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Teaching a 'Humanistic' Science: Reflections on Interdisciplinary Course Design at the Post-Secondary Level

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Development of post-secondary curriculum in emerging interdisciplinary fields presents particular challenges in course design and resource utilization, especially when the field is interdisciplinary by nature of its inherent breadth. A new course at the University of Calgary, designed to introduce undergraduate students to the methods and philosophy of Acoustic Ecology --- the study of sound and its effects on health, cognition and culture -- exemplifies both the challenges and some practical solutions. Following a brief history of the concept and its philosophy, a summary and critique is presented from the first offering of the course as a pilot project. Conclusions drawn include the necessity of an integrative approach to interdisciplinary fields of study that are true 'interdisciplines', the utility of experiential fieldwork, and the advantages presented by a student group with diverse academic backgrounds.

Introduction: Mapping the Territory

The development of new post-secondary courses in established disciplines allows the course designer to follow a path – one that may have many branches and options, but a path previously taken by other course designers and instructors with some success. The development of new courses in interdisciplinary contexts, and in new disciplines, requires a somewhat different process of exploration, largely without maps. Literature searches may turn up few truly relevant results. Precedents may be incompletely applicable to the situation at hand. Unexpected attendance -- or lack of it – at the first class may suddenly turn a lecture course into a seminar, or vice versa. The course designer and/or instructor's task is to turn uncertainty into an advantage. This requires 1) flexibility in planning; and 2) a pedagogic focus on conveying to students *how* and*why* the integrated field of study (or 'interdiscipline'; Klein 1990) answers questions that cannot be answered by its predecessors or its component disciplines. The latter task is crucial, since it demonstrates the necessity of integrative thinking to the understanding of emerging fields of study that do not segregate the traditional categories of Sciences, Social Sciences and Humanities. It is my purpose here to describe one such exploration and to show its significance to the philosophy and pedagogy of interdisciplinarity, in the hope that it may serve as an example to curriculum designers and other administrative decision makers of the advantages of interdisciplinary approaches. The implications of such approaches for administrative structures will be discussed in the concluding section.

In order to clarify the significance of interdisciplinarity to the discussion presented here, it is useful to distinguish among the terms *multidisciplinarity*, *transdisciplinarity,* and *interdisciplinarity*. According to theorist Julie Thompson Klein, the distinction is crucial. She describes multidisciplinarity as "a juxtaposition of disciplines"(Klein 1990, p.56), such as the teaching of social history with history of the arts. Multidisciplinary frameworks may in time give rise to interdisciplinary ones, or to new disciplines (e.g. Performance Studies, Gender Studies). Transdisciplinarity is defined as describing "conceptual frameworks that transcend the narrow scope of disciplinary world views...signif[ying] the interconnectedness of all aspects of reality" (*ibid.*, p.66), e.g. rhetoric, phenomenology, and sociobiology. Interdisciplinarity, however, is not associated with a

specific category of subject matter or method. In fact, Klein suggests that its definition tends to flex with the uses to which it is put in the service of scholarship and pedagogy. It is rather a process of integrating methods and information, which may be, derived from particular disciplines into a unified approach that is not limited by any particular canon. From this concept comes Klein's use of her coined term 'interdiscipline', which is particularly useful to the emerging category of fields which begin as interdisciplinary networks rather than growing from a multidisciplinary base. For purposes of discussion here, I propose to limit its use to the description of fields of study that are fully integrated; that cannot be broken into component disciplines without distortion. Examples of such interdiscipline are Urban Planning (integration of history, architecture, art, geography, demographics, design, engineering), Choreography (physiology, kinesiology, history, literature, music, aesthetics), and Environmental Studies (geography, biology, geology, anthropology, chemistry, resource management).

