

REVERSE CROSS- MODAL TRANSFER BETWEEN TOUCH AND VISION IN NEWBORNS INFANTS : SHAPE vs.TEXTURE*



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INTRODUCTION: Several studies have shown neonates' abilities to coordinate information between vision and touch. Streri and Gentaz (2003; 2004) showed that 3-day-old newborns can visually recognize the shape of a previously felt object. However, these studies did not examine the reverse transfer, i.e. a tactual recognition of a seen object. Moreover, to our knowledge, no study has examined whether a cross-modal transfer between vision and touch exists for another property, such as texture. Nevertheless, newborns are able to compare texture density information across modalities (Molina & Jouen, 2001). Shape and texture are both amodal object properties, shared by vision and touch. Yet, whereas shape is a structural property and is essential to object identification, texture is a material property that allows object identification when their shapes are similar. A comparison between these properties in a cross-modal transfer task would allow us to understand how the visual and haptic modalities process information on the properties of objects. In four experiments in newborns infants, we used an habituation/novelty reaction procedure to provide evidence for a reverse cross-modal transfer of shape and texture from touch to vision and from vision to touch.

SUBJECTS:

- Part 1. Cross-modal transfer of shape:
-from touch to vision: 12 newborns (mean age: 49h)
-from vision to touch: 12 newborns (mean age: 38h)
Part 2. Cross-modal transfer of texture:
-from touch to vision: 16 newborns (mean age: 45h30)
-from vision to touch: 16 newborns (mean age: 60h).

OBJECTS

shape: tactual objects: wooden cylinder 35mm long and 10mm in diameter/ wooden prism 35mm long and 45 triangle base.

visual objects: wooden cylinder 100 mm long and 30mm in diameter /wooden prism 100 mm long and 45mm triangle base.

-texture: tactual objects: 2 wooden smooth cylinders 35 mm long and 10 mm in diameter, including one with 12 pearls on it.

visual objects: 2 wooden smooth cylinders 100mm long and 30mm in diameter, including one with 24 pearls on it.



PROCEDURE :

- From touch to vision (exp. 1 & 3):
-Haptic habituation: successive tactual presentation of an object in newborn's right hand until reaching habituation criterion.
-Visual test phase: alternative visual presentation of familiar and novel objects during four trials.

Hypothesis: A cross-modal transfer from touch to vision is evidenced if newborns looked longer at the object not previously held.

- From vision to touch: (exp.2 & 4)

- Visual habituation: successive visual presentation of an object until reaching habituation criterion.
- Haptic test phase: alternative presentation in newborn's right hand of familiar and novel objects during four trials.

Hypothesis: A cross-modal transfer from vision to touch is evidenced if newborns held longer the object not previously seen.

RESULTS:

Exp.1: Cross-modal transfer of **SHAPE** from touch to vision: 11 newborns looked longer at the novel object (ie. shape not previously held) and 1 newborn looked longer at the familiar object (ie. shape previously held). Cross-modal transfer of shape from touch to vision was shown. (see table 1).

Exp. 2: Cross-modal transfer of **SHAPE** from vision to touch: 6 newborns held longer the novel object (ie shape not previously seen) and 6 newborns held longer the familiar object (ie shape previously seen) Failure to show cross-modal transfer of shape from vision to touch. (see table 1).

Exp. 3 Cross-modal transfer of **TEXTURE** from touch to vision: 13 newborns looked longer at the novel object (ie, texture not previously felt) and 3 newborns looked longer at the familiar object (ie, texture previously touched) Cross-modal transfer of texture from touch to vision was shown. (see table 2).

Exp. 4: Cross-modal transfer of **TEXTURE** from vision to touch: 13 newborns held longer the novel object (ie, texture not previously seen and 3 newborns held longer the familiar object (ie texture previously seen). Cross-modal transfer of texture from vision to touch was shown. (see table 2).

SHAPE			
(exp. 1) haptic habituation		visual test	
mean total time habituation	mean number of trials	novel	familiar
92.1	5.3	76.96*	35.03
(exp. 2) visual habituation		haptic test	
mean total time habituation	mean number of trials	novel	familiar
110.3	6.4	103.7	32.98

$p < .01$ $t(11) = 4.22$
 ns $t(11) = 1.76$

Table1. Characteristics of habituation and test phases in sec for cross modal transfer of shape .

TEXTURE			
(exp.3) haptic habituation		visual test	
Mean total time habituation	mean number of trials	novel	familiar
90.04	6.25	86.74*	29.91
(exp.4) visual habituation		haptic test	
mean total time habituation	mean number of trials	novel	familiar
117.82	7.87	87.11 *	36.34

$p < .01$ $t(15) = 2.99$
 $p < .05$ $t(15) = 2.34$

table 2. Characteristics of habituation and test phases in sec for cross modal transfer of texture.

GENERAL CONCLUSION: We showed that cross-modal transfer of shape is not reversible at birth. Newborns can visually recognize a shape previously held but they fail to tactually recognize a shape previously seen. This result suggests that the acquisition and nature of information about shape gathered by vision and touch are different : Visual perception is global and immediate whereas tactual perception is partial. Conversely, we evidenced for the first time, reverse cross-modal transfer of texture between touch and vision at birth. The nature of texture information gathered by both modalities seems to be equivalent. Texture would require low level process. Taken together, the results support the hypothesis concerning the ability to coordinate information between tactual and visual modalities at birth. An epigenetic point of view may be proposed. The links between touch and vision depend of the properties of objects.

Molina, M., & Jouen, F. (2001). Modulation of manual activity by vision in human newborns. *Developmental Psychobiology*, 38, 123-132.

Streri, A., & Gentaz, E. (2003). Cross-modal recognition of shape from hand to eyes in human newborns. *Somatosensory & Motor Research*, 20(1), 11-16.

Streri, A. & Gentaz, E. (2004). Cross modal recognition of shape from hand to eyes and handedness in human newborns. *Neuropsychologia*, 42, 1365-1369.