A Study of Sound Objects and Structures

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Abstract

This paper describes a pedagogical method to engage students in the study of sound objects using an acousmatic, phenomenological approach. The interdisciplinary course is taught at the undergraduate level in the school of Arts, Technology, and Emerging Communication at the University of Texas at Dallas. The primary goal of the course is to teach students to become experts of their own listening. Schaeffer's Solfège des Objets Musicaux (1966) shaped the design of this phenomenological approach to teaching auditory perception while the framework of Temporal Semiotic Units (TSUs) supported the approach to musical structures. The paper first describes the theoretical foundation for the study method, then describes students' progression through the phases of the learning experience, and concludes with an invitation for more research about leading students towards greater understanding of the cognitive processes engaged by auditory perception.

Keywords

auditory perception, education, phenomenology, sound object, sound studies, temporal object, sound object

An Acousmatic, Phenomenological Approach to Teaching the Study of Sound Objects

This paper describes a lesson designed by the researcher in the "Introduction to Sound Design" course taught in the Bachelor of Arts program in the school of Arts, Technology, and Emerging Communication at the University of Texas at Dallas. The class is a prerequisite for all undergraduate courses in sound design. Within the contemporary digital environment the production of audiovisual content is organized by technologies through a continuous chain of virtual processes. However, a displacement of focus occurs during these processes that results in a greater importance given to each separate process as opposed to the phenomenon of their production. The lesson described here was an attempt by the instructor to separate the object from the production process in order to teach students to understand the cognitive processes engaged by auditory perception.

The nature of digital sound objects is characterized by their immateriality and plasticity, and this makes it difficult to identify, seize, and maintain a consistent relationship with them. In digital production, a sound effect does not exist consistently and stably from one phase to another of the production flow or from one technological environment to another. Rather, it changes appearance as it is carried over different workstations and represented through different interfaces. Therefore, depending upon the computational

settings, sound objects are open to an infinite variety of transformations and actualizations that become unexamined by the sound designer. While the technological environment is generally thought to foster creativity and to allow for more fluid production processing, it presents a risk, especially in an educational context, of diverting attention and intention from the sound itself to the profit of the technological processes. The pedagogical challenge is to refocus students' singular attention to sound objects. Engaging students in a meaningful relationship with sound can lead to their deeper understanding of its expressive potential. This paper discusses a phenomenological teaching approach for the study of sound objects that focuses upon acousmatic contexts and use of a descriptive vocabulary provided in Schaeffer's morphology of sound glossary. It emphasizes a means to synthesize the various aspects of interactivity with sound into a consistent experience. While phenomenology and the theoretical framework derived from Pierre Schaeffer's (1966) study of the sound object are frequently used in educational programs in music or other sound studies, their use in instruction for technological and industrial applications of audiovisual products is rare. Sound and images are also considered to be technological effects; that is, they are caused and generated by technological devices i.e. screen, computer, loud speaker, headset that are constantly present and identify their origin. The pedagogical practice described here assumes and takes advantage of this "schizophonic" setting to focus on the reception of auditory phenomena without questioning their natural and technological origins.

In order to discuss this practice, a preliminary distinction must be made between the studies of sound conducted in different disciplinary fields such as acoustics, psychoacoustics, engineering, and music. Seemingly a mere rhetorical distinction, it is premised upon Schaeffer's central idea in "Traité des Objets Musicaux" that a sound object is neither the realistic object of acoustical studies nor the ideal object of musical studies[1]. Rather, a sound object is intentional and emerges at the intersection of the external acoustic manifestation of sound and the intention of the listener pointed toward this manifestation. Kane Bryan wrote,

> "This object of intentionality is not the same as the physically material object, which, from a scientific perspective, causes my perceptions. Being the correlate of an act of synthesis on my part, the intentional object is no longer bound to any particular spatio-temporal adumbration. It is independent of any factual context—it has become an essence[2]".

