APCAM 2014

13th Annual Auditory Perception, Cognition, and Action Meeting

Thursday, November 20th

Hyatt Regency Long Beach Hotel

Long Beach, California

Program sponsored by

WASHBURN UNIVERSITY

Welcome to APCAM 2014

Let us be the first to welcome you to (the Hyatt Regency Long Beach Hotel in) Long Beach, California, site of the thirteenth annual Auditory Perception, Cognition, and Action Meeting (APCAM 2014). From its inception APCAM has pursued a unique mission: ". . . to bring together researchers from various theoretical perspectives to present focused research on auditory cognition, perception, and aurally guided action". We believe it to represent one of the only meetings where within a single session you will find a mixture of both basic and applied auditory research, reflecting different types of theoretical models, varying levels of processing accounts, and all manners of stimuli (including speech, music, and environmental noises). We believe that the fact that APCAM is in its thirteenth year is a testament to the openness of its attendees to hear other perspectives, a principle characteristic of scientific progress.

Successful preparation of this year's APCAM would not have been possible without generous contributions of time and money from several sources. Primary among these is the Psychonomic Society, which, for several years now, has continued to cover all the expenses associated with meeting rooms, A/V equipment, and poster displays. Elimination of this major expense is the principle reason that we are able to provide APCAM as a free event. The society continues to cover room and equipment costs for its satellite meetings because it is believed that those meetings represent added value to the larger society conference. Thus, it is hoped that you also will be sure to attend the subsequent meeting of Psychonomic Society and enjoy its packed program as well. You should feel free to pass along gratitude to society leadership for helping to make APCAM available at no cost. We also want to express our gratitude to Washburn University, which, for several additional years, has absorbed the responsibility and costs associated with formatting and printing APCAM conference programs. Likewise, the committee extends its thanks to Kristopher (Jake) Patten for his help in reviewing abstract submissions again this year.

It should be clear that it takes a lot of people to arrange this event each year, and it is our hope that their efforts translate into a positive and rewarding meeting for you, its attendees. Ultimately, however, its success depends upon the strength of the program and ensuing discussions that you helped to generate. We hope that you concur that this year's program delivers a collection of novel and thoughtful work. Thank you to all presenters for choosing to share your work with us.

APCAM's vitality has depended largely on attendees sharing information about the conference with their colleagues by word of mouth. We therefore kindly ask that if you enjoy your APCAM experience, then please pass that information along to other colleagues and bring them to our next meeting (slated for Chicago, Illinois on November 19, 2015). In this way our shared meeting can remain vibrant and continue to grow.

Additionally, if there are issues that arise during the meeting, or thoughts that you have for further enriching the program or its execution in the future, then please do not hesitate to share those concerns or thoughts with any of us on the committee at any point. We welcome your feedback. For now, have a pleasant and productive day at APCAM.

Sincerely,

The APCAM 2014 Organizing Committee
Michael D. Hall (Chair)
Devin McAuley
John Neuhoff (Founder)
Peter Q. Pfordresher
Mike Russell

APCAM 2014 Schedule

8:00	**Registration – Regency Ballroom H, Hyatt Regency (Upper Level – 4th floor)**	
8:30	**Opening Remarks**	
	Pitch & Melody (abstracts pages 8 – 9)	
8:40	Rising pitch accelerates and falling pitch decelerates: An effect of representational gravity on perceived auditory motion	**Timothy L. Hubbard**
9:00	Nobody sings in tune, and what that means for the origins of tonality	**Peter Pfordresher** **Steven Brown**
9:20	Encoding of staggered polyphonic musical motives: The effects of time-offset between motif entries on mismatch negativity (MMN)	**Madeline Huberth** **Takako Fujioka**
9:40	A Day Reconstruction Method study of musical emotion in everyday life	**Daniel Vastfjall** **Marie Helsing**
10:00	**Break (20 mins)**	
	Invited Address (abstract page 10)	
10:20	***The Effectiveness of Increasing and Decreasing Amplitude on Localizable Auditory Warnings***	***Thomas Z. Strybel*** ***Mary Ngo***
	Temporal Aspects of Music (abstracts page 11)	
10:50	Attention, density, and coherence in musical time estimation	**Rhimmon Simchy-Gross** **Elizabeth Margulis**
11:10	Drumming and tempo: The effects of loudness change on tempo perception and action	**Adam Johnson** **Michael McBeath** **K. Jakob Patten**

Poster Session (11:45 AM – 1:15 PM) Grand Ballroom (located in the Long Beach Convention Center) Abstracts located on pages 17 – 26		
Lunch (1:15 – 2:00 PM)		
Invited Address (abstract page 13)		
2:00	***The Multisensory Revolution: Implications for Auditory Event Perception***	***Lawrence D. Rosenblum***
Speech (abstracts page 14)		
2:30	Categorical perception for speech based upon rapid frequency changes	**Michael Hall John M. Hollander Rachael Bryson**
2:50	Validating the use of an online platform to collect spoken word recognition data	**Julia Strand Joseph Slote**
3:10	**Break (20 min)**	
Perception – Action & Attention (abstracts pages 15 – 16)		
3:30	Using auditory noise to reduce postural sway in standing adults	**Jessica Ross Anne Warlaumont Lilly Rigoli Ramesh Balasubramaniam**
3:50	Multi modal target localization and body roll	**Patrick M.B. Sandor David Hartnagel Christophe Bourdin Alain Bichot Martine Godfroy-Cooper**
4:10	The frontal midline Θ rhythm as a psychophysiological index of listening effort	**Matthew Wisniewski**

4:30	Musical change deafness across languages, voices, and reverb	**Michael Gordon Alejandro Ataucusi Daniel Kobylarz Benjamin Ciccarelli Andrew Lucila**
	Discussion	
4:50	Program-related publication	**Michael D. Hall Devin McAuley John Neuhoff Peter Q. Pfordresher Mike Russell**
5:20	**Closing Remarks**	

Posters (abstracts located on pages 17 – 26)		
1	**When nature calls: Natural regularities guide human perceptual biases**	**Zachary Wilkinson Michael McBeath K. Jakob Patten**
2	**Impact of environmental obstruction on judgments of sound source distance**	**Michael K. Russell Kelsee Wright**
3	**Auditory feedback of movement alters visual afterimage of an object**	**Brian W. Stone Jessica Tinker**
4	**The role of semantic processing in the allocation of auditory attention when presented with competing acoustic stimuli**	**John McGee Charlie Cullen**
5	**“Feel the joy”: A significant role of a “bass sound” in today electronic music, from Favela Funk in Brazil to an analogue synthetizer scene and a Bass scene in Los Angeles**	**Lenka Moravkova**
6	**Studying the cognitive connections between auditory and visual perception and their applications in music, art, and new media**	**Olena Anisimova**
7	**Can Hebb be distracted? The impact of different forms of auditory distraction on sequence learning.**	**Francois Vachon Alexandre Marois Jean-Denis Thériault Katherine Labonte Maxime Legendre**
8	**Factors that influence ear witness identification**	**Heather Rodd Jason Leboe-McGowan Launa Leboe-McGowan Doug Alards-Tomalin**
9	**Tracking modulations to the dominant in classical minuets: A concurrent probe-tone study**	**W. Dowling Rachna Raman Barbara Tillmann**
10	**Deviant sounds does not capture attention when presented among, and simultaneous as, standard vibrations**	**Erik Marsja Greg Neely Fabrice Parmentier Jessica Körning-Ljungberg**

