

APCAM 2009

**8th Annual Auditory Perception, Cognition,
and
Action Meeting**

Thursday November 19

Boston Sheraton Hotel

Boston, MA, USA

Program sponsored by

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UNIVERSITY**



Welcome to APCAM 2009

We are pleased to welcome you to the eighth annual Auditory Cognition, Perception, and Action Meeting (APCAM). The goal of APCAM is to bring together researchers from various theoretical perspectives to present focused research on auditory cognition, perception, and aurally guided action. APCAM is a unique meeting in its exclusive focus on the perceptual, cognitive, and behavioral aspects of audition. Many thanks to all those whose contributions have helped make APCAM such a success. We would also like to thank The College of Wooster and Washburn University. Enjoy your meeting!

Sincerely,

John Neuhoff
Devin McAuley
Peter Q. Pfordresher
Mike Russell

| APCAM 2009 Schedule | | |
|---|--|---|
| 7:30 | Registration | |
| 8:00 | Opening Remarks | |
| <i>Action and Attention (abstracts pages 7 – 9)</i> | | |
| 8:10 | Action as an organizing principle of auditory cognition | Laurie Heller* Benjamin Skerritt |
| 8:30 | Directional information in speech or passive listening influences the sense of agency on a visuomotor tracking task | John Dewey* Thomas Carr |
| 8:50 | Visual Distinctiveness of Target Words Reduces Semantic Auditory Distraction | Dylan Jones* John Marsh Philip Beaman Helen Hodgetts |
| 9:10 | High Working Memory Capacity Attenuates the Deviation Effect but not the Changing-State Effect: Further Support for the Duplex-Mechanism Account of Auditory Distraction | Patrik Sörqvist* |
| 9:30 | Target Similarity and the Impairment found for Detecting the Dual Occurrence of Targets | Tamara Ansons* Jason Leboe Todd Mondor |
| 9:50 | The involuntary capture of attention by novel sounds: Is it really about novelty? | Fabrice Parmentier* Jane Elsley Jessica K. Ljungberg |
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| <i>Environment and Events (abstracts pages 10 – 12)</i> | | |
| 10:20 | Do vocal imitations enable the identification of the imitated sounds? | Guillaume Lemaitre* Arnaud Dessein Karine Aura Patrick Susini |
| 10:40 | Influence of clutter on the perception of distance and altitude. | Michael Russell* |
| 11:00 | Multisensory integration in percussion performance | Bruno L. Giordano* Federico Avanzini Marcelo Wanderley Stephen McAdams |
| 11:20 | Event perception based upon minimal spectral information | Michael Hall* |
| 11:40 | Hooray for Hollywood II: Sound and Speech Lessons from the Entertainment Industry | Lawrence Rosenblum* |

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| 12:00 Break (10 min) | | |
| <i>Timing, Tuning, and Tone (abstracts pages 12 – 13)</i> | | |
| 12:10 | Implicit learning of temporal structures: Evidence from an adaptation of the SRT paradigm | Barbara Tillmann* Melissa Brandon Catherine Stevens Josephine Terry |
| 12:30 | Probabilistic Modeling of Tone Perception | Deepti Ramadoss* Colin Wilson |
| 12:50 | Intonation, Tuning and Attuning | Andreas Georg Stascheit* |
| Lunch (1:10 – 2:00 PM) | | |
| <i>Poster Session (2:00 – 3:30 PM): Abstracts located on pages 17 – 31</i> | | |
| <i>Music and Pitch (abstracts pages 14 – 16)</i> | | |
| 3:30 | The integration of pitch and time in ratings of melodic goodness | Jon Prince* |
| 3:50 | Cross-Modal Affective Priming: Effect of Major and Minor Triads on Word-Valence Categorization | Frank Ragozzine* Michael J. Gismondi |
| 4:10 | Evidence for a Neuroanatomical Distinction during Anticipation and Experience of the Chills Response | Valorie Salimpoor* Mitchel Benovoy Kevin Larcher Alain Dagher Robert Zatorre |
| 4:30 | White Matters: Investigating the Effects of Musical Training on Temporo-Frontal Fiber Tracts in Children | Gus Halwani* Lin Zhu Andrea Norton Psyche Loui Ellen Winner Gottfried Schlaug |
| 4:50 | Messages from the Dark Side of Pitch Perception and Production | Psyche Loui* Gottfried Schlaug |
| 5:10 | Musical features of intermediate complexity for music recognition | Mihir Sarkar* |
| 5:30 | Closing Remarks | |

Posters (abstracts located on pages 17 – 31)

| | | |
|-----------|--|---|
| 1 | Serial memory for lists of spoken items: An examination of talker location and voice changes | Cindy Chamberland Emilie Chamard Helen Hodgetts Dylan Jones Sébastien Tremblay |
| 2 | Algorithm To Measure The Visual And Auditory Evoked Potentials In A Non-Clinical Research Context | Bruno Giesteira João Travassos Diamantino Freitas |
| 3 | Sensitivity to sequences of time intervals in “speech” and “non-speech” conditions | Simon Grondin Nicolas Bisson Caroline Gagnon |
| 4 | The surface is where most of the action is: Impact of observer stability on affordance perception. | Shannon Bechard Michael K. Russell |
| 5 | Isolating the role of attention sharing from preparation in timing with gaps | Paule Ellefsen-Gauthier Rémi Gaudreault Claudette Fortin |
| 6 | Regulatory fit and performance on the Montreal Battery of Evaluation of Amusia | Samantha Tuft Molly Henry Devin McAuley |
| 7 | Sure you’ve got a pretty face, but what does your voice sound like? An investigation of auditory and visual attractiveness | Nicolette Zeller Michael K. Russell |
| 8 | Altered Auditory Feedback, Self-attribution, and the Experience of Agency in Sequence Production | Justin Couchman Peter Q. Pfordresher |
| 9 | Monolinguals’ sensitivity to rhythm in bilingual and monolingual French and English | Pascale Lidji Isabelle Peretz Jake Shenker Caroline Palmer |
| 10 | Auditory Dominance in Temporal Memory | Pierre-Luc Gamache Simon Grondin |
| 11 | Visual Perceptual Load and the Attentional Breakthrough of Sound | Dylan Jones Robert Hughes John Marsh William Macken François Vachon |
| 12 | Effects of Visual Information on Interactive Speech Alignment | Neal Dykmans Lawrence Rosenblum |
| 13 | Exploration of Auditory Novel Distraction and Semantic Processing with Involuntary Attention Capture. | Philippe Audette Todd Mondor |
| 14 | Mapping listener perception of weapon signature for single-shot impulse fire | Jeremy Gaston Tomasz Letowski Kim Fluitt |
| 15 | Performance of clave rhythms by expert drummers | Grant Baldwin David Gilden |

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| 16 | Brain plasticity associated with auditory processing in the blind | Catherine Wan Amanda Wood Jian Chen Sarah Wilson David Reutens |
| 17 | Using an auditory-motor mapping therapy to improve expressive language abilities in nonverbal children with autism | Catherine Wan Lauryn Zipse Andrea Norton Krystal Demaine Rebecca Baars Jennifer Zuk Amanda Libenson Loes Bazen Gottfried Schlaug |
| 18 | Perceiving Emotional Arousal in Music Recruits Production Areas | Hui Li Psyche Loui Robert Rowe Juan Bello Gottfried Schlaug |
| 19 | The perception of temporal segmentation of sound patterns | Michael Kubovy Minhong Yu Joseph Arwood |
| 20 | A Perceptual Sound Retrieval and Synthesis Engine | Mihir Sarker Ananth Ram Barry Vercoe |
| 21 | Age and experience as determinants of sensitivity to shifts in tonality in South Indian Classical (Carnatic) music. | Rachna Raman J. Walter Dowling |
| 22 | Do Metrical Accents Create Illusory Phenomenal Accents? | Bruno Repp |
| 23 | Unmasking the role of masking in the attentional blink through the perceptual organization of sound | François Vachon Sébastien Tremblay Robert Hughes Dylan Jones |
| 24 | Auditory feedback and melody switching in music performance | Peter Q. Pfordresher Peter E. Keller Iring Koch Caroline Palmer Ece Yildirim |
| 25 | Absolute pitch: The pitch of voices is difficult to identify | E Glenn Schellenberg Patricia Vanzella |
| 26 | A study of emotional reactions induced by manipulating a sonically augmented interactive device | Guillaume Lemaitre Olivier Houix Nicolas Misdariis Patrick Susini Yon Visell Karmen Franinovic |
| 27 | Attention captured - What constitutes a good alarm? | Jessica Ljungberg Fabrice Parmentier Jane Elsley |
| 28 | Laminar cortical dynamics of conscious speech perception | Sohrob Kazerounian Stephen Grossberg |