Study Design

A core trait of phenomenology as a research methodology is the inclusion of participants' experience in the research. Unlike other study methods in which subjects remain uninformed of the researcher's goals, the phenomenological method requires consent, knowledge of the goals and methods of the study, and active participation in the formation of the knowledge produced by the research. Therefore, students were given terms and concepts to enable a new awareness of their relationship with active auditory perception. For instructional purposes, the sound object was presented to students as the synthesis of processes and revealed to them gradually as the lesson unfolded. Throughout the semester, students engaged in active discovery of their own listening experience as they were encouraged to examine sound objects from a clearly

asserted subjective perspective. The researcher framed the students' experience through the listening process by adopting the use of Schaeffer's typo-morphology of the sound object to enable them to describe their experience of the sound object uniformly and to later observe intersubjective verification with research by sound designers and music composers.

As a philosophical discipline and as a research methodology, phenomenology also allows "one to delineate carefully one's own affective, emotional, and imaginative life, not in a set of static objective studies such as one finds in psychology, but understood in the manner in which it is meaningfully lived"[3]. Focusing on perception and on the modes of appearance of the world to consciousness, a phenomenological approach to sound offers the possibility to synthesize, individually and collectively, the multiple experiences of sound into one singular object, which we define as a sound object. With a goal to train future sound designers who will be responsible for creating and organizing sounds and sound sequences with a specific intention and purpose, this theoretical approach offers the greatest potential to increase students' awareness of the potential of sound objects within the production process.

In the study of sound, music, and perception, phenomenological research approaches have a very rich tradition. One of the most prominent researchers in the study of sound and music has established his framework within phenomenology: Pierre Schaeffer, the inventor of *musique concrete*. Seminal studies conducted by this pioneer are focused and centered upon the idea that listening is the act of perception constitutive of the sound object. Of value to educators of sound design, the researchers ground their work in a radical re-conditioning of the act of listening, specifically *acousmatic practice*, which render production and observation of the sound object more meaningful. The course lesson was therefore shaped by the practice of *acousmatic* listening developed by Schaeffer, and was the preliminary step leading to a general understanding of sound objects and sonic structures for student sound designers. Specifically, the acousmatic situation is centered upon the act of listening, which is identified as the origin of the phenomenon to be studied. It therefore shifts the investigation of sound objects from questioning subjectivity or subjective listening to an examination of the acts of a subject's consciousness. In the *acousmatic* situation, "…the subject is asked to describe his own perception itself, instead of the external references to the perceived sound"[4].

Acousmatic theory refers to the Pythagorean experience in which disciples would listen to Pythagoras hidden behind a veil in order to discern meaning absent of other modes of perception. In its contemporary version the experience is supported by audio recording and reproduction technologies, which allow for the separation of a sound from its source. For Schaeffer, this practice allows for the bracketing of causal listening, whose primary intention is to identify the sound as the effect of a physical and visible cause and leads to the phenomenon of acousmatic listening. In order for a sound designer to achieve the synthesis of experience and understanding of perception, it is necessary to perform a radical transformation of the notion and practice of listening. For most students listening is not an activity, it is merely a passive reception by which a meaning or message is given by auditory means, while the real activity is taking place afterwards and consists of reflecting upon some of the aspects of the sound that have been memorized and can thus be described. This preconceived notion that listening is an *a-*

posteriori abstract and conceptual activity has to be put aside, or bracketed, as Husserl explains, to thoughtfully examine perception and induce valid descriptions of the content of perception. The shift required to perform such bracketing is temporal, and it aims to situate participants and their experience within the present. For this reason, in the first experiments conducted in the class, students were not asked to listen to a sound, and *then*, describe it, but rather were invited to draw along the duration of the sound something that would represent it. These initial experiments established the context for their listening for the remainder of the class. The first experiments also framed the initial phase of phenomenological research by offering an examination of the *nowness* of auditory perception and raw sound objects among students.
Moustakas and Clark describing phenomenological epoché, *or the moment of suspended judgment,* assert the difficulty of establishing and maintaining this type of observation for both designers and researchers[5]. The epoché frames this study of the sound object in practice, employing a looping sequence of these four phenomenological phases: Epoché, Reduction, Eidetic variation, and Intersubjective verification