11	**Performance pressure enhances novel speech category learning**	**Seth Koslov Todd Maddox Bharath Chandrasekaran**
12	**Electrophysiological correlates of the effect of distal speech rhythm on word learning**	**Katherine Jones Tuuli Morrill Jason Moser Lisa Sanders J. Devin McAuley**
13	**Skull Music: Spectral filtering by the skull influences musical listening preferences**	**Jitwipar Suwangbutra Michael Hall Michael Gordon**
14	**Is 9 louder than 1? An audiovisual cross-modal interaction between number magnitude and sound amplitude**	**Alexander Walker Doug Alards-Tomalin Launa Leboe-McGowan**
15	**Affective influences on musical memories**	**Alejandro Ataucusi Michael Gordon**
16	**An evaluation of the role of vowel formant frequencies and vowel duration on the perception of foreign accent.**	**Kit Ying Chan Michael Hall Ashley Assgari**
17	**Dichotic listening is tough, and only gets tougher: Impact of attentional control on dichotic listening in young and older adults.**	**Chad Rogers Lisa Payne Sujala Maharjan Robert Sekuler Arthur Wingfield**
18	**Superior fluid cognition in musicians compared to non-musicians**	**Katherine Moore Jim Meyer Stephanie Willette**
19	**The effect of cadences on harmonic expectancy**	**Brooke Okada Robert Slevc**

Oral Presentations

8:40

Rising pitch accelerates and falling pitch decelerates: An effect of representational gravity on perceived auditory motion

Timothy L. Hubbard

An auditory target ascended or descended in pitch at a constant velocity, and participants rated whether pitch velocity decelerated, remained constant, or accelerated. Ascending auditory pitch motion was judged as accelerating, and descending auditory pitch motion was judged as decelerating. This pattern was stronger if auditory pitch was in a high frequency range or if auditory velocity was faster, and presentation of a concurrent visual stimulus that ascended or descended in the picture plane had minimal influence on ratings of auditory motion. The data appear to reflect a combination of actual auditory velocity and expectations regarding ascending or descending motion that are based on experience with movement of physical objects. More specifically, an ascending physical object in physical space would be expected to decelerate, and so an ascending auditory target that maintained a constant velocity in frequency space would be perceived as accelerating (as a constant velocity would appear increasingly faster than the expected deceleration). Similarly, a descending physical object in physical space would be expected to accelerate, and so a descending auditory target that maintained a constant velocity in frequency space would be perceived as decelerating (as a constant velocity would appear increasingly slower than the expected acceleration). The data are consistent with previous findings and suggestions that (a) constant visual velocity is not perceived as constant, (b) representational gravity influences representation of auditory pitch, (c) the vertical dimension of auditory frequency space maps onto the vertical dimension of visual physical space, and (d) perception of constant velocity requires stimulus motion to correspond to natural object motion. An account involving an amodal spatial representation that incorporates information regarding the implied direction of gravitational attraction is suggested.

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9:00

Nobody sings in tune, and what that means for the origins of tonality

Peter Pfordresher *University at Buffalo, The State University of New York*
Steven Brown *McMaster University*

Theories of the origin of tonality from the time of Pythagoras onward have assumed that musical intervals are defined precisely, as based on mathematical principles. In fact, “musicality” in performance has often been operationalized with respect to adherence to such mathematical tuning principles. Virtually all such theories are based on tunable instruments, such as strings or pipes. However, tuning principles have only rarely been examined using vocal data, despite the fact that the voice is the most ancestral and universal musical instrument used by humans. In the present study, we analyzed the tuning of sung musical intervals, doing so across both highly trained and untrained singers. In contrast to the precision of intervals seen with musical instruments, we found that sung intervals are extremely broad, showing marked overlap with neighboring interval categories. We consolidate these results into a model of tonality based on both motor and sensory factors that contribute to the formation of sung melodies.

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9:20

Encoding of staggered polyphonic musical motives: The effects of time-offset between motif entries on mismatch negativity (MMN)

Madeline Huberth *Stanford University*
Takako Fujioka *Stanford University*

In music, a motif often repeats in different melodic lines. Previous event-related potential (ERP) studies have shown that the mismatch negativity (MMN) reflects simultaneous encoding of different melodic lines in the memory trace, as well as observed the time limits for maintaining such encoded information. However, occasionally motif entrances occur before the conclusion of the previous motif. No studies have examined how MMN is influenced by the time interval between motif entrances and by motif presentation in multiple melodic streams. Here we specifically investigated whether repeated motif presentation across two separate voices is encoded as a single entity or two separate entities, and whether motives overlapping in time impede or enhance the strength of encoding. We recorded the electroencephalogram (EEG) from 12 musicians, using a 5-note motif repeated with varying its entry pitch level and the number of overlapping notes. For 18% of trials, the 5th note was a contour changing deviant. The 'one-voice' arrangement used a half-octave range for the motif entry pitch, while in the 'two-voice' arrangement, alternating motives were moved one octave lower. In both cases, the entrances overlapped by two notes, or none (e.g., silence in between). With zero-note overlap, MMN in frontal electrodes was larger in the one-voice compared to the two-voice condition. This suggests that even if the same motif is repeated, presenting them across the two voices makes its encoding specific to each voice. In contrast, with motives overlapping by two notes, no significant frontal MMN was observed, while differences between standard and deviant ERP were significant in the centro-parietal electrodes for both voice conditions. Moreover, the N1 peaks were significantly delayed compared to those in zero-overlap conditions. These observations suggest that different memory processes in the auditory cortex are active when melodies are temporally concurrent.

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9:40

A Day Reconstruction Method study of musical emotion in everyday life

Daniel Vastfjall *Linkoping University*
Marie Helsing *Linköping University*

Only a few studies have been done of the prevalence of musical emotions in everyday life. Previous studies of musical emotions have used either a small number of participants reporting a large number of episodes (Juslin, Liljeström, Västfjäll, Barradas & Silva, 2008), or a large number of participants reporting a small amount of episodes (Juslin, Laukka, Liljestöm, Västfjäll and Lundqvist, 2011). In the present study, we used the Day Reconstruction Method (DRM) to collect a large sample of episodes, musical and nonmusical. The DRM made it possible to examine music listening behaviors, emotions experienced in response to music, and emotion regulation behaviors, as if they occurred in real life. The results showed that music occurred in approximately a third of all the episodes, and that participants reported experiencing emotions to the music in 67 % of those cases. Similarly to previous findings, positive emotions were more often experienced than negative when music occurred. By comparing musical and nonmusical episodes we could identify emotions that were more common when music occurred. The emotion regulation strategy factor "Music specific regulation" was the second most frequently used strategy, and the most intensively used. Music was related to lower stress levels, and higher general and social health scores. The use of 'Music specific regulation' was related to less stress. Liked and self-chosen music was related to both stress and health (general and social) which supports the claim that musical preferences are of great importance for the responses to music.

