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On: 21 September 2012, At: 23:45

Publisher: Psychology Press

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## International Journal of Psychology

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/pijp20>

### Cognitive

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Version of record first published: 24 Jul 2012.

To cite this article: Angela Nowell (2012): Cognitive, International Journal of Psychology, 47:sup1, 109-151

To link to this article: <http://dx.doi.org/10.1080/00207594.2012.709089>

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creased/decreased hand size; (b) to understand whether tactile acuity and inner representations of the hands can be modulated by mirror illusions, which were induced using an Augmented Reality (AR) setting designed to act as a mirror image of the right hand. 33 healthy right-handed volunteers participated in the study all of which were subjected to four sessions: a) Illusion of a decreased size of the left hand; b) increased size of the left hand; c) right and left hands were normal sized; d) in the control session without no AR settings. Results indicate, that the degree of ownership, and the sense of control of movements to the hands, in the increased hand size session can modulate inner representation of the hands and tactile acuity. These findings indicate that the way people subjectively relate to the limbs they observe through distorted mirror images will have an impact on whether perceptual modalities can be modulated. This could have an important impact on how to utilise augmented reality and mirror illusion in therapy.

### Motor action reduces temporal asynchrony between perceived visual changes

**Yann Coello** *University Lille Nord de France, France;*  
**Xavier Corveleyn;** **Joan Lopez-Moliner**

When perceiving a single visual object, the binding of its different physical properties (e.g. colour, motion), must take into account the differential processing delays within the visual system. Consequently, temporal order judgments of changes of object dimensions often give rise to the perception of asynchrony, even when the changes occur synchronously. We analysed the effect of performing a motor action on the perceived relative timing between changes of position and colour of a visual target by using a TOJ. Results showed that in the perceptual condition (no action), change of colour must precede (-37.9ms) change of position, in order to perceive a synchronous change of both target's visual attributes. This physical asynchrony almost vanished when the same changes took place near the end of a manual reaching action executed towards the visual target (-3.3ms). This reduction of asynchrony was, however, not observed when participants performed TOJ of visual attributes change in the presence of concomitant tactile information (-36 ms), but with no action. The perceptual relative timing between visual changes was also unaffected when the timing was obtained by comparing each visual change to tactile information resulting from motor action (-33.5ms) or external stimulation (-27.8ms). Altogether, these results suggest that signals associated with the organisation of a motor action, but not sensory information itself, contribute to reduce the differential delays when processing visual attributes of a single object. Furthermore, the effect of action was not observed when judging relative timing of object-related (visual) versus object-unrelated (tactile) sensory information.

### Newborns' preference for goal-directed actions

**Laila Craighero** *University of Ferrara, Italy;* **Francesca Simion;** **Carlo Umiltà;** **Irene Leo**

The central role of sensory-motor representations in cognitive functions is almost universally accepted. However, determining the link between motor execution and its sensory counterpart and when, during

ontogenesis, this link originates is still under investigation. The aim of the present study is to investigate whether at birth this link is already present and 2-day-old newborns are able to discriminate between visual cues indicating goal-directed or non-goal-directed actions. Here, with a preferential looking technique, a hand grasping a ball was the observed movement and we orthogonally manipulated the three factors necessary to successfully reach the goal: (a) presence of the ball, (b) direction of the arm movement, and (c) hand shaping. Results indicated that newborns orient more frequently and look longer at a hand shape for whole hand prehension, but only when the movement is directed away from the body and toward the external world. In addition, newborns prefer the away from the body movement only when the object is present. We argue that newborns prefer a movement directed toward the external world only when it may develop into a purposeful movement because of the presence of the to-be-grasped object. Overall, our results support the existence of primitive sensory-motor associations since the first days after birth.