Epoché allowed the student to experience the immediacy of the sound object, its real existence as a temporal object, and to anchor the experience of sound objects in the present. Furthermore, *epoché* was not just the primary practice of students, but also the context required for observation of student experiences to be maintained and redefined for the purpose of the study. Through the emergence of the temporal dimension in epoché, the raw sound object was revealed and made available for a closer examination by students. Reduction could then be applied to the raw sound object in order to capture its perceptual dimensions and the primary traits of its identity.

Lesson Design

Phase 1: Epoché
During the first phase of the lesson, students were asked to respond to questions about the permanence of the sound object:

What allows me, along the perception of the sound object, to maintain a unique and identical intentionality? What of the immediate past and/or the near future constitutes a persistently coherent context with what is perceived?

In terms of phenomenology, this phase addressed the primary retention and protention associated with the perception of a temporal object as a unique form. Husserl defines perception, retention and protention as the three components of the identity of the sound phenomenon[6]. These components comprise a single mental process running in both directions, from the present to the past, and from the present to the future. This intentional process maintains a consistent impression of the temporal object throughout the continuum of its changes. The impression of what is just passed, retention, and the anticipation of what is about to happen, protention, are continuously informed by the flow of changes and maintained as a unique object of intentionality. Pedagogically, the use of primary retention permitted students to point to different dimensions of the sound object, and towards which their attention should focus when listening for identification.

Phase 2: Reduction

In the second phase, students experienced sessions of reduced listening framed by each of the four dimensions identified by Schaeffer in the Typomorphology section of his work in *Traité des Objets Musicaux,* which include material, sustainment (or energetic articulation), form, and variation. The dimension of material contains the manifestations of the spectral qualities of a sound object i.e. mass and harmonic timbre. As students learned, the sustainment, or energetic articulation, dimension pertains to the variations of energetic texture of the sound throughout its existence. The form dimension characterizes the envelope of the sound throughout its evolution and contains the criteria of dynamic profile and attack. Finally, the variation dimension relates to the consistent modes of variation of the mass or height of the sound. This part of the lesson was intended to produce different intentional sound objects from the same auditory material. In these sessions, each sound was presented four times, one for each dimension. This phase was inspired by Schaeffer's description of reduced listening where the various dimensions of the sound object are used to differentiate between several sources in a complex auditory environment, instead of their assumed origins[7]. For example, in a recording of a typical urban soundscape, human voices were differentiated from the traffic noises on the basis of their mass and harmonic profile in the dimension of material, and of their gait in the dimension of energetic articulation.

In this portion of the lesson, we began to share and compare the results of our analyses. We waited in order that we might initiate a collaborative process over the production of converging impressions without individual views tainting consensual production. What was gained at the end of this phase was a set of intentional "lenses" allowing us to grasp the sound object's behaviours in the four dimensions of its existence. These behaviours, or qualities that are entirely inherent to the sound object and attached to it, allow for the differentiation of the sound object, but not yet for their description. It is only when these qualities can be connected with perceptual invariants that the sound object can be described as a structure of these qualities.

Phase 3: Eidetic Variation

The point of studying eidetic variation marked a return to the object itself with the goal to contribute to the emergence of structured descriptions of the experience. The overarching question for this inquiry was framed by a question about how primary retentions, or morphological qualities of the sound object, organize the constitution of its identity. The experiments performed during this phase were essentially detailed descriptions of each of the qualities exhibited by various sound objects in the four dimensions of their existence. The analyses were performed individually and their results were shared, discussed, and combined to form convergent qualitative descriptions of the sound objects. This phase allowed for the emergence of a precise vocabulary pointing to the acoustical qualities of the sounds and employed the numerical scale proposed by Schaeffer, as described below.