The designation of 'interdiscipline' also applies to an emerging branch of Environmental Studies, a field called Acoustic Ecology, which integrates acoustics, cognitive psychology, aesthetics, geography, sociology and music. Acoustic Ecology may be called a "humanistic science" --- its roots lie at the intersection of music composition and the science of acoustics with social movements toward environmental awareness. It encompasses the study of sound in human and natural environments (including noise, music, speech, animal communications, and silence) as it interacts with issues of cognition, community, culture, and health. As a field which transcends traditional categories of study, including the division between Fine Arts and Sciences, it represents an evolving interdiscipline which is relatively new to academic scrutiny and to inclusion in curricula. For this reason, it provides a useful example of the challenges involved in developing interdisciplinary courses based on integrated subject matter rather than a combinative multidisciplinary perspective

Precedents in Pedagogy

The literature of interdisciplinary education in its general sense of including more than one discipline is extensive and inclusive, but often of limited relevance to the teaching of fully integrated subject matter at the post-secondary undergraduate level. The majority of it refers to multidisciplinary collaborations at the secondary level; e.g. using art, literature, and/or geography to teach history. Most studies, too numerous to cite here, focus on the successes and failures of specific programs. Accounts of secondary and undergraduate pedagogy may present interdisciplinarity as an administratively imposed task that requires team teaching (Meister and Nolan 2001, Frank and Schülert 1992, Bartell 1979). The notion of interdisciplinarity as a concept inherent to some fields of study is rarely given emphasis. Even fields of study that began in the 1960s and '70s as interdisciplines, e.g. Communications and Women's Studies, developed in the 1990s to include discipline-specific canons of literature and methodology. Thus, the question of 'what is an interdisciplinary subject?' imposes itself on the process of course design.

Literature on interdisciplinary pedagogy at the level of university undergraduate programs is focused on three principal areas: definition, defense, and evolution. A distinction between multidisciplinary and interdisciplinary approaches is drawn by Squires (1992), who cites "integrative degrees" such as medical sociology as examples of fully realized interdisciplinarity motivated by new categories of employment. Hagoel and Kalekin-Fishman (2002), working from within the perspective of medical sociology, trace the expansion of disciplinary concepts in the sciences, citing Environmental Studies and Medicine as fields in which interdisciplinary conceptualization and collaboration are crucial, but sometimes resisted both by discipline-oriented scholars and by students. Lombardo (1992) discusses problems of definition inherent in the founding of new disciplines, since traditional disciplines may change with time to encompass aspects of others. As an example, she traces the development of Cultural Studies as a socio-political response to the limitations of traditional English departments and suggests that such developments may be facilitated by a focus on problem solving and teamwork. The defense of interdisciplinarity as equal in value to the method-centered approach of traditional disciplines is a recurring theme, apparently because such defenses are considered necessary to overcome administrative barriers in educational institutions. Interdisciplinarity may be regarded as "counter-factual", although this does not necessarily inhibit cooperation (Weingart and Stehr 2000, p.111). Newell (1992) argues that undergraduate education in a specific discipline need not precede interdisciplinary approaches, since "the wholistic perspective of interdisciplinarity allows disciplinary literature to be read as representative of a perspective, rather than definitive in itself."

The integration of knowledge and methods from widely differing disciplines into a seamless unity requires respect, imagination and lateral thinking. For disciplines based in the methods of science, the task of integration with non-scientific fields is particularly problematic, since it may involve accepting the validity of alternative methods of proof. In a defense of multi-disciplinary and integrative approaches from a scientist's point of view, Stephen J. Kline presents a series of hypotheses based in Systems Theory. The second of these is:

> "*Honor All Credible Data*. In multidisciplinary work, we need to honor all credible data from wherever they arise. (This includes not only data from various disciplines and from our laboratories, but also from the world itself, since we have no labs from which we can

> obtain data for many important purposes.)" (Kline 1995, p.6)

Newell's view (*op.cit*.), as well, is directly applicable to the integration of scientific with non-scientific methods in education. Students of art history, for example, need not learn the mathematical principles of engineering in order to understand why the ceiling of a Gothic cathedral is vaulted -- the builders of the time did not have access to algebraic formulas, either. They do need to know that forces are exerted on load-bearing walls, and that the success of a given design depends on an understanding, whether mathematical or experiential, of those forces. Thus, an appreciation of disciplinary canons sufficient to motivate the interdisciplinary scholar or student to ask for assistance from a specialist is appropriate, while full facility with the specialist's discipline is not usually required. The designer of an interdisciplinary course would be well advised to request specialist colleagues to review drafts of the course proposal and syllabus.

