

Occipital cortex activation by long-term repetitive tactile stimulation is necessary for object recognition in blinds: A case report

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20 Tactile vision has been approached from a variety of angles using different techniques. So far, a certain kind of object (and text) recognition has been shown, though seeing as such has not been achieved yet, and it remains unclear. Trough repetitive passive tactile stimulation perceptual processing is transferred from temporo-parietal to occipital areas, which affects object recognition. We report the results of passive tactile stimulation, as well as rTMS, applied to a 50 year old left handed blind male with over 97% loss of vision, who suffers from Peter's anomaly and microphthalmia. After 15 weeks of passive tactile stimulation, the subject showed increased activity
25 in occipital areas associated with the development of visual-like perception which remained unchanged after three months without passive tactile stimulation. Inhibitory rTMS over the visual cortex led to noticeable reduction of spatial recognition performance and visual sensations in this subject. Stable changes in occipital cortical activity can be associated with subjective sensations of seeing. Once occipital activation has been achieved, it is necessary
30 for spatial object recognition. Both facts highlight the implication of occipital areas in tactile vision and the cortical plasticity of passive tactile long-term stimulation in people with blindness.

Keywords: Blind; Cortical plasticity; ERP; Passive tactile stimulation; rTMS.

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- seriously: A theory of socioemotional selectivity. *American Psychologist*, 54, 165-181.
- Carstensen, L.L. (2006). *The influence of a sense of time on human development. Science*, 312, 1913-1915.
- Carstensen, L. L. (2007). *Growing old or living long: Take your pick. Issues in Science and Technology*, Winter 2007, 41-50.
- Eastman, S.T., & Billings, A.C. (2001). Biased voices of sports: Racial and gender stereotyping in college basketball announcing. *Howard Journal of Communications* 12(4), 183-201.
- Feu, S., Ibáñez, S.J., Sáenz-López, & Gutiérrez, (2008). Evolución de las jugadoras en las selecciones españolas de baloncesto. *Apunts. Educación Física y Deportes* 93, 71-78.
- Guillén, F., & Sánchez, R. (2009). Competitive anxiety in expert female athletes: Sources and intensity of anxiety in National Team and First Division Spanish basketball players. *Perceptual and Motor Skills* 109(2), 407-419.
- Jowett, S. (2009). Validating Coach-Athlete Relationship Measures with the Nomological Network. *Measurement in Physical Education and Exercise Science*, 13, 34-51.
- Krane, V. (1994). A Feminist Perspective on Contemporary Sport. *The Sport Psychologist*, 8, 393-410.
- Krane, V. (2001a). "We can be athletic and feminine," but do we really want to? Challenging hegemonic femininity in women's sport. *Quest*, 53, 115-133.
- Krane, V. (2001b). One lesbian feminist epistemology: Integrating feminist standpoint, queer theory, and feminist cultural studies. *The Sport Psychologist*, 15, 401-411.
- Krane, V., & Barber, H. (2003). Lesbian experiences in sport: A social identity perspective. *Quest*, 55, 328-346.
- Krane, V. (2009). A sport odyssey. *Qualitative Research in Sport and Exercise*, 1(3), 221-238.
- Lafont, L., Proeres, M., & Vallet, C. (2007). Cooperative group learning in a team game: Role of verbal exchanges among peers. *Social Psychology of Education*, 10(1), 93-113.
- Leite, N., Vaz, L., Maças, V., & Sampaio, J. (2009). Coaches perceived importance of drills items in basketball players' long-term development. *Revista de Psicología del Deporte*, 18, (Supl.), 457-461.
- Lázaro, I. y Villamarín, F. (1993). Capacidad predictiva de la auto-eficacia individual y colectiva sobre el rendimiento en jugadoras de baloncesto. *Revista De Psicología Del Deporte*, 4, 27-38.
- Leo, F.M., Sánchez, P.A., Sánchez, D., Amado, D., & García Calvo, T. (2009). Influence of the motivational climate created by coach in the sport commitment in youth basketball players. *Revista de Psicología del Deporte* 18(Supl.), 375-378.
- Lin, C.S. (2009). Gender differences in spectator's motivation for Taiwanese men's basketball. Lin, Cheng-Shiun: United States Sports Academy, US.
- López, F. (1999). Evolución del apego desde la adolescencia hasta la muerte. En López F., Etxebarria I., Fuentes M.J. y Ortiz M.J. (Eds.), *Desarrollo afectivo y social* (pp.41-66). Psicología. Pirámide.
- López Sánchez, F., Etxebarria Bilbao, I., Fuentes Rebollo, M.J., Ortiz, M.J. (coord.) (2005). *Desarrollo afectivo y social*. Madrid: Pirámide.
- López, F. (2009). *Amores y desamores. Procesos de vinculación y desvinculación sexuales y afectivos*. Madrid: Biblioteca Nueva.
- Martín, M. (2004). Generating female freedom among women's relationships in rugby union narratives of sexual difference. Tesis doctoral no publicada, Brunel University, London.
- Moreno, J.A., Conte L., González, D., Martín-Albo, J., & Núñez, J.L. (2010). Efectos de intervención del clima tarea sobre la motivación de estudiantes en la enseñanza deportiva. *Estudios de Psicología*, 31(1), 67-77.
- Refoyo, I., Romaris, I.U., & Sampedro, J. (2009). Analysis of men's and women's basketball fast-breaks. *Revista de Psicología del deporte*, 18(3), 439-444.
- Sáenz-López, P., Giménez, F.J., Ibáñez, S.J., & Jiménez, A.C. (2008). La visión de las jugadoras internacionales de baloncesto sobre su proceso de formación. *Habilidad Motriz*, 31, 33-42.
- Ruiz, R. (2006). Diferencias de liderazgo en entrenadores de judo a nivel competitivo. *Cuadernos de Psicología del Deporte*, 6(2), 21-38.
- Smith, R.E., & Smoll, F.L. (1991). Behavioral research and intervention in youth sports. *Behaviour Therapy*, 22, 329-344.