The dimension of material, the mass of the sound, or its way of occupying the field of frequencies, is examined using a numerical scale ranging from 1 to 7 with the following description:

1. sine wave
2. single pitched musical sound
3. chords and groups of pitched musical sounds
4. bells, metal plates, gong
5. group of distinct (or distinguishable) coloured white noise
6. coloured white noise
7. white noise

This quality was coupled in students' analyses with the melodic profile and the profile of mass displayed in the dimension of variation. The melodic profile relates to the perception of movement of the sound in the field of pitch. This movement can be continuous, *glissando*, or discontinuous, scale based; it can be of small or great amplitude; fast or slow; cyclical, unidirectional or bi-directional. The three types of melodic profile are fluctuation, evolution and modulation.

Observation of the profile of mass relates to the perception of inner movement in the qualities of mass and harmonic timbre without necessarily any change in pitch. This coupling reveals that the consistency of sound objects, or the capacity to seize them as unified forms, was in part supported by the articulation of these qualities:

• sounds with a heavy mass (4-7) appear as consistent forms if their profile of mass is primarily continuous and slow • sounds with a lighter mass (1-3) maintain consistency even with discontinuous and fast movements

While it is not the goal of this paper to present in detail the type of descriptions performed for each of the seven morphological qualities of sounds, it is worth noticing that the vocabulary used for the description of harmonic timbre converged in the semantic region of visual perception, while the vocabulary used for the grain converged in the semantic region of tactile perception, revealing the limitations of the phenomenological method. By the end of this phase, the students had gained sufficient control of reduced listening to be able to associate the impression produced by a sound to its acoustical qualities by producing detailed and structured descriptions of its behaviours in the four dimensions.

Phase 4: Intersubjective variation

A phase of intersubjective verification closed the students' study of sound objects. It consisted of an experiment based on a selection of 30 sounds, with one sound randomly assigned to each participant who would be responsible for producing its description. The descriptions were then collected and shared within the entire group in which students were challenged to pair each description to a sound it was intended to represent. The process was highly interactive, involving multiple acts of auditory scrutiny of each sound, and a return to epoché as a means to reframe the attention. One of the primary objectives of this phase was to make the participants aware of their listening capabilities and to lead them to the understanding that the actual existence of the sound object is entirely dependent upon their intention. The correlated objective was to give the students a consistent vocabulary to describe and analyse sound objects, and to help them engage in a rigorous practice of listening.

The use of a phenomenological approach allowed us to create an educational process in which the necessary theoretical components of acoustics and psycho-acoustics were not pre-defined and given but instead arose from students' consistent practice and became anchored in their consciousness.

The use of Temporal Semiotic Units (TSUs) in moving from Sound Objects to sonic structures:

At this stage of the study, students were confident with their capacity to identify, describe, and discuss qualities of isolated sound objects. They were able to use this expertise to differentiate and characterize sound objects on the basis of their morphological properties. During the next stage of the study, we focused on extending this expertise to the exploration of what we called *forms of forms*, or meaningful organizations of sound objects with the goal to understand not only the role of morphological properties in the formation of meanings and in the structuring of the listening experience, but also the active role of directed intentionality in this process. The system of Temporal Semiotic Units (TSUs) was particularly well suited for this extension of the scope of our study precisely because the researchers and composers of the laboratory *Musique et Informatique de Marseille* (MIM) had designed this system with such a goal in mind.