8:10

Action as an organizing principle of auditory cognition

Laurie Heller*
Benjamin Skerritt

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How is high-level auditory information about our environment organized? Rather than primarily telling us about the structural properties of stationary objects, auditory information may be better suited to reveal the fundamental types of interactions that occur between objects and substances, such as impacts, scrapes and splashes (e.g. Gaver 1993). A series of experiments probed the psychological organization of a wide range of environmental sounds through categorization and typicality judgments. First, listeners rated the likelihood of various possible causes of a sound. Next, a new set of listeners learned exemplar-based categories of sounds based on the groupings found in the first experiment. Listeners judged the typicality of sounds in each class. The results indicate that listeners have explicit access to physical properties of sound-generating events and can implicitly use these properties to organize sounds. The psychological groups of sounds are better described by their causal actions, such as bouncing or dripping, than they are by properties of their causal objects, such as wood or hollow. These psychological groups are well-discriminated by a small set of acoustic variables, suggesting the possibility of a small set of higher-order auditory features that typify each fundamental type of sound event.

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8:30

Directional information in speech or passive listening influences the sense of agency on a visuomotor tracking task

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The sense of agency is the feeling of intentionally making things happen. For example, skilled drivers normally perceive a strong causal link between their steering and the direction of their cars. Some studies have suggested that the sense of agency depends on comparing a representation of a motor action (an efference copy) to reafferent sensory feedback (e.g. visual feedback of an outcome). A sense of agency occurs when feedback matches the efference copy for a voluntary action. However, other studies have shown that merely priming the spatial location where a moving object will undergo a forced stop increases participants' subjective feeling of causing the stop themselves. This suggests that consistency between prior thoughts and subsequent feedback is sufficient for a sense of agency even without a forward motor signal. The current study investigated if concepts activated by directional information in speech influences the sense of agency on a motor task with visual feedback. Participants used four arrow keys (up,down,left,right) to move an object on a computer display with delayed visual feedback. Agency was operationalized as a rating of control given by participants after a sequence of moves. Control ratings were lower when incongruent auditory distractors (recorded voices saying up,down,left, or right) played during the task compared to conditions with congruent distracters or no distracters. In another experiment, participants read serially presented distracter words aloud. Again, control ratings were lower in the incongruent conditions. Furthermore, when spoken word distracters were congruent with keyboard input the reported number of matches between keyboard inputs and visual feedback increased. The results show that representations of motor actions (keypresses) maintained over periods 500-1000ms interacted automatically (involuntarily) with to-be-ignored stimuli. This affected performance (RTs) as well as the sense of agency for visual feedback.

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8:50

Visual Distinctiveness of Target Words Reduces Semantic Auditory Distraction.

Dylan Jones*
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Learning lists of visually-presented words is more difficult when to-be-ignored words are being heard and this is particularly the case when they are similar in meaning: Intrusions from irrelevant items categorically-related to list members increase and correct recalls decrease. We here show that this semantic similarity effect can be reduced dramatically by making the target items perceptually more distinct. The to-be-remembered words could occur either all in the same unusual font type or all in different unusual fonts. Our experiments showed that more distinctive lists are less prone to distraction from words of similar meaning. During the retrieval process the cognitive system has problems not just remembering the items but the sense modality in which they were presented. Making the visual items more distinct helps also to encode more accurately the modality from whence they came (that is, 'source monitoring' is improved), decreasing the likelihood that words of a similar meaning from an inappropriate source (heard words) will be reported.

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9:10

High Working Memory Capacity Attenuates the Deviation Effect but not the Changing-State Effect: Further Support for the Duplex-Mechanism Account of Auditory Distraction

Patrik Sörqvist*

University of Gävle

Some studies have found a relationship between working memory capacity (WMC) and auditory distraction outside the serial recall paradigm, whereas several attempts to find this relationship within the serial recall paradigm have failed. The reason may be the nature of the serial recall task or the nature of the effects under investigation. The present experiment investigated the role of WMC in disruption of serial recall by suddenly deviating sounds (the deviation effect) and by continuously changing sounds (the changing-state effect). The correlation between WMC and the deviation effect was significant, but not the correlation between WMC and the changing-state effect. Furthermore, the two correlations differed significantly. These results suggest that the serial recall task is not responsible for the failed attempts to find a relationship between WMC and auditory distraction, and they suggest that the two effects are produced by different mechanisms which support the duplex-mechanism account of auditory distraction.

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9:30

Target Similarity and the Impairment found for Detecting the Dual Occurrence of Targets

Tamara Ansons*
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The phenomenon of repetition deafness (RD) effect and the auditory attentional blink (AAB) are two findings wherein people may be comparatively insensitive to the dual occurrence of targets that occur relatively close to in time. In the former case, the insensitivity is in detecting identical targets, whereas, in the latter case, the insensitivity is in detecting different targets. Although both of these findings reveal an impairment in identifying targets, little is known as to whether or not these effects are the result of the same underlying cognitive process. In the current set of experiments, we examined both RD and AAB using a single paradigm to determine whether one perspective might be able to account for these impairments. If a RD perspective accounts for these impairments, the impairment should increase as the similarity of targets increases; however, if an AAB perspective accounts for these impairments, the impairments should not differ across the similarity of the targets. In the first study, two different target glides were presented either once, twice, or not at all within a sequence of pure tones. We found that the impairment for repeated targets was greater and more long-lasting when two different target glides were presented, compared to when identical target glides were presented. The second and third studies used a similar paradigm to examine whether the magnitude of the impairment for detecting two targets would systematically vary with the degree of similarity between the targets. As with the first experiment, the targets could be presented either once, twice, or not at; however, instead of using glides as the targets, the target sounds were three different harmonic tone complexes. Consistent with Experiment 1, we observed the greatest impairment when targets were dissimilar, compared to when they were similar. These findings and implications for theories of RD and AAB are discussed.

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9:50

The involuntary capture of attention by novel sounds: Is it really about novelty?

Fabrice Parmentier*
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Unexpected auditory events can capture our attention away from a focal task, reflecting the existence of brain mechanisms detecting changes in our environment. This phenomenon can be studied in the lab using the cross-modal oddball task, in which participants judge visual targets presented in sequence while ignoring auditory distracters. Most targets are preceded by the same sound (standard) while randomly dispersed targets are preceded by a different sound (novel). Laboratory studies show that novel auditory stimuli elicit specific electrophysiological responses (N1/MMN, P3a, RON) as well as a behavioral cost in the visual task. While past research has mostly focused on electrophysiological responses to the novels, recent work has endeavored to identify the cognitive mechanisms underpinning this behavioral distraction effect. The present study follows up on this by re-visiting the received view that novelty distraction follows ineluctably from the sound's low probability of occurrence or, put more simply, its unexpected occurrence. Our study challenges this view and argues that past research failed to identify the informational value of sound as a mediator of novelty distraction. We report an experiment in which the probabilistic and temporal relationship between auditory distracter and visual target were manipulated. We show that (1) novelty distraction is only observed when the sound announces the occurrence and timing of an upcoming visual target; (2) that no such distraction is observed for deviant sounds conveying no such information; and that (3) deviant sounds can actually facilitate performance when these, but not the standards, convey information. We conclude that novelty distraction is observed in the presence of novel sounds but only when the cognitive system can take advantage of the auditory distracters to optimize performance.