Acoustic Ecology as Interdisciplinary Pedagogy

The literature of post-secondary education in Environmental Studies, itself a developing interdiscipline, gives particular emphasis to the necessity for interdisciplinary and transdisciplinary approaches (Pawson and Dovers 2003; Belsky 2002; Hamelin 1995) and to the advisability of presenting environmental topics within the framework of social and ethical perspectives drawn from the Humanities (Foster 1999). So does Acoustic Ecology, the study of sound (including music, noise, and silence) and its effects on health, cognition and culture. Like all ecological studies, it shares the characteristics of a science (physical properties and measurement of sound), a social science (human perception and social attitudes toward sound) and a branch of the humanities (aesthetics of sound, definitions and vocabularies used to describe sound). Still in its infancy as an academic research field, Acoustic Ecology is at this time practiced primarily by musicians, composers, music educators, broadcasters, and recording technicians. Their observations combine art and science, a constant reminder not to concretize this rich field of inquiry into static methodologies.[1] The philosophy and methods of Acoustic Ecology are still in their developmental stages, as recent writers acknowledge (Dietze 2000, Karlsson 2002, Truax 2001). As such, the field affords opportunities for the development of interdisciplinary pedagogy from the standpoint of basic structural decisions: What are the operative categories of knowledge? How are they defined? How can principles and methods derived from different disciplines be combined? How do combinative and integrative approaches differ, and what are the effects of each on student comprehension?

In 1999 I was presented with the opportunity to develop a new interdisciplinary course for the University of Calgary. Called "Introduction to Acoustic Ecology", it began as a block course[2] designed to present the basic concepts of the subject and some of its potential applications. My intention was to design a course that would give students a background in an emerging interdisciplinary field that combines scientific with humanistic modes of thought and learning, and consequently to expose university undergraduates to a form of study that would embody the nature of interdisciplinarity by merging several categories of learning. The first step was to ponder the scope of disciplinary connections. Physics (acoustics), Engineering (design), Architecture and Planning (indoor and urban soundscapes), Geography (natural soundscapes), Psychology and Neurology (audition), Musicology (connections between soundscapes and musical aesthetics; musico-linguistic connections, uses of music as a therapeutic mode), and Sociology (effects of taste and attitude on noise-induced stress) were all significant. Each discipline, however, bristled with specific methods that were impossible to impart to undergraduates in one week. The solution was to base the course on experiential exercises that would demonstrate the principles of the various component methodologies without requiring a thorough knowledge of any one of them. Experiential learning would provide a bridge between the factual domain of science, the interpretive domain of the social sciences and the imaginative domain of the humanities (*Figure 1*).

Thus, experiential exercises would have to be combined with references to theoretical and methodological approaches derived from disciplinary knowledge. They would include developing attention to auditory information (listening exercises), perceiving and describing soundscapes on the campus (sound mapping and sound journaling, which require attention to acoustics, auditory perception, design and geography), and producing sounds (improvisations, which require attention to acoustics and aesthetics).Figure 2 illustrates the connection of exercises with related categories of knowledge

Introducing Acoustic Ecology to Undergraduates

Acoustic Ecology is an emerging field of study that weaves together aspects of physics, health sciences, communication theory, education theory, psychology, biology, neurology, anthropology, sociology, musicology, and aesthetics. First defined by Canadian composer R. Murray Schafer, it is the study of sound (including noise, music, and silence) in natural and social environments, its effects on listeners (human and otherwise), and its history and evolution.

--Preface to University of Calgary course syllabus,' Introduction to Acoustic Ecology', 2000.

A brief history of the field is now necessary, as it provides the rationale for specific pedagogical decisions. Canadian composer and music educator R. Murray Schafer pioneered the development and dissemination of Acoustic Ecology, as well as coining its title. Working in the late 1960s and 1970s at Simon Fraser University, Schafer began the practice of sound mapping, a technique for describing the ambient noises in a given locale through graphic maps. His Vancouver Soundscape Project, a prototype for the

Figure 1: Categories of learning for "Humanities / Science" integration

Humanities	
Aesthetic	Responses, Alterations
Historical	Precedents, Evolution
Experiential/Descriptive	Experiences, Analyses
Factual	Properties, Measurements
Sciences	