Temporal Semiotic Units (TSUs) form a system of musical analysis based on the identification of temporal meaning associated to musical segments. This system has been developed by researchers and composers of the laboratory *Musique et Informatique de Marseille* (MIM) in order to address the meaning of musical segments and their role in musical structures. Unlike the sound objects strictly defined according to their morphological properties within the framework of reduced listening, TSUs are defined according to the kinetic interpretation of their temporal behaviours: "TSUs are sound forms which convey meaning through their dynamic pattern over time"[8]. They consist in a system of description of musical content, by which the stream is experienced as a succession of units, each of them associated with a sensation of movement. At the moment, this system comprises 19 units each of them referring to a specific sense of movement such as, *Waves, Falling, Moving Forward, Spinning, Stretching…*

The series of experiments conducted in class with the TSUs aimed at developing the students' understanding of musical and sonic structures and the relationships between objects and structures. The methodology guiding these experiments is phenomenological as it seeks the emergence of values and meanings from the critical exploration of individual listening experiences. Similarly with the first experiments with the sound object, students placed their listening activities within the frame of *suspended judgment* and reduced their intentionality to the identification to of the unity of the temporal auditory object. They had acquired experience and confidence in this practice applied to individual sounds. They had integrated it as the premise of a renewed interaction with auditory objects in which these objects are revealed as new forms and a consequence of this interaction. The difficulty presented here is the temporal span of this interaction that has to be extended over the duration of an entire piece of music.

To overcome the challenge presented by temporal span and to teach participants to maintain attention and consistency of intentionality over longer duration, the first experiment used Anton Webern's *Three Short Pieces: Opus11* and progressively extended the duration of the practice of epoché to several minutes. From this practice, students were able to reveal a piece of music as a *form of forms*, flowing in synchrony with their consciousness. One of the emerging experiential structures resulting from this phase was a transformation of the mental representation of the continuity of music from a succession of distinct events connected by external principles to a unified experience of episodes hierarchically organized and nested within one another. Within this unitary flow of the piece of music emerging from the primary intentional act of perception, subordinate events can be differentiated on the basis of their functional contribution to the sustainability of unity.

The unified experience of episodes hierarchically organized and nested within one another identified in this process is in many points similar to the ecological flow of events opposed by James Gibson to the conceptual time conceived as a series of successive events[9]. Within this framework, and within the phenomenological perspective a form of forms, is perceived as a whole even before the perception of the entirety of its structural components. The sense of the form is not delivered retroactively, after the perception reaches the last structural component. Instead, it emerges continuously and supports the differentiation and identification of all the structural components, events, episodes or forms.
Once the episodes had been identified from this hierarchical perspective, the group engaged in a collective process to describe concurrently the acoustic qualities of the episode and the characteristics of the perceived movement. This experiment produced a set of morphological and semantic descriptions addressing such questions as:

- In what dimension of the sound is the movement happening?
- Onto what quality of the sound is the sensation of a particular movement applied?
- Is the movement of progressive extinction perceived through manifestations in different domains such as mass, gait, or dynamic profile?

This aspect of the study was crucial as it allowed bringing back the previously established qualities of the sound object and connecting them to structural functionalities. The intentional act of listening initially applied to short sound objects was thus extended to music, allowing students to understand their role in the elaboration of music structures and in the emergence of musical meaning. At this stage, students were engaged in a meaningful interaction with music that is best described by Eric Clarke as the "awareness of meaning arising while listening to music"[10]. Final steps in the lesson focused upon intersubjective verification and led to two summary experiments.

In the first summary experiment, students worked on the convergence of their descriptions with the descriptions of the 19 TSUs. These convergent descriptions are available in the appendix.

Afterward, they listened to the set of typical audio examples of TSUs produced by the laboratory Musique et Informatique de Marseille (MIM) and had to match these examples with the descriptions. For each category of TSU (19), four musical examples were provided. With the exceptions of some ambiguous cases, students were successfully able to group the four examples corresponding to a category of TSU and to match this group with its description.

In the second summary experiment students analysed a musical sequence using TSUs, supported by the documents, examples, and descriptions they had collectively established. This experiment was collective, and its outcome was compared to the analyses of the same piece produced by researchers from the MIM. While there were some divergences in the identification and naming of some episodes, the segmentation was identical across participants. This part of the lesson had two positive outcomes: validation for the students who found their analysis equivalent to those produced by composers and music specialists, and for the creators of the TSUs system who gained evidence revealing a measure of universality.