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10:20

Do vocal imitations enable the identification of the imitated sounds?

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|----------------------------|--|
| Guillaume Lemaitre* | <i>IRCAM</i> |
| Arnaud Dessein | <i>IRCAM</i> |
| Karine Aura | <i>Université Toulouse 2 le Mirail</i> |
| Patrick Susini | <i>IRCAM</i> |

Studying vocal imitations might tell a lot about the psychological mechanisms of sound source identification, if we consider the assumption that, in an everyday conversation, vocally imitating a sound enables the listener to identify what the speaker imitates. We report two studies investigating this assumption. First, we asked couples of participants to listen to series of everyday sounds. One of the participants (the “speaker”) had then to describe a selected sound to the other one (the “listener”), so that the listener could “guess” what was the sound heard by the speaker. No particular instruction was provided about “how” to describe the sounds. The results showed that, spontaneously, the speakers used, among other para-linguistic cues, large numbers of onomatopoeias and vocal imitations. Moreover, these results suggested that the identification performances were increased when vocal imitations were used, compared to when only verbal descriptions were used.

Second, we sampled twenty-eight sounds across an experimental taxonomy of kitchen sounds and required laypersons to vocally imitate these sounds. Another group of participants was then required to categorize these vocal imitations, according to what they thought was imitated. A hierarchical cluster analysis showed that, overall, the categories of vocal imitations fitted well with the categories of imitated sound sources. However, by using finer analysis techniques, we also showed that some imitations inconsistently clustered. On the other hand, the consistent clusters of imitations were perfectly predicted by a few acoustical descriptors.

These results are therefore consistent with the assumption that vocally imitating allows identification of what is imitated. They also suggest that “what is imitated” contains information both on the sound source, and on the sound signal properties, particularly on the temporal patterns of the sounds.

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10:40

Influence of clutter on the perception of distance and altitude.

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| Michael K. Russell* | <i>Washburn University</i> |
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Every day, we judge the world about us using sound. We detect events. We perceive objects approaching or withdrawing. We judge a sound-producing object’s distance and location. However, the world we perceive and act within is more frequently than not a cluttered world. The objects that fill our world shape the sound reaching our ears. It follows, then, that clutter would shape our perception. An auditory event may be detected but the spatial location of that event may be unknown or uncertain. The purpose of the present study was to determine the extent to which perceptual judgments of nearby objects were affected by the presence of clutter. Participants were given the task of judging whether a target was close enough to be grasped or whether it was high enough to avoid contact. The findings are discussed with respect to current, traditional methodology and the information influencing spatial perception.

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11:00

Multisensory integration in percussion performance

Bruno L. Giordano*
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We investigated how auditory and haptic information about the hardness of objects is integrated for the purpose of controlling the velocity with which we strike an object. Our experimental manipulations and data analyses considered a variety of factors that should be integrated in a theory of multisensory perception: expertise of the perceiver; context (unimodal vs. multimodal); between-modalities congruence; between-participants agreement in sensory weighting; performance.

On a trial, participants struck a virtual object with a constant velocity and received feedback on correctness. When the performance criterion was reached, feedback was eliminated, the auditory and/or haptic hardness of the struck object were changed, and the effects on subsequent striking velocity and performance were measured. In unimodal trials only the haptic or auditory display was presented. In multisensory trials, the audio-haptic changes could be congruent (e.g., both increased in hardness) or incongruent. We recruited participants with different levels of expertise with the task: percussionists, nonpercussionist musicians and nonmusicians.

For both modalities, striking velocity increased with decreasing hardness, and vice versa. With the vast majority of participants, changes in haptic hardness were perceptually more relevant because they influenced striking velocity to a greater degree than changes in auditory hardness. The perceptual weighting of auditory information was robust to context variations (unimodal vs. multimodal), independent of expertise, uniform across participants and modulated by audio-haptic congruence. The perceptual weighting of haptic information was modulated by context and expertise, more varied across participants and robust to changes in audio-haptic congruence. Performance in tracking velocity was more strongly affected by haptic than auditory information, was not at its best in a multisensory context and was independent of information congruence.

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11:20

Event perception based upon minimal spectral information

Michael Hall*

James Madison University

In sinewave speech, sentences are perceived despite replacing speech signals with sinusoidal tones that track formant center frequencies. This finding has been argued to be consistent with neither the operation of a phonetic module nor principles of perceptual organization (Remez, Rubin, Pisoni, & Carell, 1981). Furthermore, it has been characterized as “bistable”, with listeners recognizing component tones while perceiving their combination as an utterance (Remez, Pardo, Piorkowski, & Rubin, 2001). An alternative, general auditory account will be provided. It will be demonstrated that mistuning or reversing of a tone stream adversely affects speech perception, even though listeners can detect component tones. Nonspeech replications also should be possible; data will be presented that demonstrate recognition of musical instruments with very few harmonics. Thus, it is not unusual to recognize events despite minimal spectral information. Sinewave speech will be likened to duplex perception, which has been established for speech and nonspeech stimuli.

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11:40

Hooray for Hollywood II: Sound and Speech Lessons from the Entertainment Industry

Lawrence Rosenblum*

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I will discuss how the entertainment industry can provide useful lessons about some important concepts in psychoacoustics and speech science. For example, sound designers for film spend substantial effort fine-tuning the reflected sound of sets and simulating that sound in the studio. These professionals believe that the audience can detect very small inconsistencies in the audible properties of a space, as well as between a space's visible and audible characteristics. Next, foley artists have developed a rich tool set to replicate and simulate the emitted sounds portrayed in film and television. Many of these tools are based on principles with perceptual relevance including the caricaturization of salient acoustic features, and the selection of substitute events with dynamic similarity. With regard to speech, recent findings on voice-to-face talker matching are exemplified in the work of animation directors who must carefully cast a voice to match a character's look. These directors also spend months splicing together recordings of voice actors who have been recorded alone, so that the actors sound as if they are having a natural conversation with one-another. This fact evidences our perceptual sensitivity to speech alignment, or inadvertent imitation, that occurs between interlocutors. Finally, these natural imitative tendencies are apparent in the craft of expert impressionists. These performers learn to exaggerate the most distinctive aspects of a talker's voice, and when doing so, recruit brain areas not used by novices. Throughout, recent research findings will be discussed which are consistent with the work and insights of these entertainment professionals.

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12:10

Implicit learning of temporal structures: Evidence from an adaptation of the SRT paradigm

Barbara Tillmann*

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Melissa Brandon

University of Western Sydney, MARCS Auditory Laboratories & University of Wisconsin

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Implicit learning of artificial structures has been investigated mostly for visual, spatial or motor processing, but rarely for temporal processing, particularly in the auditory modality. The few experiments investigating learning of temporal structure concluded that temporal structures can be learned when coupled with another structural dimension, such as spatial structures or pitch structures. In addition, these studies used variable temporal structures depending on participants' response times (Response-to-Stimulus Intervals) and/or structures without metrical framework. The present study investigated temporal structure learning without a correlated second dimension and with temporal sequences containing metrical structures (weak vs. strong). Our task was an adaptation of the classical Serial Reaction Time paradigm, using an implicit task in the auditory domain. Findings reveal that participants learn the temporal structures over the exposure blocks and provide the foundation for a new series of experiments investigating the implicit cognition of temporal processing.

