0615. **Implications of the McGurk Effect for Assessment, Diagnosis, & Intervention**

Stephen D. Oller, Ph.D.
Texas A & M University at Kingsville

John W. Oller, Jr., Ph.D., Linda C. Badon, Ph.D., & Shalini Arehole, Ph.D.
University of Louisiana at Lafayette

Learning Outcomes: Participants will

1) experience firsthand, review, and discuss evidence for cross-modal transfer and the integration of the senses;

2) view 4D video of a fetus and consider, review, and discuss interactions across modalities before and after birth;

3) discuss the implications of cross-modal transfer and sensory integration for intervention with normal and disordered populations;

4) discuss implications for assessment and diagnosis of disorders.

SUMMARY:
The McGurk effect is a relatively familiar but poorly understood, perceptual and motor phenomenon in the literature. It is achieved by pairing a mismatch between articulatory gestures and sequences of sounds. For example, if the syllable /ga/ is paired with the facial articulatory gesture for /ba/, listener/viewers typically perceive the sound as a funny "retroflex" /da/ or even /ga/. When they look away from the moving face, they hear the speaker saying /ba/.

What is most surprising, as our participants discover and discuss, is the fact that perceivers who know that the illusion is created by looking at the moving face, are still unable to prevent themselves from experiencing it. The visual image shapes the auditory perception. Infants as young as two months show preference for lip shapes that match a spoken vowel over ones that do not match. They seem to anticipate the McGurk effect. Adult listeners remark that the effect causes them to distrust the person in the video. Perhaps this is because of the mismatch. There is something false about the image. According to the theory of true narrative representations, "truth" in its most mundane sense requires a faithful match of symbol to content, but in McGurk's experiment a mismatch occurs.

The McGurk phenomenon refutes the strong modularity hypothesis by showing that the senses are richly integrated early in development. We present an audio/video demonstration of the McGurk effect that participants experience for themselves. The McGurk effect itself illustrates a natural bridge from sense to sense, and from sensation to movement. It is powerful evidence of the integration of distinct sensory modalities with the dynamic qualities of movement. The modalities themselves are evidently integrated and also ranked to some extent. Vision coupled with the articulatory movements overwhelms the auditory signal in the McGurk effect. It is the auditory signal that is adjusted rather than the visual one. The brain makes sense of the auditory signal in terms of what we see happening. Seeing appears to be believing in a

deeper sense than commonly supposed.

However, vision and audition are not the only elements involved. Movement is also involved, perhaps critically. A still image by itself accompanied by an auditory signal cannot produce the illusion. This session will also present evidence of the integration of taste, smell, and touch along with vision and audition as well as movement. Our sense of balance, on which many movements depend, connects and intermediates touch, sight, and hearing. We show 4-D video of a baby as early as 12 weeks of gestation (in the womb) demonstrating that the senses are integrated with movement early on and sum up research showing that taste and smell are functional well before birth as are touch, vision, and hearing. Infants assisted by the movement involved in sucking, for instance, can translate from touch to vision and vice versa. Neonates are capable complex defensive movements before any significant experience has occurred postnatally. A normal neonate that has never been hit in the face by a moving object still defends against one that appears to be on a collision course toward its face. All the evidence suggests the strong inference that the senses and capacities for movement are well integrated prior to birth. Participants discuss implications for theories and practices in intervention.

While integration of the senses with movements cannot depend much if at all on post-natal learning, there are linguistic aspects of early infant development that absolutely depend on experience. For instance, to associate mom's familiar voice with her unfamiliar face exposure to the coordination of mom's movements with the simultaneous fluctuations in the sound of her voice is essential. The theory of pragmatic mapping explains this result. The McGurk effect, and all similar mismatches, are precluded in true narrative mapping relations, e.g., where the coordination of face and voice is relatively perfect. Theories of synchrony explain this coordination. Pragmatic mapping is likewise illustrated, explained, and generalized as the essential process enabling the discovery of the meanings of the child's first receptive words as well as the first productive words a few months later. Just as the child's association of mom's familiar voice with her face requires pragmatic mapping of voice to face; the association of words with persons or actions (receptive vocabulary) also requires that mapping; as does the mastery of the surface forms of words to associate them with meanings (the first productive words). All this is illustrated with practical and simple real-life examples. Unlike the preprogramed integration of the senses pragmatic mapping absolutely depends on specific learning experiences. In this way, sensation and movement are profoundly different from language acquisition.