The use of a phenomenological method in pedagogical design was inspired by two main motivations:

1. The high level of technological skills required today in the professional practice of audiovisual technologies has diverted the attention from what should be at the centre of any creative activity in this field: our relationships with sounds and music.

2. The constant search for efficiency in education tends to focus on fast delivery of technical skills, leaving little or no time for educational processes dedicated to fostering awareness that individuals are in control of their creative and communicational capacities.

This lesson in the study of sound objects successfully contributed to the realization by students of their active role in the perception and understanding of auditory contents.

The subjective approach to listening used in this study opened paths for comparison, appropriations, translations and consistent descriptions. Students were able to see that they could become experts of their own listening. From this perspective, they gained the ability to integrate subjective variations of interpretations in their own design of auditory products. Perhaps more importantly, they became active contributors in their own educational process and contributed to greater understanding of this experience for teacher/researchers. It is expected that this description of a phenomenological, acousmatic approach to teaching sound design could inspire others to engage in teaching the various techniques used to generate digital objects such as images, virtual environments, or games with the goal to progressively develop a consistent educational framework for these disciplines supported by an ecological and phenomenological approach to the perception and understanding of these digital objects.

Appendix

19 Temporal Semiotic Units (TSUs) – with semantic and morphologic descriptions

1. ***Falling:*** suspension at a zenith with a rapid downward movement of pitch.
Semantic Description: abruptly interrupted unstable balance. Suspension then swing. The acknowledgment of the suspension is delayed.
Morphologic Description: Limited in time.
Phase 1: uniform with an internal movement of suspension
Phase 2: acceleration and evolution in pitch.

2. ***Expansion:*** a push or pull outward creating a wider sound space.
Semantic Description: Conveys the feeling of moving towards the maximum of a process. Feeling of expectation. Two contradictory forces creating the feeling of an increasing tension.
Morphologic Description: Limited in time.
Phase 1: constant increase of one of the parameters of the matter of the cell.

3. ***Slowing:*** deceleration of movement in any given direction.
Semantic Description: feeling of a movement's forward progressively (but rapidly) pulled to a stop.
Morphologic Description: Limited in time.
Phase 1: two opposite profiles (successive or simultaneous). Something going forward and something pulling back.

4. ***Waves:*** undulating movement of crests and troughs in a cyclical pattern.
Semantic Description: each cycle conveys the feeling of being pushed forward with a decreasing energy. The general feeling is that of steadiness.
Morphologic Description: Unlimited in time. Repetition of a delta pattern increase/decrease of energy. The delta pattern can apply to various parameters (pitch, intensity, mass…). Slow to moderate tempo.

5. ***Inertial:*** scattered sounds attempting to initiate full motion.
Semantic Description: sounds like something trying to begin a motion.
Morphologic Description: Unlimited in time.
Phase 1: a short articulated form.
Phase 2: an opposition to Phase 1; can be a suspension, a silence, or a holdback.

6. ***Endless:*** a constantly extending trajectory that never ceases.
Semantic Description: trajectory conveying the feeling that it could extend forever.
Morphologic Description: Unlimited in time.
Phase: a trajectory performed by one or several parameters of sound is heard (pitch, intensity, mass) with the feeling of an energy constantly renewed.

7. ***Chaotic:*** constant, confusing motion and excessive sounds.
Semantic Description: General feeling of confusion; ensemble with a high internal mobility but without a general direction.

Morphologic Description: Unlimited in time; high density of multiple events, contradictory and possibly simultaneous.

8. ***Compressive Expansion Explosion:*** uneven compression of sound followed by a uniform crescendo.
Semantic Description: Feeling of compression at first then release of the energy, going from local energy to diffused energy.
Morphologic Description: Limited in time.
Phase 1: discontinuous and uneven matter.
Phase 2: uniform with a crescendo.