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10:00 Break (20 mins)

10:20

Invited Address

The Effectiveness of Increasing and Decreasing Amplitude on Localizable Auditory Warnings

Thomas Z. Strybel *California State University, Long Beach*
Mary Ngo *Pacific Science and Engineering Group*

Catchpole, McKeown and Withington (2004) described three dimensions of information that can be conveyed by auditory warnings and alarms, meaning, urgency and location. We evaluated the effectiveness of dynamic amplitude changes on the urgency and localization of auditory warnings in a series of experiments to evaluate the efficiency at which auditory cues changing in amplitude (constant, decreasing/receding, or increasing/looming) facilitated participants' visual search performance. Cue effectiveness was assessed in visual search tasks in which one or two auditory warnings were presented in different experiments, and these signaled one or two visual targets in a clutter visual field. We also examined the interaction of amplitude changes, pulse rate and harmonicity because these factors are known to affect the perceived urgency of auditory warnings.

When a single cue and target were presented, we found no effects of amplitude, harmonicity or pulse rate on visual search latency. When two cues were presented, each signaling the location of one of two visual targets presented, targets signaled by decreasing amplitude cues were identified first and produced the fastest search latencies. When two cues were presented, one valid (signaling a target) and one invalid (signaling a distractor) dynamic amplitude cues produce faster search latencies than constant cues. These results will be discussed with respect to designing effective auditory alarms, especially when multiple alarms are possible.

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10:50

Attention, density, and coherence in musical time estimation

Rhimmon Simchy-Gross *University of Arkansas*
Elizabeth Margulis *University of Arkansas*

Decades of work have illuminated much about time perception and the estimation of duration. Filled intervals are judged as longer than empty intervals (Thomas & Brown, 1974). Incoherent stimuli are judged as longer than coherent stimuli (Boltz, 1995). What remains unknown is whether these effects depend on attention. This study aims to explore the role of attention on the time-estimation effects of density (the degree to which a temporal interval is filled with events) and coherence (the degree to which the events within the temporal interval cohere into a stable structure) in music. Concurrent non-temporal processing randomly varied between subjects, where participants either judged musical excerpt durations (single-task), or did so while simultaneously completing a visual-search task (dual-task). Composed musical excerpts randomly varied within subjects by density (low; medium; high) and coherence (coherent; incoherent; repeated). Verbal estimation and reproduction judgements measured perceived duration. Overall, the dual-task group judged the excerpts as shorter than the single-task group. In the single-task group, low-density excerpts were judged as shorter than medium- and high-density excerpts, and coherent excerpts were judged as shorter than incoherent and repeated excerpts. Interestingly in the dual-task group, repeated excerpts were judged as longer than both coherent and incoherent excerpts. These results suggest undivided attention is essential for the time-estimation effects of density and coherence and, since schematic expectations are automatic (Bharucha, 1994), the effect of coherence is due to memory-based chunking mechanisms (Poynter, 1989) rather than attention-based expectancy mechanisms (Tse, 2004). Future work explores the role of expectations in musical excerpt duration judgements.

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11:10

Drumming and tempo: The effects of loudness change on tempo perception and action

Adam Johnson *Arizona State University*
Michael McBeath *Arizona State University*
K. Jakob Patten *Arizona State University*

There is a common belief in the realm of music that acoustic intensity and tempo are positively related. The current study explores this relation, examining the tempo perception and tempo production of skilled versus novice percussionists. Two experiments tested five hypotheses, three perceptual (Experiment 1) and two motoric (Experiment 2): H1) As actual tempo changes, listeners perceive those changes with relative accuracy; H2) Changes in acoustic intensity distort perception of tempo; H3) Both skilled and novice percussionists display this perceptual distortion; H4) When producing intensity changes on a drum pad, novice percussionists unintentionally distort their playing tempo; H5) When producing intensity changes on a drum pad, skilled percussionist do not distort the tempo. In Experiment 1, participants listened to metronomes that gradually changed in intensity and/or tempo and identified the direction and magnitude of their perceived tempo change using a computer mouse. Our findings verify that both percussionists and non-percussionists perceive tempo changes with relative accuracy (H1). We found that both groups display a perceptual bias that distorts perceived tempo changes due to intensity changes (H2, H3). In Experiment 2, participants produced various tempo and intensity changes on a drum pad. We found that novice percussionists altered their performed tempos due to changes in intensity (H4), whereas skilled percussionists did not (H5). Our general findings support that listeners integrate tempo and intensity perceptually and when playing percussion instruments; however, experience with percussion reduces the production effect. We propose this perceptual bias to integrate dimensions exists because it is beneficial in auditory scene analysis. If acoustic intensity and tempo change together in nature with some regularity, having auditory perceptual mechanisms that assume this correlation can help listeners track and parse sounds in the auditory scene.

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Poster Session (11:45 AM – 1:15 PM)
Grand Ballroom (located in the Long Beach Convention Center)
Abstracts located on pages 17 – 26

Lunch (1:15 – 2:00 PM)

2:00

Invited Address

The Multisensory Revolution: Implications for Auditory Event Perception

Lawrence D. Rosenblum *University of California, Riverside*

Multisensory research has burgeoned over the last 15 years, and much of this work has shown that the senses always work together, and that the perceptual brain is designed around this fact. Perceptual phenomena once considered to be largely the purview of a single sense have now been shown to be influenced by other senses. Likewise, areas of the brain that have been thought to be receptive to unimodal input, are now known to be modulated by crossmodal input. Interestingly, this research often shows that the multisensory primacy of perception is organized around distal event properties, a fact that could have critical implications for more action-oriented accounts of perception. In this talk, I will argue that the science of auditory event perception would benefit from consideration of how audition fits in multisensory perception. Supportive examples will be drawn from our own research on multisensory speech and speaker perception. I will suggest that fundamental principles of auditory event perception such as its mechanism, informational support, and parameters of learning, be considered in a multisensory context.