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12:30

Probabilistic Modeling of Tone Perception

Deepti Ramadoss*
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This study tries to instantiate Moren and Zsiga's (2006) phonological model of perceptual cues for Thai tones (pitch values contributing to lexical meaning) in which pitch targets are right-aligned with targets, using probabilistic models. Each model computes probability distributions based on a training stimuli set comprising of three target values representing each stimulus. The models vary based on the relationship between the three probability distributions; Model 1 employs independent distributions and later models use distributions with covariance matrices. Comparing results of the models and human perception experiments (Zsiga and Nitisaroj, 2007), the first and last model's predictions match human categorization 68.18% and 36.36% of the time respectively. This result seems counterintuitive, since dependent distributions (considered 'more informative' and facilitate generative models of perception), appear to hinder correct categorization. Further research investigating differences among distributions is required and could provide evidence of the use of statistical regularities in speech perception.

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12:50

Intonation, Tuning and Attuning

Andreas Georg Stascheit*

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The paper focuses on auditory cognition by analysing the structure of the specific activities of listening involved in processes of tuning in musical contexts. The analysis refers to Edmund Husserl's methodological reflections on the phenomenological attitude and to the phenomenology of sensory experience as developed by Erwin W. Straus.

(1) Tuning as Diagnosis

The tuning activities that prelude every rehearsal of music ensembles present an example of human social action aiming at the installation of a common, shared context, where a task of extraordinary artificiality represents the topic of collaboration: the comparative diagnosis of two sounds, often significantly different in relation to timbre and intensity, with regard to their pitch. The paper discusses the structures of this "examination of sound", which reveal interesting parallels to essential methodological aspects of phenomenological research as depicted by Edmund Husserl.

(2) Tuning as "Inter-Esse"

In contrast, in the context of "making music together" tuning and attuning are continuously present throughout the whole unfolding musical process. In this context, as the temporal dynamic of this process in most cases excludes an explicit diagnostic activity and control, tuning activities occur in a different mode: motility and auditory sensitivity now appear as immediately linked.

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3:30

The integration of pitch and time in ratings of melodic goodness

Jon Prince*

University at Buffalo

In typical Western music, pitch often dominates time, perhaps because pitch exhibits more structure. This research tested how varying the amount of structure in these two dimensions affects how pitch and time combine in judgments of melodic goodness. Melodies had either the original sequence of elements, a reordered sequence of existing elements, or a sequence with random elements. This manipulation was used for both dimensions independently, creating a crossed 3 pitch by 3 time conditions design. Participants were instructed to attend only to pitch, time, or both. Despite the selective attention instructions, both dimensions always contributed to goodness ratings. The effect size of pitch was considerably larger than that of time in all cases except for the attend time instruction, in which the main effects were of equal size. The pattern of how pitch and time contributed to ratings differed across instruction. Pitch and time combined independently only when attending time. When attending pitch, the effect of time declined with reduced pitch structure. When attending both pitch and time, the original pitch and time sequence was disproportionately better than other conditions. These results have four implications. First, pitch dominates melodic goodness ratings regardless of the degree of temporal structure. Second, listeners can consciously emphasize either dimension in this context, suggesting some independence between pitch and time on an explicit level. Third, however, listeners cannot ignore entirely either dimension when forming a goodness rating, suggesting some interdependence between pitch and time on an implicit level. Fourth, when attending to both pitch and time simultaneously, the unique combination of the original pitch and temporal elements can affect goodness ratings in an interactive manner. Overall, the combination of pitch and time in music can vary in complex ways based on conscious and involuntary allocation of attention to these two dimensions.

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3:50

Cross-Modal Affective Priming: Effect of Major and Minor Triads on Word-Valence Categorization

Frank Ragozzine*

Youngstown State University

Michael J. Gismondi

Youngstown State University

In affective priming experiments, prime words having either positive or negative valence are presented, followed by target words having either positive or negative valence. On some trials, valences of the prime and target are consistent; on other trials, valences are inconsistent. A common finding is that subjects more quickly identify the target valence on consistent trials than they do on inconsistent trials (e.g., Fazio et al., 1986). Sollberger et al. (2003) obtained an analogous result using musical stimuli as primes. Specifically, they presented consonant (positive) or dissonant (negative) chords, followed by visually-presented target words having either positive or negative valence. Subjects categorized the targets faster on consistent trials than they did on inconsistent trials. In the present study, I examined whether other musical stimuli can produce cross-modal affective priming. Many people perceive the valence of music in major modes as positive, and the valence of music in minor modes as negative (Hevner, 1935; 1936). Crowder (1985) found that even a single major or minor chord can reliably be categorized as happy or sad, respectively. Thus, in the present experiment, subjects heard either a C-major triad or a C-minor triad on each trial. The triad was followed by a target word that appeared on a computer monitor. Subjects categorized the target as either positive or negative, and reaction times (RT) were recorded. Ten subjects experienced an equal number of major-positive, major-negative, minor-positive, and minor-negative trials in a random order. A 2x2 repeated-measures ANOVA on the RTs revealed a significant interaction between triad type and word valence: $F(1, 9) = 7.67, p = .022$, partial $\eta^2 = .46$. As expected, subjects responded faster on the consistent trials (major-positive, minor-negative) than they did on the inconsistent trials (major-negative, minor-positive), thus demonstrating cross-modal affective priming.

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4:10

Evidence for a Neuroanatomical Distinction during Anticipation and Experience of the Chills Response

| | |
|---------------------------|---|
| Valorie Salimpoor* | <i>McGill University, Centre for Interdisciplinary Research in Music Media and Technology</i> |
| Mitchel Benovoy | <i>McGill University, Centre for Interdisciplinary Research in Music Media and Technology</i> |
| Kevin Larcher | <i>Montreal Neurological Institute</i> |
| Alain Dagher | <i>Montreal Neurological Institute</i> |
| Robert Zatorre | <i>Montreal Neurological Institute</i> |

The “musical chills” response is a well-established phenomenon that characterizes peak emotional responses to music. In this study, we use an innovative combination of ligand-based PET scanning and fMRI scanning to examine the neurochemical and hemodynamic basis of the chills response. We were specifically interested in examining whether the experience of chills is mediated by dopamine release, and if so, when and where in the striatal reward circuit does this occur. The results provide the first direct evidence for endogenous dopamine release in the striatum and converging hemodynamic activity during the chills response. Importantly, we demonstrate a temporally mediated neurofunctional distinction between the dorsal and ventral striatum. During the experience of the chills response, significant dopamine binding and hemodynamic activity is observed in the ventral striatum. However, during the anticipation of the chills response, similar activity is observed in the dorsal striatum. These results have important implications for understanding the reasons why music is pleasurable for humans and may help explain why it has persisted throughout history.

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4:30

White Matters: Investigating the Effects of Musical Training on Temporo-Frontal Fiber Tracts in Children

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|--------------------------|--|
| Gus Halwani* | <i>Harvard Medical School</i> |
| Lin Zhu | <i>Harvard Medical School / Beth Israel Deaconess Medical Center</i> |
| Andrea Norton | <i>Harvard Medical School / Beth Israel Deaconess Medical Center</i> |
| Psyche Loui | <i>Harvard Medical School</i> |
| Ellen Winner | <i>Department of Psychology, Boston College</i> |
| Gottfried Schlaug | <i>Harvard Medical School / Beth Israel Deaconess Medical Center</i> |

Auditory-motor interactions play an important role in vocal output and sensory feedback. A primary structure in this interaction is the arcuate fasciculus (AF), a white-matter fiber tract connecting each hemisphere’s posterior temporal gyrus to its inferior frontal regions. In general, the left AF has been thought to play a crucial role in vocal output in general and in semantic tasks in particular, while the right AF has been implicated in prosodic tasks. We used MR diffusion tensor imaging to examine the development of the AF on both hemispheres in two groups of children: one group participated in regular instrumental music instruction and practice, while the other group did not. Various parameters of the AF (volume, number of fibers, axial and radial diffusivity) were compared between groups in hopes of elucidating the contributions of musical training to the volume and composition of these particular white-matter tracts. The musically trained group of children exhibited increased tract volume, with the lateralization of this effect varying depending on the instrument in which the subject received training. In particular, keyboard players showed increased volume in the left-inferior AF relative to non-musician controls, while the string players showed a tendency towards relatively increased tract volume in the right-inferior AF. Our results support the notion of training-induced white-matter plasticity, providing important information about hemispheric differences in auditory-motor connectivity and how it might be remodeled in individuals that formally learn and regularly practice musical instruments. It appears that musicians whose instrument requires more refined pitch-motor mapping show a stronger right-hemisphere effect while those playing fixed pitch-key instruments show more left hemisphere effects. Further investigations will help answer questions about the direction of causation associated with these observations.