Figure 2: Integration as demonstrated by Acoustic Ecology

Humanities	
Aesthetic	Improvisations, Alterations to ambience, Preferences
Historical	Prior ambiences, Development of concepts
Experiential/Descriptive	Listening exercises, Improvisations, Awareness of ambience, Sound walks and mapping, Sound journaling
Factual	Properties of sound, Properties of hearing, Parameters of measurement
Sciences	

concept of sound mapping, categorizes and quantifies sounds of all types in Vancouver neighborhoods[3]. Schafer's objective was to make the music community as well as the general population more aware of their auditory surroundings. Schafer's followers, particularly composer Barry Truax, continued his work at Simon Fraser and are now active in promoting the concept of Acoustic Ecology worldwide[4]. The idea of considering the world as a vast soundscape -- the auditory equivalent to a landscape, a crucial concept in Acoustic Ecology -- is now promoted by the World Forum for Acoustic Ecology (WFAE), with affiliate branches in Canada, the United States, Germany, Switzerland, France, the United Kingdom, Ireland, Japan, and Australia[5]. Founded in 1993, the WFAE began publishing a journal in 2000 and now keeps educational resource lists and articles on its website.

The course plan for the University of Calgary was not directly modeled on the Simon Fraser University courses of Schafer and Truax. The basis for this decision was the fact that I would be working with undergraduates who would not necessarily have any background in music or in communication theory, as the SFU students did. More significantly, the block course format would allow one week for all aspects of the course except the final fieldwork project, which was due only four weeks later. Providing the technical background for the component disciplines of Acoustic Ecology was not feasible under the time restraints. Thus, my principal objective with the course was to provide

a brief introduction to the ideas and *Weltanschauung* of the field, along with exercises that would give a taste of the practitioner's experience. In effect, the purpose of the block course was to be a pilot project, a justification for a more fully developed offering in the future.

In its first manifestation, the introductory course was offered to third and fourth-year undergraduate students through the Faculty of Communication and Culture in January 2000. The block course format was deemed appropriate for an experimental course that required spans of time for fieldwork. Of the 20 students enrolled, five were Music majors (set 1), two were from the Faculty of Science (set 2), eight from the program of Communications (set 3), and the remaining five, majors in Social Sciences and Management, signed on for a credit option with no initial preference for the topic (set 4, "unclassified").[6]

Because Acoustic Ecology is a relatively new field, literature suitable for a brief introductory undergraduate course was hard to come by. I assigned some excerpts from Schafer (1992) along with material on the WFAE website, and recommended books by Schafer (1994) and Attali (1985), but presented most material in the form of lectures, demonstrations, and auditory exercises. Students were told that because the course had a concentration on auditory concepts, they would be expected to listen rather than read as their primary mode of information intake--- reading supplemented lecture and discussion, rather than the reverse. Most had little difficulty in adapting, and those that did were encouraged to ask for help. Students were requested to report any hearing difficulties that might interfere with their ability to do the assigned exercises; none did.

The course content was structured around four central questions, each introducing a series of related concepts and techniques. In the first unit *'What is hearing?'* introduced lectures on the physics of sound and the physiology of hearing, along with a history of ambient noise derived from Schafer's speculations in *The Soundscape* (1994) as well as my own investigations. "Ear-cleaning exercises" from Schafer (1992), designed to enhance auditory attention, were also introduced in conjunction with my own audialization exercises (a sample is given in the Appendix, below).[7] The question *'How is sound described?'* led to considerations of vocabulary drawn from music and physics, and to the social-scientific concepts of sound as cultural unifier, boundary delineator, commodity, and communication system.

The third question, *'What are the ambient sounds of this campus?'* introduced instruction in sound-mapping techniques and observations of sound in outdoor and architectural spaces. In the afternoon of the second day I led students on a soundwalk through the University of Calgary campus so that they could practice sound-mapping techniques in preparation for their assigned fieldwork projects. The walk began inside a building composed of classrooms and faculty offices, then proceeded through a landscaped outdoor quadrangle, the Student Union building, an Engineering facility, and a Music Department practice room wing. At each location, the students took notes on their impressions and drew a sound map. These were shared in a discussion at the end of the day.

Finally, *'What is your unique experience of listening?'* led to experiential exercises in language as sound, the body as resonator, rhythm as measurement, and music as ambience. In the first set of exercises students experienced language as a series of sound patterns and visited the campus Linguistics laboratory for a tour of the "Sounds of the World's Languages" software.[8] Some 'body as resonator' exercises included listening to their own speech through stethoscopes and creating improvised percussion with handclaps, footsteps, knee slaps, finger snaps, tongue clicks, and abstract vocalizations. Improvisation with voices and "found instruments" (keys, beverage bottles, shoes, notebook covers, binders, pencils) was also practiced in a particularly resonant stairwell. The purpose of these exercises was to expand students' perceptions of how sound is created, as well as their awareness of how much ambient sound they usually "screen out" --- a recognition of what is physically heard but not attended to, and the ways in which such ignored sounds can influence their responses to speech, their mood and their ability to concentrate. The element of play, rarely made available to adult students, was an additional factor. A few students found it difficult to participate at first; all but two (both Management students from Group 4) joined in once the musicians showed obvious enthusiasm.