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2:30

Categorical perception for speech based upon rapid frequency changes

Michael Hall *James Madison University*
John M. Hollander *James Madison University*
Rachael Bryson *James Madison University*

Categorical perception (CP) is perhaps the best known phenomenon in speech perception, having traditionally been associated with claims concerning phonetic modularity (e.g., see Harnad, 1987, for a review; for some nonspeech demonstrations, see Miller, Weir, Pastore, Kelly & Dooling, 1976; Burns & Ward, 1978). Yet, a unified explanation, including why CP has only been observed in certain stimuli, has not been established. The current investigation evaluated one potential general explanation derived from the perception of frequency transitions and glides (Nabelek, Nabelek, & Hirsh, 1970; Schouten, 1985)—that listeners can only derive limited information in response to rapid changes in frequency. Three experiments sought to address this possibility using traditional identification and discrimination tasks. Experiment 1 included /ba/-/da/ continua that varied F2 onset frequency as a function of the corresponding steady-state (1,200, 1,400, or 1,600 Hz), revealing sharp labeling boundaries and corresponding discrimination peaks that were determined by transition direction. Experiment 2 varied rates of frequency changes by combining the 1,200 Hz continuum from Exp. 1 with continua that equated vowel and consonant durations both by reducing vowels (to 30 ms) and extending consonants (to 125 ms). Evidence of binary boundaries with changes in transition direction was observed across all continua except those with lengthened transitions. Although a few individuals showed categorical responses to longer transitions, these suggested a third category, indicating greater access to transition details. Analogous nonspeech (single-formant) conditions also were included in both experiments, but did not reveal CP. CP evidence was obtained in Experiment 3 when using sinusoidal equivalents to F2 manipulations from Exp. 1, but with a shorter steady-state to improve chances of reliably assigning labels to perceived glide direction. Taken together, these findings suggest that rapid changes in frequency can be sufficient to produce CP. Theoretical implications and suggestions for future research will be discussed.

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2:50

Validating the use of an online platform to collect spoken word recognition data

Julia Strand *Carleton College*
Joseph Slote *Carleton College*

Models of spoken word recognition typically make predictions that are then tested against word recognition scores of human subjects (e.g., Luce & Pisoni, 1998). Collecting word recognition data can be extremely time-consuming for researchers and tedious for participants. Recently, some labs have begun to explore methods for using online sources such as Amazon's Mechanical Turk (mTurk) to collect data (Buhrmester, Kwang, & Gosling, 2011). Due to its distinct advantages in participant availability, diversity, and cost, mTurk is an attractive platform for data collection. Many classic findings in cognitive psychology have been successfully replicated online, including the Stroop effect, task-switching costs, Simon task, and Flanker task (Crump, McDonnell, & Gureckis, 2013). The current research evaluated the use of mTurk for collecting spoken word recognition data and auditory lexical decision data. Although users online were faster and less accurate overall than participants in the lab, the results revealed very strong correlations ($r = .84 - .91$) between online and laboratory measures for both word recognition accuracy and lexical decision latency. In addition, scores obtained online and in the lab were equivalently correlated with factors that have been well established to predict word recognition including word frequency, phonological neighborhood density, and length.

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3:10 Break (20 mins)

3:30

Using auditory noise to reduce postural sway in standing adults

Jessica Ross *University of California, Merced*
Anne Warlaumont *University of California, Merced*
Lilly Rigoli *University of California, Merced*
Ramesh Balasubramaniam *University of California, Merced*

While the role of the visual and vestibular systems in the control of balance is better understood, the role of the auditory modality is much less explored. In this study, we set out to examine the effect of periodic and randomly varying auditory stimulation on postural fluctuations. Uncorrelated auditory noise and musical stimuli were presented to 40 participants through headphones. Postural fluctuations and body kinematics were measured using a force platform in conjunction with a 3D motion capture system. Variability of sway was reduced in noise conditions when compared with silent and music conditions in musically untrained participants. Stochastic resonance describes the amplification of signals with the addition of noise in threshold-based systems, including sensory systems. Our results support the theory that stochastic resonance can contribute to auditory feedback mechanisms that aid in standing balance, a phenomenon previously reported in the use of somatosensory feedback. Auditory noise should be explored as a possible tool for enhancing environmental feedback important for motor system function, and specifically for improving balance.

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3:50

Multi modal target localization and body roll

Patrick M.B. Sandor *IRBA Institut de recherche Bimédicale des armées*
David Hartnagel *IRBA Institut de recherche Bimédicale des armées*
Christophe Bourdin *ISM UMR-7287 Aix-Marseille Université*
Alain Bichot *IRBA Institut de recherche Bimédicale des armées*
Martine Godfroy-Cooper *San Jose State Univ Foundation, NASA Ames Res Center*

Seated in a tilted-room in darkness, seven participants made repeated head-free, open-loop, egocentric localizations of visual, 3D virtual auditory, and bimodal visual-auditory targets projected randomly across a two-dimensional (2D) hemispherical frontal field. Between sessions, roll-body orientation in space was modified at very low under-threshold velocity (~5°/min) to ensure it was infraliminal, i.e. not consciously perceived by the participant. Target localization was performed using a handhold-pointing device under three different body-roll orientations (6° to the left, 0° and 6° to the right), under the hypothesis that infraliminal modifications of the gravity vector would nevertheless affect localization performance. Preliminary results suggest that auditory and visual maps of 2D egocentric space differ both in terms of precision (variability of the responses) and accuracy (closeness of the responses) as a function of direction and eccentricity of the targets. The effect of body-roll orientation on target localization was found to be 1) modality-dependent and 2) eccentricity dependent in the dimension of elevation. Inter-individual differences in auditory localization performance were reported with four participants unable to determine target elevation. The differential effect of body-roll as a function of the modality of presentation of the target is discussed in relation with stimuli characteristics and sensorimotor transformations.

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4:10

The frontal midline Θ rhythm as a psychophysiological index of listening effort

Matthew Wisniewski *Air Force Research Laboratory*

Psychophysiological studies of listening effort have mainly focused on peripheral measures (e.g., pupillometry) and auditory-evoked/event-related potentials (AEP/ERPs), with greater amplitude responses associated with greater effort. Frontal midline Θ dynamics in EEG (FmΘ; 4-7 Hz) correlate with mental effort in non-auditory tasks, but little work has characterized Θ during listening. Here, FmΘ and AEP/ERPs were investigated concurrently in listening tasks varying in difficulty. In a speech-in-noise task (Experiment 1), FmΘ power increased with decreasing signal-to-noise ratio (SNR) and positively correlated with self-reports of effort. Performance varied across SNRs. However, an effect of SNR on FmΘ remained when analyzing only correct trials, suggesting effects were not performance-related. In Experiments 2 and 3, listeners performed an auditory-oddball detection task wherein frequency differences between standard (70%) and oddball (30%) tones were small (< 1 semitone) or large (> 12 semitones). FmΘ power was greater in small frequency difference conditions. As in Experiment 1, this effect did not appear to be dependent on differences in performance. In contrast to previous work, components of AEP/ERPs (N1, P2, & P3) to speech (Experiment 1) and oddball tones (Experiments 2 & 3) showed reduced amplitudes under difficult listening conditions. AEP/ERP component amplitudes may reflect the ease to which stimuli are detected and/or differences are recognized. FmΘ, typically attributed to medial prefrontal regions, may increase in power when these processes fail to proceed implicitly and require greater attentional resources. Future studies should explore the full gamut of event-related features in EEG. Time-frequency features may be especially useful for investigating listening in the absence of a stimulus (e.g., anticipatory listening), and in situations where stimulus- and effort-related effects on AEP/ERPs are difficult to parse.

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4:30

Musical change deafness across languages, voices, and reverb

Michael Gordon *William Paterson University*
Alejandro Ataucusi *William Paterson University*
Daniel Kobylarz *William Paterson University*
Benjamin Ciccarelli *William Paterson University*
Andrew Lucila *William Paterson University*

A growing body of evidence has suggested that listeners may be insensitive to distortions of tones, chords, and melody when presented in close comparison. The current research was targeted at information that changed the acoustic coherence of pairs of stimuli. Specifically, listeners made same/different evaluations between pairs of vocal presentations with singers performing in Spanish or English, and with dry or wet reverberant backgrounds. All stimulus pairings were separated by 1000 ms bursts of Gaussian noise. As opposed to past speech research with inattentional deafness, replacing the voice of a singer with a new voice in either Spanish or English was found to be highly noticeable in our study. However, for changes that occurred within the same singer's voice, listeners tended to be insensitive to a major change in reverberation – particularly when the performance was in Spanish relative to English. Both adding and removing reverberation to Spanish-language performances caused the native English participants to perform at near-chance levels detecting the difference. The interaction of linguistic familiarity and reverberant qualities suggest the semantic and sensory encoding constraints that may dictate how attentional resources are allocated in change deafness.

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Poster session (11:45 AM – 1:15 PM)
Grand Ballroom (located in the Long Beach Convention Center)

1

When nature calls: Natural regularities guide human perceptual biases

Zachary Wilkinson *Arizona State University*
Michael McBeath *Arizona State University*
K. Jakob Patten *Arizona State University*

Human perceptual dimensions of sound are not necessarily simple representations of the actual physical dimensions typically used to describe sensory input. In particular, research on the perception of interactions between acoustic frequency and intensity has revealed that listeners exhibit a bias to expect pitch and loudness to change together. Research supports that this perceptual bias exists because the correlation between changes in acoustic intensity and frequency occurs with such reliability that it constitutes a natural regularity. Findings from these studies provide evidence that the auditory system has adapted to expect this naturally occurring relationship in order to facilitate auditory scene analysis, the parsing and tracking of sound sources as listeners analyze their acoustic environments. However, this correlation has only been tested and supported with human speech and musical sounds. The current study explores if animal sounds also exhibit the same natural correlation between intensity and frequency and tests if people exhibit a perceptual bias to assume this correlation when listening to animal calls. Our principal hypotheses are that animal sounds tend to exhibit a positive correlation between intensity and frequency and that, when hearing such sounds change in intensity, listeners perceive them to also change in frequency and vice versa. Our tests examining the acoustics and perceptions of 21 animal calls and 8 control stimuli support both hypotheses. This research provides further evidence of perceptual biases coupling with natural regularities in the auditory domain. More generally, it provides a framework for understanding perceptual biases as functional adaptations that help perceivers more accurately anticipate and utilize reliable natural patterns to enhance scene analysis in real world environments.

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Impact of environmental obstruction on judgments of sound source distance

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Countless times each day, humans and non-humans are exposed to sounds that derive from seen and unseen objects. Following that exposure, individuals often attempt to determine the location, distance, and motion of such sounds. Despite the frequency with which individuals perform such tasks, relatively little is known about the auditory spatial abilities of humans. The lack of research in this realm is confounded by the tendency of laboratory investigations to make use of settings and designs lacking in ecological validity (i.e., those that stand in stark contrast to the everyday environments inhabited by most perceiving-acting organisms). For example, laboratory investigations into auditory distance perception often involve an experimental setting that is limited to little more than the perceiver and the sound-producing object. Such settings have been referred to as “sterile” (Plomp, 2002) and could be considered the equivalent of Euclidean space. Conversely, James J. Gibson (1979/1986) considered the world inhabited by most organisms to be filled with what he referred to as “furniture” of the earth (i.e., clutter). The purpose of the present study was to determine the extent to which auditory distance judgments were affected by (1) clutter as well as by (2) the metric used by participants to report the distance of the unseen, auditory target. In short, participants were exposed to an unseen sound source and required to judge the distance of that source using a body-neutral metric (feet, inches) or body-scaled metric (number of steps). Half of the participants judged target distance in a obstruct-free setting while the remaining participants judged target distance in a situation where the auditory target was placed on the adjoining section a L-shaped wall. The findings of the study will be discussed with respect to the accuracy of distance reports, the impact of response metric, and the degree to which clutter affects perceptual judgments of the world.

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Auditory feedback of movement alters visual afterimage of an object

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Participants in total darkness who are exposed to a brief, bright flash will experience a positive afterimage of objects seen during the flash, well after the room is dark again. If the afterimage is of a body part, say a hand held in front of the face, then moving that hand in the dark causes the visual afterimage to immediately fade or 'crumble'. This happens despite a complete lack of new visual information, likely due to a conflict between proprioceptive feedback of movement and illusory visual input of the static afterimage. A previous study found similar fading for afterimages of held objects moved in the dark, leading the authors to suggest that held objects incorporate into the body schema incredibly quickly. Our experiments provide evidence for an alternate explanation, demonstrating multisensory object-tracking wherein non-visual sensory information updates visual experience, and no bodily incorporation is involved. We show that auditory feedback of object movement is sufficient to induce afterimage fading of objects moved in the dark; in other words, audition perceptually 'captures' vision in this paradigm. In follow-up experiments, we show that the afterimage fading effect scales with the magnitude of proprioceptive feedback, and we show that tactile feedback alone can induce the effect even when the object is not held. Our data suggest that a sensory feedback account explains the fading of afterimages of objects better than a body schema extension account.

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The role of semantic processing in the allocation of auditory attention when presented with competing acoustic stimuli

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Many devices such as smartphones rely heavily on audio to get the attention of users, but this is not always easy in noisy real-world environments. The temptation for sound designers is to simply use volume as a surefire way of gaining the listener's attention, resulting in a vicious cycle in which each new device is merely contributing to an ever increasing bedrock of ambient noise. It may, however, be possible to exploit attributes other than volume as a means of effectively gaining a listener's attention in competitive acoustic environments. In this paper, we describe an experiment investigating the degree to which semantic processing plays a role in the allocation of auditory attention for non-speech background sounds when presented in the presence of competing foreground acoustic stimuli. A crossover repeated-measures experimental design was used in which participants were required to acknowledge background sounds from two sound sets (urban and rural) in three separate test conditions (a control condition, a speech task condition, and a music task condition) to examine whether or not one sound set offered any advantage over the other. Response time, success in the foreground task, and cognitive load were measured across all three test conditions. Results showed that participants were able to acknowledge background sounds with a success rate of over 95% with no statistically significant difference in average response time between rural and urban sounds in any of the three test conditions. It was observed that participants responded significantly quicker to background sounds in the speech condition compared to the music condition and that three of the sounds recorded significantly faster average response times in the speech condition compared to the music condition. It was also found that non-musical participants responded significantly quicker to the sound of a siren in both the speech condition and the music condition.

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"Feel the joy": A significant role of a "bass sound" in today electronic music, from Favela Funk in Brazil to an analogue synthesizer scene and a Bass scene in Los Angeles

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This presentation deals with a specific role of a "bass sound" (low frequencies in the range of 10 – 300 Hz) in current digital and analogue music. This comparative research is concentrated on various treatments of a "bass sound" in three different music scenes: Favela funk in Brazil, current analogue synthesizer scene in Los Angeles, and a Bass scene in Los Angeles. Based on a participant observation, multi-sited fieldwork, and in-depth interviews with several musicians (Twin Braids, Clipping, Don Blanquito, ...) and record label owners (Brainfeeder, Man recordings, ...) , I tend to answer following questions: why is the "bass sound" playing such an important role in the music of my informants, what are the aesthetic and even bodily qualities of a "good bass sound", what are the effects of it on the audience? In the paper, I am also considering the physical aspect of the low frequencies – trying to explain what are the objective physical differences between digitally emulated bass (by any VST plugins such as Massive instruments) and the one of an analogue synthesizer (i.e., Moog) along with an aesthetic variation expressed by the musicians. This paper explains a communicative role of the "bass sound" in today electronic music and reveals production, physical and aesthetic strategies the music producers employ in their musicianship. In addition, it evaluates a "bass sound" as a cross-cultural music pattern which may vary in different genres, yet establishes a mutual music understanding regardless of territorial, cultural and economic diversity.

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Studying the cognitive connections between auditory and visual perception and their applications in music, art, and new media

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Studying the correlation between auditory and visual perception opens the possibility of finding average statistical data for audio-visual conformities, which can be used in different areas of art and new media.
Materials and Methods: the test was developed and conducted.
The test investigated audio-visual interactions in cognitive-emotional domains.
The software could be programmed for the practical application of the test results.
Methods of computation results: analytical, comparative, empirical distribution of observational results.
Results and Discussion: one of the aim of the test was to investigate the regularity between the height of musical register and emerging colors. Conclusions: audible sounds correspond with associated colors through the correlation of their perceived frequency and wavelength. A correlation was found between the sound frequency and light wavelength, also between sound frequency and level of lightness in the chromatic and achromatic associated colors. Increasing the sound frequency increases the lightness of the color also increasing the sound frequency increases the light waves in emerging colors.
Regularities were investigated between visual and sound associations during the perception of video without sound. Results: the more distinctly figures with more active motions appear in the picture, the more distinctly auditory associations appear.
Perception of music is a complex process of cognitive psychology. The correlation between the perception of sound and associative colour (phenomenon of "arbitrary synaesthesia") is based on physiological and cognitive factors. Test results in this field can be applied in different areas of art, new media and medicine.

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Can Hebb be distracted? The impact of different forms of auditory distraction on sequence learning.

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Sequence learning plays a key role in many daily activities such as language and navigation. One classical phenomenon used to study this type of learning is the Hebb repetition effect, i.e. improved serial recall for a repeated sequence of items compared to non-repeated sequences. The present study sought to assess the nature of the processes involved in this form of sequence learning by evaluating its vulnerability to auditory distraction. Typically, sound can cause unwanted distraction either by interfering specifically with the processes involved in the focal task (interference-by-process) or by diverting attention away from a focal task regardless of the type of processing that task involves (attentional capture). The changing-state effect — the marked disruption of serial recall by irrelevant changing sounds relative to repeated sounds — is thought to be the result of a conflict between two seriation (or ordering) processes. To examine the role of seriation in Hebbian learning, participants performed visual serial recall, in which one to-be-remembered sequence was repeated every four trials, either in the presence of a to-be-ignored changing-state or steady-state auditory sequence. Despite the presence of the changing-state effect, the Hebb effect was unaffected by changing sounds. The role of attention can be assessed through the deviation effect; i.e. the disruption of performance due to attentional capture induced by the unexpected occurrence of a sound that deviates from the rest of the auditory sequence. Although serial recall was poorer for trials in which a deviant sound was embedded in the to-be-ignored auditory sequence, attentional capture failed to preclude Hebbian learning from taking place regardless of whether the deviant was restricted to repeated trials or not. The failure from irrelevant sound to interfere with the Hebb effect suggests that seriation and attentional processes do not play a key role in this type of sequence learning.

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Factors that influence ear witness identification

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The purpose was to investigate the heuristics involved in how people identify a suspect in a crime that they have only heard. Of particular interest are the auditory qualities--such as pitch and tone—that may be characteristic of those whose voices are chosen most often as the suspect in a crime. To test for this, all voices used in the experiment were altered, with male voices manipulated upwards in frequency to sound more female, and female voices manipulated downwards in frequency to sound more male. Altered recordings were rated by a set of participants on their perceived genderness and naturalness, to ensure that they did not sound overly artificial. The voice rated as most androgynous—sounding neither overtly masculine nor feminine—was used as the target for the experiment. Participants were presented with one of three auditory events that were either neutral or criminal in nature, combined with background noise that was classified as high stress or low stress. They were then assigned to a delay condition of either one day or 21 days, after which they were presented with a voice line-up containing the previous target and 9 foil voices. Following presentation of each voice, participants decided whether they thought a voice was the target, as well as rated their certainty in their choice on a sliding scale of 0 to 100 (0 = confident not criminal, 50 = uncertain, and 100 = absolutely certain). This procedure allowed us to test the hypothesis that there would be an overall effect of gender, with male voices being chosen more often—and more confidently—as the target. Furthermore, we anticipated that lower-pitched voices would be chosen more often than higher-pitched voices.

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Tracking modulations to the dominant in classical minuets: A concurrent probe-tone study

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Previously we used Toiviainen and Krumhansl's (2003) concurrent probe-tone technique to study listeners' tracking of modulations in Carnatic music (APCAM, 2013). With modulation, the correlation of probe ratings and the tonal-hierarchy profile for the initial key declines, and correlation with the new key profile increases. This reverses when the piece modulates back. Here we apply that technique to the investigation of modulations in classical minuets. We used minuets in studies finding an improvement effect in recognition memory, in which the rejection of same-contour lures improved during the first 12-15 s of hearing a novel melody because the memory system has time to bind the melodic contour to the musical scale (Dowling & Tillmann, 2014; Tillmann et al., 2013). This led us to investigate the time course of formation of the tonal hierarchy representation involved. In Study 1, 84 musicians and 84 nonmusicians rated one of the 12 probe tones continuously while hearing the first eight measures of one of two minuets (one modulating and the other not). A Latin square to control the order of presentation of the probe tones, so that each probe was rated an equal number of times on each of the 12 trials with a minuet. Thus, we could look at the development of the profiles across trials. The tonal profile of the initial key emerged clearly during the first three trials, as assessed by correlation. There was some tendency for the correlation of responses with the profile for the dominant to increase following the modulation, but there was no tendency for the correlation with the initial tonic to decrease. This agrees with earlier results suggesting that a conventional modulation to the dominant does not strongly alter the sense of tonal center very much. In Study 2 we are currently replicating Study 1 with six minuets.

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Deviant sounds does not capture attention when presented among, and simultaneous as, standard vibrations

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Sudden and unexpected changes in the auditory and visual channel are known to capture attention. This attention capture has been shown to negatively impact performance in an ongoing task (i.e., deviance distraction). In three experiments we examined if deviant stimuli presented in a different modality than a standard stimuli caused distraction in a visual categorization task, using a multi-sensory oddball task. In two experiments a deviant sound was presented (20% of trials) against 80% vibrotactile standard trials. In one the standard was omitted on deviating sound trials, while in the other the standard and deviants were presented simultaneously. In the third experiment the standard vibration was omitted in 20 % of the trials without any presentation of a deviant sound. Results showed distraction by deviating sounds, but not when standard vibrations were presented simultaneously. Interestingly, the omission of a standard vibration showed distraction. In conclusion, deviance distraction might be bound to within rather than between modalities.

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Performance pressure enhances novel speech category learning

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The dual-system framework postulates that feedback-based category learning is mediated by an explicit, reflective learning system and an implicit, reflexive learning system (Ashby & Maddox, 2010; Chandrasekaran, Koslov, & Maddox, 2014). The frontally-mediated reflective system generates and tests rules based on feedback and is therefore dependent on working memory resources. In contrast, the striatally-mediated reflexive system is involved in pre-decisional integration of stimulus dimensions, and not contingent on working memory resources. Recent work has hypothesized that novel speech categories are optimally learned by the reflexive learning system in adulthood. In the current study, we examined the impact of performance pressure on speech category learning in adults. Performance pressure leads to a form of global avoidance state (Maddox & Markman, 2010) that has been shown to enhance reflexive processing in the visual domain (Markman, Maddox & Worthy, 2006; Worthy, Maddox & Markman, 2009). Participants in the low pressure condition were simply instructed to perform their best. In the high pressure condition, participants were told that they had been paired with a (fictitious) partner, and that each had to independently exceed a performance criterion in order for either to get a monetary bonus. The subject was then told that the partner had already exceeded the criterion, putting the pressure on the subject alone. We tested and found support for the hypothesis that performance pressure should enhance speech learning. To determine whether the effect was due to enhanced reflexive system processing, as predicted, we fit a series of computational models to the data. We found that participants in the high pressure condition used reflexive strategies earlier and more often during learning than participants in the low pressure condition. Implications for motivational effects, broadly defined, on novel speech category learning are discussed.

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Electrophysiological correlates of the effect of distal speech rhythm on word learning

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Recent research has demonstrated that rhythmic patterns in speech influence word segmentation and learning (Morrill et al, 2014). When exposed to syllable sequences in an artificial language, adult participants judged disyllabic words that had been congruent with distal speech rhythm (repeated pitch patterns at the beginning of the sequence) as more word-like than incongruent words, although transitional probabilities between syllables of all words were equivalent. The current study investigates the neural correlates of the effects of distal speech rhythm on language perception and learning. Electroencephalogram (EEG) was recorded while participants completed an artificial language learning task. Event-related potentials (ERPs) were extracted from the EEG to examine the effect of distal speech rhythm on early perceptual processing (as revealed by P1 and N1 components) and later post-perceptual processing (as revealed by the N400 component). Behavioral data confirms that congruent words are rated as more word-like than incongruent words, and ongoing analysis suggests that there is greater N400 amplitude for congruent words than for incongruent words after exposure to the artificial language. In addition, for congruent words there is a tendency for higher (more word-like) ratings to correspond to greater N400 amplitude. These findings are consistent with the hypothesis that distal speech rhythm influences word learning, such that congruent words are learned better than incongruent words and therefore upon re-exposure are more likely to engage lexical processing mechanisms, as reflected by an enhanced N400. Results also point to the potential utility of the N400 as a neural marker of individual differences in sensitivity to the effect of distal speech rhythm on word learning.

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Skull Music: Spectral filtering by the skull influences musical listening preferences

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The skull creates a dense and resonant body for a listener that filters all incoming sounds. With respect to this spectral influence, the current research investigated how the resonances of the skull might vary across individuals to shape listening preferences for music and tones. The spectral properties of skulls were measured by presenting a broadband Gaussian noise to a person's the skull (temporal bone) and recording the sound from the opposite side of the head. These recordings were analyzed via mean FFTs and used to generate a set of skull-specific peak filters for application to samples of baroque music and complex tones (E1, A#1, and D#2 samples of a cello). To produce the filtered sample for a given skull, up to six of the 2nd order peak filters were used with separate gain control; 40th order low- and high-pass filters were used in between peak filters to eliminate additional gain. The participants, who were the same individuals whose skulls were used in the original recordings, listened to and rated their preferences for the stimuli that were filtered to match their own skull or other's skulls, along with unfiltered versions of the stimuli and control stimuli that reflected only the low- and high-pass compensatory filtering. The results may be used to suggest the subtle influence of the skull as it shapes preferences. Notably, it seems that listeners tended to prefer the filtering of other skulls relative to their own with the baroque music. It may be that the added gain in the peak resonances of the skull produced a moderately irritating quality relative to the other conditions. However, listeners did not show a preference between the filtered-versions of the complex tone. Results are discussed in terms of how the skull might reasonably inform listening according to a source-filter model.

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Is 9 louder than 1? An audiovisual cross-modal interaction between number magnitude and sound amplitude

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The current study examined whether the magnitude of a task irrelevant symbolic number (Arabic digit) could bias peoples' judgements of a sound's loudness. To asses this research question an experimental paradigm similar to that used by Leboe and Mondor (2010) was employed. In this paradigm, participants completed a number of trials in which they were presented with a reference sound that was followed shortly by a target sound. All target sounds were constructed to be either 10% louder or 10% quieter in comparison to a reference sound featured on a particular trial. The participants' task in this experiment was to categorize a target sound as louder or quieter than the previously heard reference sound using keys labelled "L" and "Q" respectively. In order to investigate whether the magnitude of a number could bias these responses, one block of trials featured target sounds that were presented simultaneously with either a small (1, 2, 3) or large (7, 8, 9) magnitude digit. Another block of trials acted as a control condition, where target sounds were presented simultaneously with scrambled versions of the same six single-digit numbers. Participants' responses revealed a significant main effect of number magnitude, $p = .004$, partial eta = .262, which demonstrated that participants judged target sounds as "louder" more frequently when they were presented with large magnitude numbers as opposed to small magnitude numbers. Furthermore, a significant interaction between condition and number magnitude was found, $p = .006$, partial eta = 2.40. This interaction was due to participants' responses in the control condition being unaffected by numbers presented in a scrambled format. These results support the assertion of cross-modal interactions between sound intensity and number magnitude providing evidence for a notational-independent magnitude system (Walsh, 2003).