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4:50

Messages from the Dark Side of Pitch Perception and Production**Psyche Loui***
Gottfried Schlaug*Harvard Medical School*
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Human interactions rely on perceiving and producing sounds. For the voice to perceive and produce pitches accurately, the brain must learn to represent, plan, and execute target sounds, to perceive auditory feedback from vocal output, and to match this feedback with its intended representation so as to fine-tune the motor plan in real time. Using psychophysics, neuroimaging, and noninvasive brain-stimulation with normal and tone-deaf (TD) subjects, I will show that neural networks controlling this feedforward-feedback system requires an interaction between bilateral frontotemporal networks. In a first behavioral study, we showed that the abilities to perceive and reproduce pitch height, which are normally effortless and highly correlated, are uncorrelated and disrupted in TD subjects, suggesting a disconnection between perception and production brain regions. This disconnection was confirmed and extended in a diffusion tensor imaging study in TD and control subjects: tractography revealed that the arcuate fasciculus, a white matter bundle connecting temporal and frontal lobes, is reduced in fiber volume among TD subjects, especially in its superior division in the right hemisphere. This disconnection provides support for the importance of frontotemporal interactions not only in language, but in sound perception and production more generally. Finally, to reverse-engineer the perception-production network, we applied transcranial direct current stimulation (tDCS) over superior temporal and inferior frontal regions on both hemispheres during pitch production. Results showed diminished accuracy in pitch matching after stimulation over left inferior frontal and right superior temporal gyri compared to sham stimulation. Taken together, results suggest that intact function and connectivity of a distributed cortical network, centered around bilateral superior temporal and inferior frontal regions, are required for efficient interactions with sounds in the environment.

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5:10

Musical features of intermediate complexity for music recognition**Mihir Sarkar****MIT Media Lab*

In order to understand how people identify music pieces when listening to them we must determine the set of audio features required to do so. We set out to analyze the complexity required of relevant musical features to recognize a particular song from a catalog of Indian instrumental songs. By designing a theory of musical features inspired by the intermediate complexity theory for visual features, we developed a computer program that recognizes music pieces based on high-level musical structures such as notes and tempo of varying complexity. We find that music pieces are recognized after an average of 5 notes, and no better with more information.

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Poster session 2:00 – 3:30

1

Serial memory for lists of spoken items: An examination of talker location and voice changes

Cindy Chamberland*
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In auditory serial memory, performance is markedly impaired if the to-be-remembered (TBR) items are spoken by multiple talkers – the talker-variability effect (TVE; e.g., Goldinger, Pisoni, & Logan, 1991; Hughes, Marsh, & Jones, in press). In a series of three experiments, we tested whether spatially distributing the TBR items can also produce a TVE by examining the effects of both location and voice changes in combination. Within the serial recall paradigm, lists of TBR digits were spoken either in a single or multiple voices, from one or multiple spatial locations. The analysis of recall performance showed that the detrimental effect of location was much smaller than that of voice changes. However, both effects were abolished when participants were required to perform articulatory suppression during presentation of the TBR items. Our findings challenge the item-decay based account of the TVE (Goldinger et al, 1991; Martin et al, 1989) and provide insights into the role of auditory perception in memory.

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2

Algorithm To Measure The Visual And Auditory Evoked Potentials In A Non-Clinical Research Context

Bruno Giesteira*
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University of Porto

This paper aims to describe the algorithm developed in the "Matlab" software with the purpose to measure the Visual and Auditory Evoked Potentials of basic stimuli developed in the fields of visual and audio communication. Here, we present not only the algorithm but also the method that supports part of our research concerning to the acquisition of certain Evoked Potentials signals (visual and auditory) which can be extrapolated to any scientific work with similar goals: to catch similarities of brain response (energy; latency; waveform; et al.) between visual and auditory basic stimuli to enhanced a common and sustained visual and auditory lexicon (framework) to apply on the development of interface devices with display (GUI - "Graphic User Interfaces" and AUI - "Auditory User Interfaces")."

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3

Sensitivity to sequences of time intervals in “speech” and “non-speech” conditions**Simon Grondin***
Nicolas Bisson
Caroline Gagnon*École de Psychologie, U. Laval*
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École de Psychologie, U. Laval

In order to investigate the possibility of having a particularly fine sensitivity to temporal variations with speech stimuli, an experiment was conducted where slight temporal variations were introduced in sentences. In this experiment, there were two types of tempo induced in the stimuli (sentences or tone sequences): 3-3-3-3 or 4-4-4. The sentences were delivered in French (the main language of participants), or in a foreign language (Slovenian), totally unfamiliar to the participants, by one male and one female speaker in each language. At each trial, the standard (St) is presented first, followed by one of the eight electronically accelerated or decelerated comparison stimuli (Co). The results indicate that discrimination, as revealed by the Weber fraction in each condition, was much better in the tone than in speech conditions. Within the tone conditions, having internal rhythms, either 3-3-3-3 or 4-4-4, did not lead to better discrimination than having 11 equal intervals.

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4

The surface is where most of the action is: Impact on observer stability on affordance perception.**Shannon Bechard***
Michael K. Russell*Washburn University*
Washburn University

James J. Gibson (1979/1986) proposed that organism and environment should be considered a single, inseparable unit (O-E mutualism). One could make the argument that the environment within which perceptual judgments are made is as important as the target of perception. This includes the surface underfoot. To determine the importance of the observer-surface relationship on perception, participants wore one of three pairs of shoes. The shoes differed in the degree of resistance between observer and ground (wooden sole, 1-d wheels, swivel wheels). Participants were given the task of determining either the minimum gap size that afforded passage or the maximum height that a surface could be stepped upon. Moreover, judgments were made using either vision or hearing. The impact of shoe, modality, and task were determined. The importance of the surrounding environment is discussed.

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5

Isolating the role of attention sharing from preparation in timing with gaps

| | |
|---------------------------------|-------------------------|
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| Claudette Fortin | <i>Université Laval</i> |

When participants expect a gap in an auditory signal to be timed, produced intervals lengthen as the gap occurs later. This gap location effect (GLE) is attributed to 1) attention sharing between timing and monitoring for the gap signal, and 2) preparation to interrupt timing. Our goal was to specify the contribution of preparatory processes to the GLE. Pregap duration varied either between trials or between blocks of trials in two conditions, the possibility of observing preparatory sequential effects being eliminated in the second condition. In the first condition, the influence of sequential effects was confirmed: produced intervals were longer when the pregap duration was shorter in preceding trials. Produced intervals generally lengthened with increasing pregap duration in both conditions however, showing that the GLE is mainly due to attention sharing before the gap occurrence. Such findings speak of the possible attentional costs related to expectancy in daily situations.