9: ***Floating:*** light and airy movement with no apparent pattern.
Semantic Description: Temporal continuum with no feeling of expectation
Morphologic Description: Unlimited in time. Slow tempo. Discrete sonic events displayed with no perceivable structure on a smooth continuum.

10: ***Heaviness:*** slow, accented movement in opposition to faster motion.
Semantic Description: conveys the feeling of a difficulty to go forward.
Morphologic Description: Unlimited in time. Repeated cell of a non-strictly identical pattern. The repetition has a controlled dissymmetry. There is an accent or a crescendo at the beginning of each repetition of the cell. Each accent renews the kinetic energy of the motion. The tempo is slow to moderate.

11. ***Propulsion:*** sound that pushes or pulls forward.
Semantic Description: feeling of being regularly pulled forward.
Morphologic Description: Unlimited in time.
Phase: unit with a constantly renewed energy and a direction. Constituted of one phase repeated with no interruption and containing an accent.

12: ***Conclusive:*** predictable end to the energy of sound.
Semantic Description: entirely predictable natural end of a movement.
Morphologic Description: Limited in time.
Phase: progressive and regular decrease of the energy.

13: ***Hesitative:*** interruption in movement.
Semantic Description: interrupted movement.
Morphologic Description: Limited in time.
Phase 1: short, varied and repeated cell evolving in one direction.
Phase 2: contrasting with the first phase, decrescendo or silence.

14: ***Entropic:*** opposite of chaotic; divergence of information that implies motion, but with immobility.
Semantic Description: feeling of a general immobility conveyed by successive contradictory directions.
Morphologic Description: Unlimited in time and made of short moments reflecting contradictory organizational systems. The contradictory directions are successive and not simultaneous. The general energy remains potential (not used in one movement).

15: ***Accumulative:*** swelling and storage of energy prior to impulse of motion.
Semantic Description: the gathering of the energy prior to the motion.
Morphologic Description: Limited in time.
Phase 1: the gathering. Concentration.
Phase 2: the very first instant of the movement. One direction.

16: ***Suspended:*** hanging in expectation of an unknown but impending movement.
Semantic Description: Feeling of hesitating, awaiting. Expectation of something to happen without knowing what or when.
Morphologic Description: Unlimited in time. Repetition of a cell on a slow tempo with no variation and very little evolution.

17: ***Obsessive:*** persistent repetition that continues the energy of motion.
Semantic Description: Persistent, autonomous repetition. Each repetition renews the energy.
Morphologic Description: Unlimited in time. One phase in each repetition. Unit with a direction (orientation) containing one cell (phase) repeated in a pulsated time.

18: ***Spinning:*** constant, animated turning.
Semantic Description: conveys the feeling of an animated, spinning or turning object.
Morphologic Description: Unlimited in time. Continuous repetition of a cell with a general "delta" pattern i.e. a crescendo-decrescendo with an accent at the apex of the crescendo. This pattern can be asymmetrical (the crescendo can be shorter than the decrescendo).

19: ***Stationary:*** constant, but directionless and purposeless.
Semantic Description: feeling of continuity. No expectation. Something is happening but goes nowhere.
Morphologic Description: Unlimited in time. Slow tempo. Regularity and permanence.

Footnotes

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Bio

Frank Dufour is a professor in the school of Arts, Technology, and Emerging communication at the University of Texas at Dallas where he teaches sound design and aesthetics of interactive arts. His research is primarily dedicated to the perception of sound and music from a phenomenological perspective. Frank Dufour is a member of the laboratory Musique et Informatique de Marseille (MIM) in which he works on the use of the system of the Temporal Semiotic Units to develop visualizations of music. As an artist, he works with the independent art laboratory, Agence5970 on interactive audiovisual installations.
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