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Affective influences on musical memories

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Music has a tremendous capacity for affecting cognitive and emotional responses for those involved with it. Of particular interest in this research is how, with limited exposure, music can become exceedingly familiar, easy to recall, and "stuck in one's head". Previous research with memory has demonstrated several key variables that predict the capacity for encoding and recognition of information, including affect, context, and semantic depth. Many of these mnemonic variables are inherently a part of a musical experience such that the music might invoke emotional expression and arousal; and be may related to a social or intimate personal context producing a depth of memory. To investigate the interaction of memory with music and emotional context, a set of studies was conducted. Initially samples of music were normed to determine their emotional valence as happy, neutral, or sad. This music was originally presented to participants with an accompanying video and they were instructed to attend to the presentation for a subsequent memory test. After a distractor task, the participants were presented a series of musical samples and asked to determine which had been presented previously. It was found that participants with little or no formal musical training had better recognition of selections that were affectively valenced as either happy or sad, relative to affectively neutral music. However, participants with 10 or more years of musical training showed no memory bias in this task. Hence, it may be that particularly among non-musicians the emotional content is critical in how music is encoded. This research is discussed in terms of both the visual and auditory context that might contribute to the affective content.

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An evaluation of the role of vowel formant frequencies and vowel duration on the perception of foreign accent.

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The current investigation used resynthesis to directly manipulate vowel formant center frequencies and durations to evaluate their role on the perception of foreign accent in three English words (bad, bud, and bad). There were twenty-five tokens for each word, representing orthogonal combinations of five levels of F1-F2 and vowel duration, respectively, ranging from beyond native values to beyond Spanish-accented values that were observed in Sidaras, Alexander, and Nygaard (2009). While listening to and viewing the intended word, native English listeners rated these stimuli on degree of foreign accentedness using a 6-point scale. Additionally, degree of comprehensibility was rated using a 6-point scale along with a seventh response option for stimuli that did not sound like the intended word. Vowel duration had no significant impact on either rating scale. For both scales, gradual changes in formant frequencies from native to accented values had a negative impact (less comprehensible and more accented) on /a/, a positive impact on /^/, but no significant impact on /æ/. Gradual changes in formant frequencies in /a/ toward the accented values pushed it toward /^/, thereby increasing confusability. However, gradual changes in formant frequencies in /^/ toward accented values pushed it away from /a/, resulting in reduced confusion. Changes in formant frequencies had minimal influence on ratings for /æ/, as it was relatively distant from /a/ and /^/ in both F1 and F2. This speculation was confirmed by the higher number of /^/ trials (323) and /a/ trials (206) that were rated as not sounding like the intended word (vs. 139 /æ/ trials). Taken collectively, these results suggest that vowel formant center frequencies influence accentedness ratings, depending upon whether or not they shift the vowel toward an adjacent category. Thus, it appears that resynthesis can provide a more controlled way to study the perception of foreign accent.

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Dichotic listening is tough, and only gets tougher: Impact of attentional control on dichotic listening in young and older adults.

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Older adults report the effort they engage in while listening throughout the day to be exhausting (Kramer et al., 1997). Hearing loss and degraded listening conditions disrupt the effortful cognitive processes that facilitate memory for heard information (e.g., Piquado et. al., 2010; 2012), but little emphasis has been placed on understanding how those processes contribute to identification and later memory for speech. In the current study, we used the classic dichotic listening paradigm to assess how attentional control diverted to one ear affects short and long-term memory for words presented to either ear. Older and young adult participants were cued to attend to the left or right before listening to streams of four unrelated words presented to each ear. Participants immediately received probes testing if the word was presented to the attended ear. Following the dichotic task, participants' recognition of all words was measured to test the indirect effects of attentional control. Response latencies were collected throughout the experiment. The results revealed that older adults were less accurate on the short-term dichotic task than young adults, and were especially likely to have intrusions from the unattended stream. On the later recognition memory test, young adults had good memory for words in the attended stream, but chance levels for unattended words. Older adults did not show this preference; their later memory for attended and unattended words was equivalent. This pattern converged with results on response latencies in both tasks, even after transforming latencies to z-scores to account for age-related general slowing (Balota et. al., 1996). The results are consistent both with accounts characterizing age-related changes as decrements to attentional control (McCabe et al., 2010) and inhibitory processing (Hasher & Zacks, 1988), and suggest the effort listeners place on hearing speech can serve to both elaborate attended information and inhibit irrelevant information.

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Superior fluid cognition in musicians compared to non-musicians

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The effect of intensive music training on cognitive function continues to gain interest as research reveals a significant positive enhancement of musical training on overall cognitive ability, including memory, attention, and executive function. The purpose of this study is to extend this research by measuring the association between music training and fluid intelligence: the ability to think abstractly and solve problems. Three groups of college students were studied: musicians with extensive experience, less experienced musicians, and non-musicians. We tested all participants using the National Institute of Health (NIH) Toolbox Cognition Battery, a group of standardized tasks that measure episodic memory, working memory, attention, executive function, and processing speed, producing a fluid cognition composite score. By comparing results among each group and with national means reported by the NIH, we found that experienced musicians scored significantly higher in fluid cognition than non-musicians, adding weight to the mounting evidence of the overall positive effect of music training on cognitive function. These results underscore the importance of music education as a cornerstone of cognitive enhancement.

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The effect of cadences on harmonic expectancy

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The implicit and automatic processing of harmonic structure is shown in harmonic priming paradigms, where subjects are faster to make an unrelated judgment (e.g., of a chord's timbre) when the end of the chord sequence is expected (tonic) versus unexpected (subdominant). This priming effect may result from automatic spreading activation, where the global context of a musical sequence establishes a specific tonal hierarchy such that some chords (e.g., the tonic) are more expected than others (e.g., Tillmann et al., 2006). Alternatively, harmonic priming might result, at least in part, from local harmonic context, based on expectations for successive events within a sequence (i.e., cadences) (e.g., Collins et al., 2014). Two experiments tested the extent to which local (vs. global) context processing underlies harmonic priming using a timbral judgment task. Participants heard 8-chord sequences and classified the timbre of the final chord as either a resonator guitar or a classical guitar. Experiment 1 compared tonic versus subdominant endings (i.e., V-I vs. I-IV) and found standard harmonic priming effects. This, like previous studies showed facilitation for tonics as part of an authentic cadence. Experiment 2 investigated whether the authentic cadence, which typically indicates a local conclusion, may heighten this standard processing advantage for tonics. Specifically, Experiment 2 contrasted the influence of non-cadential structural expectancy (based on relative stability within a global tonal context) with effects of local expectancy, examining responses both within and following cadences. Harmonic priming effects were indeed influenced by local cadential structure as well as by global tonal context overall. Because sensory overlap between contexts and targets were controlled, these data suggest harmonic priming effects reflect cognitive expectancies for both global harmonic context and specific local structural components (i.e., cadences).

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