Commentary on course assignments

Assignments for the course included a Group Project (fieldwork paper and presentation), and Sound Journals. The group project was designed to encourage cooperative decision making about venue and methodology, while the Sound Journal, a diary of sounds heard in daily life, provided a focus on the act of listening consciously. Both were exercises in experiential learning, based on the premise that any study of an environmental science must include contact with the environment (Colascibetta 2000; Covington et al. 2000). Simply reading about the mathematics of acoustics, or the neurology of hearing, does not in itself produce an understanding of Acoustic Ecology. Nor does recording give a true indication of ambient sound, since even the best equipment (which is rarely if ever available for purposes of instruction) will distort the intensity and spatial location of sound signals. Experience of the place being studied, including its spatial properties, is essential.

Group Fieldwork Projects

The Group Fieldwork Project required each self-selected team of two to four students to find a local venue for fieldwork in which they would describe and map the ambient sounds of the venue as well as suggesting possible alterations to the acoustic ambience.[9] Preliminary research and scouting of possible venues was reported in an outline,

which each group discussed with the class in order to share ideas about methods of approach. Fieldwork was scheduled for the fourth day of the block week, with the class dismissed at 11 a.m. so that groups could spend the rest of the day at their research venues. They were required to report to the rest of the class the next day on their findings and their plans for the written project, which was due four weeks later. Each written project had to include graphic sound maps of the venue and some brief examples of ambient sounds on audiotape, as well as a description of methods, processes, findings, and suggestions for further investigation.

The fieldwork projects chosen by student groups demonstrated considerable range of focus as well as methodology. Within the general guidelines given, students were free to adapt their methods to the circumstances of the venue and the tools available to them, since standardization of measurements was not possible due to lack of equipment. Thus, a group of science students with occasional access to an oscilloscope were able to take precise measurements of sound frequencies in their project, while most groups concentrated on a combination of verbal descriptions, maps modeled on the Schafer literature, and sample audio clips. Fieldwork venues chosen were primarily public areas, on campus or within the city of Calgary. One group concentrated on the university library, noting the differences in ambient noise and human activity on different floors, e.g. the Reserve Reading room (frequent entrances and exits), the Music Library (soft humming and tongue-clicking by readers of musical scores), and the mechanical floor midway up the 13-storey Library Tower. Another group mapped and described the human and electronic noises of the "Campus Cove" recreation area and pub in the Student Union building, concluding that while many of the noises were intrusive, they defined the character of the place. "Consider a place like the Cove and imagine it having no sound at all: would we really feel comfortable in an arcade with no noise or a library where talking is allowed?" .[10]

Two projects stood out as particularly demonstrative of the utility of fieldwork. One, by a group that contained one Music major and two Communications majors, analyzed the ambient noises in the Calgary Children's Hospital. The group recorded and mapped auditory activities in the Admitting area, the X-ray area, and the cafeteria. Noting the intensity of sound in the waiting room for Admitting, they realized that the noise of children interacting with toys placed there, and with each other, was not an aberration but an intentional circumstance designed to relax the children. Another surprise was the sound of a buzz saw piercing the quiet ambience near the X-ray area: it was used for removing casts, and caused noticeable anxiety in some children waiting nearby. In a list of suggestions to the hospital included at the end of the paper, the students recommended that the room containing the saw be equipped with additional sound insulation.[11] The opportunity to critique an actual working ambience gave these students the chance to apply what they had learned, and validated their observations. The other project, carried out by the two Science majors and one student from Social Sciences, investigated the soundscapes of three religious communities in Calgary by visiting a mosque, a synagogue, and a small Buddhist monastery. One science student with a particular interest in Buddhist chant obtained permission for the group to spend a full day at the monastery with audio recording equipment, then produced computer generated sonograms of chants and ambient noises. He observed that the interaction of sound and space was crucial to the ambience, demonstrated his assertion with sonograms of recordings taken at particular locations within the room, and surmised that disconnecting sound from space was liable to distort perception of the soundscape:

> "In our experience of the Great Compassion Repentance Ceremony at Avatamsaka monastery, the resonance of the room formed part of the experience. Certain frequencies were accentuated, and thus changed as we moved throughout the room –- there was a physical interaction with the space."[12]

The interdependence of resonance (sound) with resonator (spatial setting) is in fact one of the key concepts in Acoustic Ecology as it is in physics, and the student's experiential recognition of the phenomenon was undoubtedly worth more than any explanation he could have received from a textbook. For this reason, fieldwork is essential to any course of this type.

Sound Journaling

Students were also required to keep a sound journal to record conscious listening experiences outside of class time, approximately one hour each evening. The journaling process is idiosyncratic by nature, since descriptive words for sounds are not well standardized in English (one person's "crunch" is another's "crackle") and individual perceptions vary. Instructions for the process may be complex, with attempts to classify sounds into distinct categories discussed and agreed upon by the group, or open-ended; e.g. "write a description of everything you hear, in terms that make sense to you." In the block course, the latter decision was made. Open-ended journaling, while not particularly productive for quantitative research, is satisfying to the imagination. It builds confidence in students not previously accustomed to describing sounds.

As expected, the music majors in the class had considerable range of vocabulary as well as awareness of their own auditory attention. One, a flute player, catalogued the vocalizations of her pet canaries into a musical-linguistic grammar, using onomatopoeic descriptors ("chirp, peep, warble, squawk") and imitations ("bee-aaa-bee-aaa!, chee-erp") interspersed with the technical vocabulary of musicians ("tempo, pitches, rubato,

accentuation").[13] Another, a singer, spent time sitting on a bench at a shopping mall with eyes closed, taking note of the voices of passers-by in conversation and documenting her emotional responses:

> "Some male voices had a warm tone that was soothing and portrayed a comforting energy. Other male voices had a sharp edge that overpowered the warmth of the low [tones]. The female voices were most definitely higher in pitch and many had a sweet, innocent tone." [14]

One communications major concentrated less on direct description of sounds and more on explanation of circumstances causing the sounds:

> "I can hear the TV from downstairs. I can tell that some sort of sport is being watched because I can hear a crowd of people moan and groan in anticipation as they await a goal or score. The volume of the crowd has increased but there is no goal because I can hear a unified sigh of disappointment (ahhh). The crowd is getting louder again. Their cheers are indiscernible. They get louder. There are two sharp and high-pitched toots of a whistle. The announcer then announces that there has been a goal." [15]

The interweaving of auditory with other sensory images was also quite common among journal entries; e.g.:

> "The wind was blowing full gusto and this whistling and whirling was most definitely the prominent noise. It danced with my hair and moved gently through the surrounding bushes and shrubs." [16]

In general, the journaling exercise was effective in focusing attention on the conscious perception of ambient sounds. Such attention led most students into greater consideration of the amounts of noise to which they are exposed on a daily basis and the range of emotional responses that noise can evoke.

Preliminary Assessments

Outcomes from the initial course offering showed some minor discrepancies among the disciplinary background sets. Sets 1 and 2, the musicians and science majors, showed the highest levels of performance on assignments, both on powers of observation of sound as demonstrated by journal entries and by research design for the field work projects. Music majors were also the most inventive in the experiential exercises: this was not surprising, given their professional training in relating individual sounds to larger structures, as well as their performing experience. Set 3, being the largest group, varied most in course performance. Some individuals made the adaptation to aural emphasis easily, others were challenged. Set 4, predictably, was the least successful in terms of observational skills and course performance, but the individuals reported gaining greater awareness of their auditory surroundings, particularly the high levels of noise in recreational areas on campus. All students but one reported enjoying and learning from the course; the dissenter felt that the experiential exercises were inappropriate.

Some specific challenges were presented in the development of the first Acoustic Ecology course at the University of Calgary. The first was lack of familiarity on the part of administrators as well as students. An interdisciplinary course can be difficult to justify at a time when budget restrictions threaten all but courses deemed "core" to programs, even in a faculty dedicated to interdisciplinary instruction. Since the field is not yet well known in academic circles, the idea had to be presented as an experiment despite extensive precedent at another university. Since funding was provided that year for the development of block courses, a format not yet in extensive use, the course was given support as a pilot project.

