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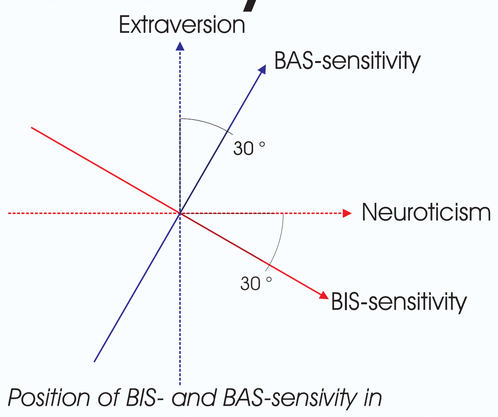
Exploring the relations of Eysenck's and Gray's personality dimensions in a German sample

Gray's theory of personality

J. A. