The Subjective Assessment of Resonating Sound-art Samples and its Relation to Psychoacoustic Measures

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Abstract: Samples from a selection of minimalist sound-art works were assessed by eleven subjects on five bipolar scales, representing aspects of evaluation and emotion. The subjective assessments were analysed in relation to psychoacoustic measures, including loudness, pitch, sharpness and roughness.

INTRODUCTION

There are many instances of drone-like sound-based art where the artist creates or finds a system of sustained acoustic resonance, and presents it to the public as an installation or recording, with very little performative intervention. The recorded works investigated here are Ros Bandt’s Mungo (ABC Music, 1994), Garlo’s Vent de Guitares No. 7 (CIP/Audio, 1994), Alan Lamb’s Primal Image (Dorobo, 1995) and Journeys on the Winds of Time (New Albion Records, 1990), Alvin Lucier’s Music on a Long Thin Wire (Lovely Music, 1992) and I am Sitting in a Room (Lovely Music, 1990), Gordon Monahan’s Long Aeolian Piano (self-published, 1987), Bruce Odland and Sam Auinger’s O+A Resonance (O+A, 1995), Paul Panhuysen and Johan Goedhart’s Requiem (Apollo Records, 1986), Dan Senn’s Hands Off (Newsense Intermedium, 1993), and Roger Winfield’s Windsongs (Saydisc Records, 1991). It was thought that the abstract nature and simplicity of these sounds would lead to subjective assessments based largely on psychoacoustic factors.

EXPERIMENTAL METHOD

Fifty-three arbitrarily selected sound samples of 20s duration were assessed by eleven subjects, nine being experienced in sound-art or music. The sounds were assessed on three evaluation scales ([dis]like, [un]interesting, and [un]pleasant) and two emotion scales (arousal and valence) (1). The relative levels of the stimuli were retained from the original recordings, and the amplification to the headphones was fixed. Standard procedures were used to measure the steady-state loudness (2), tonal pitch and pitch salience (3), and sharpness (4) of the stimuli. Time-varying A-weighted sound level and frequency centroid measurements were made, from which crude measures of amplitude and frequency fluctuation and stereophonic balance were obtained. A very approximate measurement of roughness was performed.

RESULTS

There was a high degree of correlation within the five response scales. A factor analysis of the scales produced two factors, shown in Table 1. Factor 1 (.69 of variance) will be called ‘Calmness’, as it describes a sedate and pleasant sound with positive valence. Factor 2 (.28 of variance) will be called ‘Interest’, as the [un]interesting aspect of evaluation dominates.

| TABLE 1. Response Scale Weightings (Oblique Solution) for Calmness and Interest |
|-----------------|-----------------|-----------------|
| Response Scale  | Factor1: Calmness | Factor2: Interest |
| [Dis]like       | .58             | .84             |
| [Un]interesting | 0               | .99             |
| [Un]pleasant    | .89             | .49             |
| Arousal         | -.96            | .15             |
| Valence         | .93             | .38             |
The factors prove to be useful in separating individual artists' works. In Figure 1, where the two factors are plotted against each other, the stimuli of each artist tend to group together.

![Figure 1. Factor 1 (Calmness) versus Factor 2 (Interest), Separating Individual Artists’ Works.](image)

Calmness negatively correlated to loudness ($r = -0.74, P < 0.001$), sharpness ($r = -0.56, P < 0.001$) and roughness ($r = -0.49, P < 0.001$). Interest correlated to variation in frequency centroid ($r = 0.49, P < 0.001$) and sharpness ($r = 0.39, P = 0.004$).

DISCUSSION

This study confirms that a minimalist art-form dominated by drone-like sounds, that were generated with little direct involvement by the artist, provokes a range of aesthetic responses. Within this relatively homogenous art-form, there are differences between works both in subjective responses and objectively measurable properties. Previous research has found a similar range of responses to a different set of relatively steady-state sounds (5).

In studies of emotion per se, arousal and valence are usually uncorrelated (1). Their strong negative correlation here suggests variation in emotion evoked by these works may occur mainly in one dimension, spanning the range between distress and calm.

The strong correlation between the unpleasant scale and the emotion scales suggests that a model of sensory pleasantness, such as that given by Zwicker and Fastl, would be a good predictor of emotion evoked in this context (4). The correlations with loudness, sharpness and roughness reinforce this point.

The fact that tonal pitch and pitch salience contributed little to the analysis is, to an extent, counter-intuitive. It might be that if these and other measurement techniques were refined the results would show a larger contribution from currently uncorrelated measures. Additional measures, such as those related to musical harmony and artificiality, may also enhance the analysis.

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REFERENCES