A second challenge was the diversity of student backgrounds. This was overcome without much difficulty by turning it to an advantage. If a common set of assumptions and approaches was lacking, students could share their backgrounds as a way of demonstrating the diversity of approaches possible in an interdisciplinary field of study. This was accomplished during guided class discussions by setting sample problems and asking students from various backgrounds to describe how they would approach solutions. Contributing students were then led by questioning to explain how previous experiences shaped their perspectives on the problem. Finally, the preponderance of questions over established answers, typical of an emerging field of investigation, became ground conducive to the growth of speculative thinking about such issues as noise regulation, cultural influences on auditory attention and musical taste, noise-related causes of hearing impairment, and the scarcity of silence in urban public venues.

The course has not to this date been repeated on the undergraduate level, reportedly as a result of budget constraints. It has subsequently been redeveloped for graduate students in Architecture and Environmental Design (see Postscript, below). Improvements to future versions of the course should include access to equipment that can enable precise measurement of sound. A wish list would encompass decibel meters to measure sound intensity (loudness) and oscilloscopes to measure frequencies, as well as sound analysis software. Since these are expensive items, such access would most likely necessitate collaboration with faculty members in Engineering or Physics, or with technicians in the noise control industry. Portable audio recorders would ideally be supplied to student groups doing fieldwork, preferably all

of the same type and specifications so that measurements are comparable.

Conclusions and Implications for the Teaching of Interdisciplines

The course in Acoustic Ecology presented here demonstrates an experimental method for conceptualizing and teaching in an interdiscipline, a fully integrated field for which a multidisciplinary (discrete, non-integrated) approach is not well suited. Such a course may indeed employ more than one instructor, but the crucial difference between multidisciplinary and fully interdisciplinary teaching is that the latter does not separate component disciplines as discrete units within the subject area. Instead, it requires an inquiry-based approach that defines the subject area by means of strategic questions, which often bypass traditional methodologies. Methods may thus become combinative, layering aspects of physical description and measurement, social significance, and assignment of cultural or personal meaning (refer to Figures 1 and 2, above), as exemplified by the exercises of sound walks and mapping. It is tempting to speculate that the integration of methodology along with content may well be essential to the successful teaching of interdisciplines; further research and reporting of examples are needed to complete this picture. However, the teaching of interdisciplines, particularly those that involve integrations of science and humanities, may be problematic at many institutions for administrative reasons if not philosophical ones. Support for the development of such courses may be hard to find in the first place because administrative barriers must first be overcome. One of these is the usual housing of courses in a single department or faculty. Cross-listing, a possible solution, looks precarious when the example of Acoustic Ecology is used: a course cross-listed for students in music, psychology, engineering, environmental studies and architecture – with the possible addition of sociology, geography and health sciences – is almost certain to cause objections at the Registrar's office, if not in the departments listed. For this reason, a small college may find it easier than a large university to mount such a course. Potential budgeting problems include the allotment of funds to departments and faculties sharing a cross-listed course, particularly if more than one instructor is involved. Finally, students may be wary of being graded by instructors who comes from outside their home disciplines.

Because objections by administrators are likely to result from lack of familiarity with the concept of integrated pedagogy, the simple desire to teach one course may suddenly project the planner into the arena of administrative reform. Course and curriculum designers may need to introduce the concept of interdisciplines cautiously, citing precedents from interdisciplinary theory (see Bibliography, below) and from such relatively established interdisciplines as environmental studies and biomedical engineering. In this way, newly emerging fields of study can be legitimized, developed, and passed on to students. Whether motivated by philosophy of inquiry or by the employment markets of the near future, post-secondary institutions are gradually opening to such possibilities.

Postscript

In 2001, a second version of the "Introduction to Acoustic Ecology" pilot was offered in the graduate faculty of Environmental Design, which houses programs in Architecture, Community Planning, and Environmental Sciences. Six students enrolled – four in architecture, one in landscape design, and one with a double concentration in planning and law. The structure was similar to the undergraduate version, but less time was spent on experiential exercises and more on investigation and discussion of how Acoustic Ecology could be applied to the students' areas of professional concentration. Applications included municipal planning and zoning, municipal noise bylaws, and architectural design.

