

CHANGE AT PUBERTY IN SPATIOPERCEPTUAL STRATEGY ON THE ROD-AND-FRAME TEST

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Summary.—It is now possible to study spatioperceptual strategies on the rod-and-frame test with a new scoring method. The method is presented and used to analyze cross-sectional data taken from a comprehensive 10-yr. cohort-sequential study of pubertal development of girls and boys.

The rod-and-frame test (Witkin, *et al.*, 1974) is usually scored by simply averaging the number of degrees the rod deviates from the physical vertical over eight trials without taking notice of the direction of tilt of the frame and rod [Absolute Error or Unsigned Deviation (UD) method]. However, this method confounds the four independent main variables in the task: (1) the rod starting-position effect, ρ , (2) the constant error, μ , (3) the frame-tilt effect, ϕ , and (4) the response consistency effect, σ . A signed deviation method was, therefore, developed to separate these (Nyborg, 1974, Nyborg & Isaksen, 1974).

Further methodological innovation consists in estimating which of four spatioperceptual strategies subjects use in performing the rod-and-frame task by this method (Nyborg, 1977, 1978). In accordance with the method subjects are first classified with respect to their response consistency: subjects with $\sigma > 3^\circ$ are seen as response inconsistent and are said to use a D-strategy. The response consistent subjects are further divided in accordance with the size of their ϕ -value. Subjects with $\phi > 8^\circ$ are said to use an optically dominated (C) strategy; subjects with ϕ between 2 and 8° use an optic-vestibular (somesthetic) compromise (B) strategy, and subjects with $\phi < 2^\circ$ use a vestibular (somesthetic) dominated (A) strategy.

When performance of 150 8- to 16-yr.-old girls and boys is scored in accordance with the SPS method the following changes in strategies are observed; see Table 1.

Between 55 and 93% of the 8- and 10-yr.-old children applied ineffective response-inconsistent D-strategies or heavily optically dominated C-strategies. At age 16 60% of the girls but 94% of the boys used either the effective optical-vestibular (somesthetic) compromise B-strategies or the optimal vestibular (somesthetic) A-strategies. This sex-related difference is statistically significant (Fisher's exact test $p = .04$) and parallels the usual sex difference found with the traditional unsigned deviation method.

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TABLE 1
CHANGE WITH AGE IN SPATIOPERCEPTUAL STRATEGIES OF CHILDREN ($n_s = 150$)

Age in Years	Girls								Boys							
	Systematic				Unsystematic				Systematic				Unsystematic			
	A		B		C		D		A		B		C		D	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
8	0	0	1	7	5	33	9	60	0	0	1	7	8	53	6	40
10	1	7	0	0	5	33	9	60	1	7	6	40	4	27	4	27
12	6	40	3	20	1	7	5	33	3	20	3	20	4	27	5	33
14	5	33	3	20	1	7	6	40	8	53	5	33	1	7	1	7
16	6	40	3	20	2	13	4	27	10	67	4	27	0	0	1	7
$\chi^2 = 20.3, p < .0005$								$\chi^2 = 30.9, p < .0005$								

Studies of delayed development of spatio-perceptual strategies in women with sex chromosome abnormalities (Nyborg, 1988) have further demonstrated that application of the new SPS method may extend the empirical as well as the theoretical scope of data from the rod-and-frame task.

REFERENCES

- NYBORG, H. (1974) A method for analyzing performance in the rod-and-frame test: I. *Scandinavian Journal of Psychology*, 15, 119-123.
- NYBORG, H. (1977) *The rod-and-frame test and the field dependence dimension: some methodological, conceptual, and developmental considerations*. Copenhagen: Dansk Psykologisk Forlag.
- NYBORG, H. (1983) Spatial ability in men and women: review and new theory. In S. Rachman & T. Wilson (Eds.), *Advances in human research and therapy*. Vol. 5. London: Pergamon. Pp. 39-140.
- NYBORG, H. (1984) Performance and intelligence in hormonally-different groups. In G. J. de Vries, J. P. C. de Bruin, H. B. M. Uylings, & M. A. Corner (Eds.), *Sex differences in the brain: progress in brain research*. Vol. 61. Amsterdam: Elsevier. Pp. 491-508.
- NYBORG, H. (1988) Sex hormones, brain development, and spatio-perceptual strategies in women with Turner syndrome and in school girls. In B. Bender & D. Berch (Eds.), *Sex chromosome abnormalities and behavior: psychological studies*. Boulder, CO: Westview Press.
- NYBORG, H., & ISAKSEN, B. (1974) A method for analyzing performance in the rod-and-frame test: II. Test of the statistical model. *Scandinavian Journal of Psychology*, 15, 124-126.
- WITKIN, H. A., DYK, R. B., FATERSON, H. F., GOODENOUGH, D. R., & KARP, S. A. (1974) *Psychological differentiation*. Potomac, MD: Erlbaum. (Originally published, 1962)

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