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6

Regulatory fit and performance on the Montreal Battery of Evaluation of Amusia

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|-----------------------|---------------------------------------|
| Samantha Tuft | <i>Bowling Green State University</i> |
| Molly Henry | <i>Bowling Green State University</i> |
| Devin McAuley* | <i>Michigan State University</i> |

Previous research has demonstrated that when an individual's regulatory focus (promotion versus prevention) matches the reward structure of a task (gains versus losses), they are in a state of regulatory fit and general outperform individuals who are in a state of regulatory mismatch (Maddox, Baldwin & Markman, 2006). The present study tested this hypothesis in the auditory domain using the interval subtest of the Montreal Battery of Evaluation of Amusia (MBEA). Musicians and non-musicians were told that they would be given a test that has been shown to be diagnostic of their musical ability. Consistent with the work on regulatory focus theory and the concept of regulatory fit, an interaction was found between musicianship and task reward structure (gaining points for correct answers versus losing points for incorrect answers). Musicians achieved a higher score on the interval subtest of the MBEA when points were lost for incorrect answers, while non-musicians achieved a higher score on the interval subtest of the MBEA when points were gained for correct answers. The results for musicians, in particular, are consistent with the adoption of a strategy that focuses on failure prevention rather than success promotion. Broader implications of this research for assessing effects of musical training on auditory perception will be discussed.

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7

Sure you've got a pretty face, but what does your voice sound like? An investigation of auditory and visual attractiveness

Nicolette Zeller*
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The current study investigated inter-modal perception of attractiveness. What one perceives as physically appealing may be influenced by the individual's appearance as well as by vocal attractiveness. When one is seen as being physically attractive, other qualities of that person will also appear to be favorable (i.e., halo effect). Similar effects have been observed with respect to a person's voice. It is hypothesized that one will match the attractive faces to the attractive voices. In this study, participants viewed pictures of ten males and ten females and rated the attractiveness of each individual. The participants then listened to ten male and ten female voices and rated each of them on attractiveness. Finally, to determine the degree to which facial and vocal attractiveness coincided, participants were given the task of matching faces and voices. The findings will be discussed in light of perceptual accuracy and the potential impact on interpersonal relationships.

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8

Altered Auditory Feedback, Self-attribution, and the Experience of Agency in Sequence Production

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Auditory feedback refers to the sounds one creates during sequence production. Alterations of auditory feedback (e.g., delayed auditory feedback) can disrupt production. However, it is not clear whether altered feedback actually functions as feedback. We addressed this issue by having participants rate the degree to which they experienced altered feedback as resulting from their actions (self-agency). In two experiments, participants performed short novel melodies from memory on a keyboard. Auditory feedback during performance could be manipulated with respect to its pitch contents and/or its synchrony with actions. Participants rated their experience of self-agency after each trial. In the first experiment, participants performed alone. Altered feedback reduced the experience of agency, and was influenced by the relatedness of the feedback sequence to produced actions. Disruption (error rates, slowing) was related to agency, with greatest disruption occurring when feedback yielded an intermediate level of self-agency. In a second experiment, the experimenter performed on a keyboard in view of participants, who were told that sounds could result from either their performance or the experimenter's. This manipulation of exclusivity reduced the experience of agency for only two kinds of altered feedback, suggesting that exclusivity has little effect on agency in sequence production tasks.

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Monolinguals' sensitivity to rhythm in bilingual and monolingual French and English

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English is generally classified as a stress-timed language and French as a syllable-timed language. We investigated whether these rhythmic differences were present in bilinguals' speech and how they influenced listeners' abilities to identify bilingualism. French and English sentences were recorded by proficient bilinguals and by monolingual speakers of each language. Monolingual listeners were presented with pairs of sentences and had to identify which sentence was spoken by a bilingual. Both French and English monolingual listeners achieved successful discrimination of bilinguals from monolinguals, except for one bilingual who was mistaken for a monolingual. In addition, English listeners performed better than French listeners. Acoustical analyses were conducted to identify the rhythmic cues (%V, ΔC , PVI) specific to monolingual and bilingual French and English. Further experiments address listeners' sensitivity to these cues as they tap along with the same speech samples.

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Auditory Dominance in Temporal Memory

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When comparing the relative duration of visual and auditory signals of a same physical duration, humans tend to judge the latter as being longer. This would be due to the fact that auditory signals generate a greater temporal accumulation than visual ones. When mixing both types of signals within an experimental session, the encoded reference is thought to be an average of the visual and auditory accumulations, weighted in favor of auditory ones. As a result, mixing both types of signals has more impact on visual judgments. The aim of the present experiment was to examine the nature of the weighting process that results in auditory dominance. We manipulated the proportion of auditory and visual signals that were presented during a session. We observed that the preponderant influence of audition in determining the memory reference is independent of the proportion of auditory/visual signals presented. That is, the auditory advantage seems to depend on qualitative considerations more than on quantitative rules.

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Visual Perceptual Load and the Attentional Breakthrough of Sound

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It has been claimed that increasing the perceptual load imposed by the focal visual task diminishes distraction by sound. Our experiments showed that making the visual items to be encoded for serial recall more difficult to see reduced the effect of an irrelevant, single, deviant sound. This proved not to be the case, however, with a sequence of changing sounds. These findings help make a bi-partite distinction in the way attentional selectivity can be compromised by sound: attentional capture, a mechanism located at encoding triggered by an unexpected auditory event, that seems to be deactivated when the load on perceptual encoding in the focal task is high. The second is interference-by-process, an ineluctable form of distraction in which the obligatory sequencing of changing-state sound disrupts the post-encoding sequence-planning.

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Effects of Visual Information on Interactive Speech Alignment

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Talkers have been known to unwittingly imitate and align to whom they are speaking. In the past, alignment during conversational interaction has been studied in scenarios in which interlocutors were lacking visual (face-to-face) speech information. Recent evidence has revealed that visual speech can induce speech alignment, and has suggested that visual speech information can act to modulate speech production responses. The present study evaluated the magnitude to which such face-to-face conversation enhances alignment. During an interactive, conversational task, lexical items were recorded from interlocutors. Prior to and following this task, repetitions of the same lexical items were obtained from the talkers in isolation. In an AXB test of alignment, a set of raters judged whether a talker's post-interaction or pre-interaction word was more similar to their respective partner's post-interaction word. The results were then compared to those of an identical experiment, in which the interlocutors were deprived of the visual information for their partner. Preliminary evidence suggests that visual information does enhance interactive speech alignment.

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Exploration of Auditory Novel Distraction and Semantic Processing with Involuntary Attention Capture.

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The current study was designed to investigate the effect of an expected or unexpected sound on performance of a visual perception task. On each trial, listeners were required to indicate whether an arrow presented on a computer screen directly in front of them was pointing to the left or right. The arrow stimulus was immediately preceded by an auditory event which could be either a pure tone, the word 'left' or the word 'right'. The probability that the arrow was preceded by a tone, a congruent word, or an incongruent word was manipulated across experiments. We expect that a congruent word will facilitate classification of the arrow stimulus regardless of whether or not it was expected, and that an incongruent word will slow classification regardless of whether or not it was expected. The results will provide an insight into the extent to which unexpected auditory events may receive semantic processing.

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Mapping listener perception of weapon signature for single-shot impulse fire

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The ability of Soldiers' to identify weapon signature from projectile weapons fire can provide critical information about ones operational environment and can cue potential danger. The present research investigates listener perception for high-quality recordings of single-shot small arms impulse sounds. In the first experiment, fifteen listeners' made similarity ratings for pairings of impulse sounds from a set of four unique tokens each of six different small arms weapons. In the second experiment, listener discrimination ability for contrasted pairs of weapons was measured for 15 listeners in a 2IFC task. Discrimination performance was best, and near ceiling, for handguns contrasted with small arms rifles. Much poorer discrimination performance was found when small arms rifles were contrasted with other rifles, even when there were large differences in projectile caliber. These discrimination results correlate well with an MDS solution based on listener similarity ratings.