At the conclusion of the course, students reported unanimously that a four-day intensive block course offering provided insufficient time to gain background and to investigate problems, and that they would support expanding the content. The course is now under development for regular scheduling as an offering in the Faculty of Environmental Design.[17] Ideally, it will be open to selected graduate students in Music, Cognitive Psychology and Health Sciences as well as those in Environmental Design, in order to encourage multidisciplinary interaction as well as an interdisciplinary approach.

Appendix: Sample audialization exercise

Rationale: The following list of sound "images" is designed to develop auditory memory (recall of sounds heard in the past) and imagination (auditory imaging of unfamiliar sounds; essentially speculative and analogous to visualization of scenes described in words). Both processes, though different in nature, may be classified under the heading of "audialization". The development of both memory and imagination in auditory contexts is applicable to encouraging attention to the heard environment: ambient noise, aural signals, foregrounding and backgrounding of sounds, auditory distracters, and conscious listening.

Audialization exercises may also stimulate memory of emotional states, so a quiet and safe environment is important.

Instructions to students: Please close your eyes and rely on your ears. As you hear the description for each sound, take a moment to "hear" it in your memory or imagination, as you would visualize an image described to you. Many of you will visualize at the same time – that's typical, and it's fine.

Sound "images" (*to be read aloud by the instructor*)

1. Opening and closing a car door.
2. Opening and closing the door of a house you lived in as a child.
3. A dog walking on linoleum.
4. A school playground.

5. A familiar body of water.
6. A familiar recreational facility.
7. A gathering storm.
8. A language (known or unknown) other than the one you commonly speak.

NB – These are examples only. The list may be altered or extended according to the instructor's objectives. It is advisable to avoid mentioning sounds that can trigger anxiety in individuals with a history of trauma associated with noise: for example, particular care must be taken if the class includes refugees from war zones.[18]

Commentary: It is helpful (and enjoyable) to encourage discussion of the group's experiences after the exercise, as long as contribution to the discussion is optional.

Images 2, 5 and sometimes 8 are particularly evocative of positive childhood memories, while 6 may raise awareness of noise levels in everyday life. In my experience, most students enjoy sharing their stories

Notes

1. For discussion of the current methodological dynamics of the field, see Henrik Karlsson (2001), "The Acoustic Environment as a Public Domain" in *Soundscape* vol.1, no.1.

2. Block courses at the University of Calgary are held one week before the regular schedule of classes for Fall or Winter Term begins. They run for four or five days of six-hour classes, and are best suited to subjects that require intense focus and experiential components.

3. For further information about the Acoustic Ecology movement and the Vancouver Soundscape Project, see the website of the World Forum for Acoustic Ecology (WFAE).

4. For an example of Truax's work, see his *Acoustic Communication* (2001).

5. WFAE Website text.

6. Each of these disciplinary background groups will henceforth be described as "sets" 1 - 4, to distinguish them from project groups ("groups").

7. Audialization is directly analogous to visualization: it is the imagining of a sound stimulus in a specific ambience.

8. The software, from UCLA, catalogues and presents all known sound patterns from all languages, giving International Phonetic Alphabet symbols and sound recordings as well as information about demographics. I find it to be an excellent tool for developing students' awareness of the functions of the human voice, as well as the auditory aspects of communication.

9. The idea of improving or altering soundscapes by reducing noise is controversial within the Acoustic Ecology movement. One point of view is that the public right to (relative) silence is crucial, and that public spaces should be designed to be acoustically neutral with a minimum of traffic noise, music, and other stimuli. Another is that noise is an intrinsic part of the public space, and that it should be recorded and described but not changed in any way. For the undergraduate course I chose the former philosophy, after presenting both, because it would give students an exercise in speculative planning.

10. Project paper: L.Cheng, D. Fournier, A. Joncic.

11. Project paper: J. Chapin, D. Gutfriend, J. Price.

12. Project paper: J. Heumann, M. McDonald, C. Quillian.

13. Sound journal entry, C.Harrington, January , 2000.

14. Sound journal entry, J.Welling., January 3, 2000.

15. Sound journal entry, S.Halasz., January 3, 2000.

16. Sound journal entry, J.Welling, January 6, 2000.

17. Collaboration with Professor Tang Lee of the Faculty of Environmental Design, who teaches Architectural Acoustics.

18. It is easy to imagine applications of audialization to therapeutic situations, analogous to Guided Imagery techniques.

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