### Healthcare decisions are context-dependent: Violation of regularity principle

**Florence Dumas** *Aix-Marseille University, France;*  
**Michel Gonzalez;** **Christophe Pascal;** **Vittorio Girotto;** **Vincenzo Crupi;** **Jean-Francois Botton**

Facing a decision problem, the ideal decision-maker would assess the costs and benefits of each feasible option, then select the option that, on average, best fulfils her goals. The choice would be independent from the alternatives that happen to occur in the decision context. However, individuals, and also experts, sometimes violate this regularity principle (Redelmeier & Shafir, 1995). When a given option is presented along with two alternatives, similar to each other, they choose it more often than when it is presented with just one of the alternatives. Despite the theoretical and practical importance of such paradoxical choices in medical decision-making, this effect and its boundary conditions have not been extensively tested. The objective of the three present studies is to generalize the effect with healthcare professionals by using realistic scenarios that involve two alternatives displaying various degrees of similarity. In our studies, 155 psychiatrists, 149 gynecologists and 89 nurse managers had to indicate the treatment they would recommend in clinical scenarios containing one of three options, or just two of them. The results showed that professionals chose the focal option more often when both alternatives were available. The paradoxical effect occurred for all scenarios. In conclusion, the context of available options affects professionals' choices when the alternatives are similar, but also when they present diverging features. Professionals need to be aware of such a source of practice variability, and encouraged to consider each option per se, before they compare the available options.

### Characterisation of change as a cognitive novelty in the solution of a physical-mathematical problem of proportionality

**Hugo Escobar** *Universidad Javeriana, Colombia*

The study has the goal of describing and explaining that cognitive development has change as a cognitive novelty at its core. The study captures the process of cognitive novelty through the employment of diverse

procedures in solving a problem that involves displacing an object by means of the manipulation of time (event duration) and speed with regards to a specific distance. This problem is presented in an interactive software possessing a complex data repertoire enabling it to follow the subject's activity. A logical-mathematical model was created to show whether participants assign data to variables in an orderly fashion, the control of variables involved in the procedure, and the presence of a plan translating into the use of multiplicative operations with both variables with regards to the distance needed to be traveled in order for the object to get to the goal successfully. Participants were 90 students. The problem allowed for the capturing of the dynamic process of psychological development, understood as change, transformation, novelty and equilibrium, where participants go from no orderly assignment of data to the variables, to partial control of variables, to a real problem solving plan involving multiplicative operations. The question for change as a cognitive novelty in a conception of development as a dynamic process is answered by this perspective in a significant way, enabling descriptions and explications coherent with the possibility of behavioural variability.

### Enhancing spatial working memory in children through differential outcomes

**Laura Esteban Garcia** *University of Almería, Spain;*  
**Ginesa Lopez-Crespo;** **Angeles F. Estevez;** **Ana B. Vivas**

It has been demonstrated that delayed face recognition memory is improved in old adults, and in patients with alcohol induced amnesia and AD, when specific outcomes (e.g. reinforcers) are associated with each face to-be-remembered (Hochhalter, Sweeney, Bakke, Holub, & Overmier, 2000; López-Crespo, Plaza, Fuentes, & Estévez, 2009; Plaza, López-Crespo, Antúnez, Fuentes, & Estévez, submitted). In the present study we assessed whether the DOP might also improve spatial working memory in five and seven-year-old children. Three spatial delayed recognition tasks were used. In the differential outcomes condition each position was paired with its own outcome. In the non-differential outcomes condition reinforcers were provided in a random manner. Participants showed a significantly better delayed spatial recognition when differential outcomes were arranged. The analyses also revealed that when the task was very easy participants did not benefit from the differential outcomes training. These findings demonstrate, to our knowledge for the first time, that spatial working memory in children is improved when differential outcomes are employed, and draw attention to the potential of this training as a therapeutic technique to facilitate working memory performance in humans.

### Studying deception in anonymous social interactions: The speed-dating paradigm

**Marcel Falkiewicz** *Nencki Institute, Poland;* **Justyna Sarzynska;** **Dagmara Bartczak;** **Anna Grabowska;** **Iwona Szatkowska;** **Tais Carmo**

Contemporary models of deception point to several cognitive processes necessary to generate deceptive behaviours. These processes include inhibition of automatic response, attention switching and capacity of working memory. When a person generates a deceptive response, these processes are claimed to