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15

Performance of clave rhythms by expert drummers**Grant Baldwin***
David Gilden*University of Texas at Austin*

Previous research on groove rhythm performance has focused on rhythms such as the swing riddim. The present research explores the clave, another regime of groove-music rhythms. In a series of three experiments, expert drummers performed Son clave and 6/8 clave under a variety of synchronization conditions, generating long continuous sequences for each recording. In Experiment 1, drummers performed the Son at four different tempos and with two different metronome pulses, or “feels:” (four-beat pulse or downbeat-only pulse). In Experiment 2, drummers performed the Son at a fixed tempo but with seven different metronome subdivision conditions, ranging from a downbeat-only pulse to a 16-beat pulse. In Experiment 3, drummers performed the 6/8 clave with three different feels: “in four” (with a four-beat pulse), “in three” (with a three-beat pulse), and “in six” (with a six-beat pulse). Data were analyzed using traditional expressive performance measures of timing and velocity, as well as with spectral analysis. Results suggest that tempo influences timing of clave in a fashion similar to swing rhythms, and that feel influences both timing and velocity accent structure.

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16

Brain plasticity associated with auditory processing in the blind**Catherine Wan***
Amanda Wood
Jian Chen
Sarah Wilson
David Reutens*Harvard Medical School / Beth Israel Deaconess Medical Center*
Murdoch Childrens Research Institute
Murdoch Childrens Research Institute
The University of Melbourne
Queensland Brain Institute

Recent imaging research has demonstrated the capacity of the human brain to modify its organisation in response to vision loss. For example, the occipital cortex in blind individuals may become activated during the performance of sound localisation and auditory language tasks. Moreover, enlarged functional representation in the primary auditory cortex has been observed in blind (relative to sighted) individuals. However, no study in the auditory domain has examined whether the extent of brain plasticity varies among individuals blinded at different stages in development. The aim of the present study was to examine brain plasticity associated with auditory processing in blind (n=24) versus sighted (n=16) individuals. First, fMRI was used to examine the presence of cross-modal activation during a pitch discrimination task. Second, volumetric measurements of the primary auditory cortex from MR scans were conducted, to examine whether complete blindness would induce structural changes. Within the blind cohort, individuals with varying blindness onset ages (congenital, early, late) were scanned. Occipital activity was observed in both blind and sighted participants. The extent of occipital activity was significantly greater in the congenitally blind participants, relative to the other blind participants and controls. Furthermore, our volumetric measurements indicate no significant difference in the size of the primary auditory cortex between blind and sighted participants. Our findings provide evidence that cross-modal plasticity is present through the life-span. The extent of this plasticity is greatest in individuals with minimal visual experience.

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Using an auditory-motor mapping therapy to improve expressive language abilities in nonverbal children with autism

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|--------------------------|--|
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Social and communication impairments represent some of the key diagnostic characteristics of Autism Spectrum Disorders. Individuals with autism often show language deficits, which range from almost complete absence of functional speech, to adequate linguistic knowledge but impairments in the use of that knowledge in conversation. The present study investigates the effectiveness of an auditory-motor mapping therapy (AMMT), similar to Melodic Intonation Therapy (MIT) for non-fluent aphasia, in facilitating speech in nonverbal children with autism. The rationale for using this therapy in nonverbal children with autism is based on the observation that they have normal if not enhanced auditory perception abilities and thoroughly enjoy making music both by themselves and in interaction with others. Furthermore, the observation that children with autism can sing, even when unable to speak, is strikingly similar to the dissociation seen in patients with non-fluent Broca's aphasia who can sing the lyrics of a song but are unable to speak the same words. Research in our laboratory has demonstrated the effectiveness of MIT in generating propositional speech in patients with aphasia, suggesting that an adapted intonation-based technique may also benefit nonverbal children with autism. Here, we present a case series of children with autism between 4-8 years of age, who presented with little or no speech prior to receiving our experimental treatment. The intervention consisted of 40 one-on-one AMMT sessions over a period of 8-10 weeks. The dependent variable was the ability to generate meaningful words or phrases. Our preliminary results indicate that AMMT can be effectively used to facilitate meaningful vocal output and even speech in these nonverbal children, and thus, offers an intriguing alternative to traditional speech therapy for children with expressive language impairment linked to autism.

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Perceiving Emotional Arousal in Music Recruits Production Areas

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|--------------------------|--|
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| Robert Rowe | <i>NYU School of Music</i> |
| Juan Bello | <i>NYU School of Music</i> |
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Music has been shown to elicit different emotions in listeners. Although there have been studies showing that pleasurable music elicits activity in networks of the brain associated with pleasure and reward, the neural basis of musical emotion and arousal is not well studied. In particular, the contribution of perception and action networks to the derivation of emotion is a notion that has been theoretically hypothesized (Meyer, 1956) but not empirically tested. To investigate how brain regions that subserve perception and action-production are involved in emotion perception, we present a parametrically designed auditory fMRI study using sparse temporal sampling imaging techniques. 19 subjects listened to 20 different 12-second musical excerpts and made arousal ratings on a four-point scale during sparse-sampled functional MR acquisitions. Musical stimuli varied parametrically in four levels of arousal, which were stimuli taken from behavioral studies (Bachorik et al., 2009) that elicited consistent arousal-ratings from a large sample of subjects. In a control condition, lateralized white noise was presented and participants' task was to rate the laterality of the noise. All music elicited highly significant activity in the superior temporal lobe and inferior frontal gyrus. High-arousal music additionally elicited activation over low-arousal music in right superior temporal gyrus, superior temporal sulcus, and amygdala. The superior temporal gyrus and superior temporal sulcus are known to subserve auditory perception, categorization, and association. While the inferior frontal gyrus is generally involved in sound sequencing and production, and the amygdala is a known center for fear conditioning and emotion processing. The coactivation of superior temporal and inferior frontal areas during the perception of emotional arousal in music suggests that the perception of musical emotion emerges from an interaction of brain areas that subserve perception and production.

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The perception of temporal segmentation of sound patterns

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| Minhong Yu* | <i>University of Virginia</i> |
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The temporal segmentation of a continuous sensory stream into a series of recognizable events is a fundamental problem facing perceptual systems. The current study is trying to formulate a theory to predict auditory segmentation. We use binary auditory necklaces as our stimuli to study auditory segmentation. Each necklaces contain two kinds of beats: notes or rests (silence). For example, the string 10101100 stands for an eight-beat necklace, in which 4 audible beats (1s) are notes and the others (0s) are rests which are silent. Different from previous studies which require participants to synchronize responses with notes, we devised new methods in the current experiments to avoid participants' synchronization effort. In the current method, as soon as the auditory necklace begins, a circular array of icons, in the form of colored shapes, appears. During each beat (regardless of whether the beat was a note or a rest) one of these icons highlighted. Thus the participant sees this highlight moving sequentially clockwise around the circle of icons. Their tasks are clicking on the icon which correspond to the note they perceived as the start of the rhythm. By exhaustively exploring all necklaces with length less than or equal to 8, we have the data to produce a comprehensive model of necklace segmentation.

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A Perceptual Sound Retrieval and Synthesis Engine

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Sound designers, audio professionals, and musicians often spend time and energy looking for the right sound for a particular piece of music or sonic environment. Current sound synthesizers either contain numerous sound presets that are laborious to parse, or batteries of parameters to tweak without straightforward connections to one's intuitive expectation. We propose a sound retrieval and modification engine based either on everyday words like "bright," "warm," and "fat," or on another sound recording. The perceptual sound synthesis engine is informed by a survey of musicians and listeners worldwide and can also be customized. This system allows dynamic tagging of sound material from online libraries, and "sound sculpting" based on common verbal descriptors instead of obscure numerical parameters.

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Age and experience as determinants of sensitivity to shifts in tonality in South Indian Classical (Carnatic) music.