As a result of a richer understanding of the McGurk effect, a more integrated, and comprehensive basis is proposed for classifying communication disorders along the lines of Cacase and McFarland (2005). The major classes of disorders are outlined and key exemplars are provided. The McGurk effect as demonstrated and explained shows that multimodal testing is essential in the case of CAPD. The argument generalizes to all complex assessment across modalities, movement systems (e.g., sucking, chewing, and swallowing versus speech production), and language/dialect boundaries. We conclude that assessment in multiple modalities, across relevant domains of experience, and in all relevant language/dialect systems is necessary to achieve valid assessments and diagnoses of disorders. Our approach amounts to building bridges across modalities and putting gates in the walls that have traditionally separated the sciences and practices focused on distinct senses, movement systems, and languages/dialects. Advantages are demonstrated from relevant research and practice for normal and disordered populations.

References:

Cacase, A.T. & McFarland, D.J. (2005). The importance of modality, specificity in diagnosing central auditory processing disorder. American Journal of Audiology, 14, 112-113.

Kuhl, P. K., & Meltzoff, A. N. (1982). The bimodal perception of speech in infancy. Science, 218 (4577), 1138-1141.

Kuhl, P. K., & Meltzoff, A. N. (1984). The intermodal representation of speech in infants. Infant Behavior & Development, 7(3), 361-381.

Kuhl, P. K., & Meltzoff, A. N. (1996). Infant vocalizations in response to speech: Vocal imitation and developmental change. Journal of the Acoustical Society of America, 100, 2425-2438.

McGurk, H., & MacDonald, J. (1976). Hearing lips and seeing voices. *Nature, 264*, 746-748.

Oller, J. W., Jr., Oller, S. D., & Badon, L. C. (2006). Milestones: Normal speech and language development across the life span. San Diego, CA: Plural Publishing.

Patterson, M. L., & Werker, J. F. (2003). Two-month-old infants match phonetic information in lips and voice. *Developmental Science 6*(2), 191-196.

Rosenblum, L. D., Schmuckler, M. A., & Johnson, J. A. (1997). The McGurk effect in infants. Perception & Psychophysics, 59(3), 347-357.

Stephen D. Oller, Ph.D., Assistant Professor, Department of Communication and Theater Arts; Texas A&M University at Kingsville, cell phone: (361) 876-3228; email: stephen.oller@tamuk.edu. ASHA Member. Author. Special needs, none. Biographical sketch: Stephen Oller's publications concern applications of the theory of abstraction to language assessment with first, second, and disordered language populations. He also spends time in the natural laboratory of life with his own developing language learners (Brenden David and Gabrielle Alana, to name only the first two) and is co-author of two introductory textbooks on language acquisition and communication disorders.

John W. Oller, Jr., Ph.D., Hawthorne Regents Professor of Communicative Disorders at the University of Louisiana at Lafayette, PO Box 43170, Lafayette, LA 70504-3170; cell phone: (337) 962-4649; email: joller@louisiana.edu. Member. Author. Special needs, none. Biographical sketch: Oller is an expert in assessment of language/dialect proficiency, communication, and disorders. He is author of 14 books , 227 articles, and the organizer of the Sertoma International Conference on Autism Spectrum Disorders (April 12-14, 2007) at the Cajundome Convention Center in Lafayette.

Linda C. Badon, Ph.D., CCC-SLP, Assistant Professor of Communicative Disorders at the

University of Louisiana at Lafayette, PO Box 43170, Lafayette, LA 70504-3170; cell phone: (337) 344-0750; email: badon@louisiana.edu. Member. Author. Special needs, none. Biographical sketch: Badon's publications, complement clinical work in assessment, diagnosis, and treatment of disorders as well as language, literacy, and cultural diversity.

Shalini Arehole, Ph.D., CCC-AUD, Associate Professor of Communicative Disorders at the University of Louisiana at Lafayette, PO Box 43170, Lafayette, LA 70504-3170; email: sxa3201@louisiana.edu. Member. Author. Special needs, none. Biographical sketch: Arehole's publications concern hearing, central auditory processing disorder, and related matters.