does not acknowledge the environmental problems posed by aviation, but also does not deny them. Statements related to environmental concerns receive a neutral score, not a negative one. Frame B, the environmental frame, moderately agrees with part of the economic reasoning (i.e. employment). Lastly, frame C also sides with both arguments, but, in contrast to frame B, emphasizes the economic values. In addition, since the first three frames account for the major part of the total portion of explained variance (cumulative 40% of the total 49%), it can be concluded that the lines of reasoning expressed within the policy discourse are internalized by most of the participants. Hence, the way the problem is framed in the policy discourse becomes internalized in the internal frames of people.

4.3 Noise annoyance response within the frames

Next, the noise annoyance response within each frame is assessed. This is done through examination of the position of statement 10, "I am annoyed by aircraft noise", in the factor arrays (see Table 1). In addition, this information is supplemented with results from a standardized noise annoyance question posed in the short interview conducted after the Q-sorting exercise. The Q-methodological and traditional survey results are both reported to cross-validate the observations. From Table 2 it can be deduced that the position of statement 10 for the different frames is overall consistent with the mean scores of the standardized noise annoyance item.

Differences greater than 2 to 3 between statement scores can be treated as significant (Brown, 1980). Based on this rule-of-thumb it is concluded that the annoyance scores vary significantly across frames.

Within frame A and D annoyance is strongly denied. For frame A the denial of aircraft noise as annoying is consistent with the belief that aviation has only economic benefits and is not associated with environmental costs. Frame D even explicitly denies aircraft noise as a problem. On the contrary, for frame B and E annoyance is (moderately) justified. Frame B prioritizes ecological concerns over the economic benefits. Aircraft noise is regarded as a serious problem. Frame E does not relate to the environment-economy dichotomy. However, here, the local conflict justifies a negative response to noise. It is important to note, however, that frame B and E do not legitimize an extreme annoyance response. After all, benefits of aviation (being national or individual) are acknowledged, so one cannot totally oppose aviation/Schiphol. Lastly, frame C strongly supports economic benefits but also acknowledges environmental values. This goes together with an average noise annoyance score.

Overall, it can be concluded that annoyance response is intrinsically related to the frames and that the frames legitimize or delegitimize different degrees of annoyance response.

Table 2. Position of statement 10 and the means and standard deviations of the noise annoyance item.

		Noise annoyance (0-10)		
Frame	**Position s10**	**Mean**	**Std.dev.**	**N**
A	-5	1.43	1.45	14
B	2	6.00	2.37	16
C	-1	4.00	1.00	3
D	-4	2.50	0.71	2
E	2	6.33	3.21	3

5. CONCLUSION

In this study the hypothesis is investigated that policy making is a possible mechanism through which the sound of aircrafts is turned into annoyance. To this effect, the policy discourse is described and the internal frames of people are revealed via Q-methodology. The factor analysis revealed five frames, which residents around Amsterdam Schiphol adopt to qualify their experience of aircraft noise. We showed that the three main frames are related to the policy discourse and that most people (36 out of 43 of all participants) use these frame in their appraisal of aircraft noise. Based on these results it is concluded that the policy discourse is a source of arguments which play a dominant role in structuring the frames of people. In addition, we show that these frames legitimize significantly different degrees of noise annoyance response. Hence, even without necessarily implying a causal relationship between policy and annoyance, the analysis has provided a better understanding of the (negative) experience of aircraft noise.

Finally, we can relate our findings to our point of departure, namely the observable trend that presently people are more annoyed than several decades ago at equal (annual equivalent energy) noise levels. Our analysis suggests that this trend can be explained by the fact that today's policy discourses around major airports more and more explicitly recognize and define aircraft noise as an important problem. This definition becomes internalized by people affected by aircraft noise and structures the experience of noise as a negative one. However, we acknowledge that to rigorously test the assumed causal link between policy and noise annoyance the other criteria necessary to qualify a causal relationship, i.e. time-precedence and non-spuriousness, would also have to be (quantitatively) addressed.

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