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The present study investigated whether sensitivity to tonality shifts (modulation) in South Indian Classical (Carnatic) music varies with musical experience and age. Carnatic music has two kinds of tonality shift: grahabēdham (shifts of tonal center) and rāgamālikā (shifts of rāgam/scale, retaining tonal center). Stimuli included 45 rāgamālikā and 10 grahabēdham shifts. Thirty Carnatic teachers, students, and untrained listeners (rasikās), under or over the age of 60, participated. Participants indicated the points at which modulations occurred, scored in terms of accuracy and response time. With rāgamālikās, teachers and students across both ages, and the younger rasikās, performed quickly and accurately. With grahabēdhams, the younger rasikās were fastest and most accurate. The older rasikās, in both conditions, were slower and less accurate. The more experienced groups across age levels were highly consistent with both types of modulation. These results indicate that applied knowledge of music facilitates preservation of musical skills with aging.

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Do Metrical Accents Create Illusory Phenomenal Accents?
Bruno Repp**Haskins Laboratories*

If music is perceived within a particular metrical framework, events coinciding with the main beat are perceived as accented. Are these metrical accents purely cognitive constructs, or do they create illusory phenomenal accents (actual differences in perceived loudness or duration)? In this study, musicians tried to detect a small increase or decrease in the loudness or duration of a single tone in a 12-tone melodic sequence while giving that sequence one of three metrical interpretations that differed in beat phase. Effects of metrical accentuation were found in all four detection tasks, but their pattern reflected a combination of sensitivity enhancement, presumably due to increased attention in beat positions, and negative bias, presumably due to violation of expectations about phenomenal accentuation of beat events. Thus, metrical interpretation does interact with auditory perception, but apparently not by creating illusory phenomenal accents.

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Unmasking the role of masking in the attentional blink through the perceptual organization of sound

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Key to our understanding of the temporal limits of attention as reflected in the attentional blink (AB)—the failure to report the second of two targets (T1 and T2) presented in close succession—is the detrimental impact of post-target distractors, typically accounted for by the construct of masking. Within the context of the auditory AB, we present two lines of evidence that question the notion of masking as a causal factor of the AB. First, we show that perceptually isolating the T2+1 distractor—by presenting it either contralaterally to or at a much higher pitch than the rest of the sounds—produces larger ABs. Second, we demonstrate that the AB is abolished when the perceptually isolated T2+1 distractor is captured by (i.e., perceptually grouped with) an additional induction sequence of irrelevant tones. Such findings are consistent with a selection-based approach to the AB that emphasizes failure of inhibition and misselection.

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Auditory feedback and melody switching in music performance

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We report research that addresses whether auditory feedback associated with a learned action sequence can enhance retrieval of that sequence. Participants learned two different melodies that were performed from memory at the keyboard. While performing, participants would either hear feedback from the melody they were performing, or from the other learned melody. An additional auditory cue sounded on each trial which could either signal the participant to switch melodies or to continue with the current melody. There was a tendency for participants to pause during events that followed the cue, regardless of cue type. Hearing feedback from a potential switch melody caused participants to pause longer (but not to switch) after the “continue” cue, relative to trials in which participants heard the melody that they performed, but did not influence behavior on “switch” trials. This result suggests that auditory feedback can trigger a learned action sequence such that participants find it difficult to inhibit a switch to the sequence associated with auditory feedback.

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Absolute pitch: The pitch of voices is difficult to identify

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Approximately 200 individuals with empirically verified absolute pitch (AP) completed an on-line test of AP ability. The test had four blocks that corresponded to four different timbres: piano, sine wave, voice, and synthesized voice. Each block had 24 trials, corresponding to all chromatic tones between A3 and G#5. Participants’ task was simply to name the tone (the pitch chroma). Semitone errors were considered correct. As in previous research, performance was better among participants who started music lessons by age 7 compared to other participants, and for piano tones compared to sine waves. Two novel findings also emerged: (1) performance was better in the two nonvocal blocks (piano, sine wave) than in the two vocal blocks (voice, synthesized voice) but it did not differ between the voice and the synthesized voice, and (2) participants whose first instrument was piano scored higher than other participants across the four timbres. The findings suggest that AP-possessors’ difficulty with identifying the pitch of voices cannot be attributed solely to vibrato--which was much more pronounced for the natural than for the synthesized voice--perhaps because voices are inextricably associated with meaning. The results also suggest that AP abilities are enhanced if one begins taking music lessons on a fixed-pitch instrument early in childhood.

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A study of emotional reactions induced by manipulating a sonically augmented interactive device

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Sounds have the power to influence listeners' emotional reactions. Whereas many studies have shown that sounds alone can influence emotional reactions, manipulating a sounding object with a specific purpose probably also influences the affective reactions of the user, depending on how easy, disturbing, rewarding, comfortable, etc. is the interaction with the object through the sounds.

In this study, we use an interactive object augmented with sounds. It consists of a glass embedded with a tilt sensor allowing it to control the generation of impact sounds when tilted. It implements the metaphor of a glass full of virtual balls that may be poured out.

Two questions are here addressed in two experiments: 1. Can the relationships between sound parameters (naturalness, sharpness and tonality) and emotional reaction found in other studies [Västfjäll et al., 2003] be generalized to impact sounds? 2. Are these relationships modified when the users, instead of passively listening to sounds, are generating the sounds by continuously interacting with an object? In a first experiment, participants were required to passively watch a set of videos displaying a user pouring virtual balls out of the glass. Different ball sounds were created that vary along the three aforementioned parameters. The participants had to report their feelings (using Valence, Arousal and Dominance scales). In a second experiment, other participants had to actively play a game, that of using the Flops to pour exactly 10 balls. Different difficulty levels were set, and three ball sounds were used. These participants had to similarly report their feelings after the task. Overall, these studies confirm the relationships between the investigated sound parameters and the reported feelings. Yet in the case of manipulation, feelings were mainly influenced by the difficulty of the task, the different ball sounds still had an influence on the valence of the feelings.

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Attention captured - What constitutes a good alarm?

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Most high risk occupations involve a stressful environment and auditory alarms designed to capture operator's attention and alert them about potential incidents. Most studies on auditory alarms have been conducted using subjective measurements to explore, for example, perceived urgency, highlighting factor such as the spoken intonation as important. The present study aimed to investigate the effect of intonation and valence on behavioral performance in using a cross-modal oddball measuring the involuntary capture of attention by sound. Participants judged if visually presented digits were odd or even while exposed to task-irrelevant sounds. In 80% of the trials, a sine wave tone (standard) preceded each digit, while on 20% of the trials the standard was replaced by a spoken word (novel). Novels varied in semantic valence (negative versus neutral) and intonation (urgent versus calm). Subjective ratings of perceived "urgency" and "attention grabbingness" were subsequently collected for these words from the same participants. The results revealed that, compared to the standard condition, all novels increased accuracy slightly and equally. Response latencies proved more sensitive, however, yielding a reduced distraction effect for urgent than non-urgent words, while the words' valence had no impact. The results from the subjective ratings on the other hand showed that both the words urgency and content increased significantly perceived "urgency" and "attention grabbingness". In conclusion, some of our findings fit well with alarm studies on alarms using subjective ratings and their assumption that subjective ratings are valuable for the design of better alarms. However, our results also highlight the lack of correspondence between subjective and objective measures of attention capture with respect to the words' content.

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Laminar cortical dynamics of conscious speech perception

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How are the laminar circuits of neocortex organized to generate conscious percepts of speech and language? How does the brain restore information that is occluded by noise using the context of a word or sentence? How is the meaning of a word or sentence linked to such a restoration process? Phonemic restoration exemplifies the brain's ability to complete and understand speech and language in noisy environments. Phonemic restoration can occur, for example, when broadband noise replaces a deleted phoneme from a speech stream, but is perceptually restored by a listener based even on subsequent context. A laminar cortical model clarifies how a conscious speech percept develops forward in time even in cases where future events control how previously presented acoustic events are heard. The model predicts how a resonant wave of activation occurs whose attended features embody the consciously heard percept. These resonance properties enable rapid and stable language learning. Supported in part by CELEST, an NSF Science of Learning (SBE-0354378) and by the DARPA SyNAPSE program HR0011-09-3-0001 and HR0011-09-C-0011).

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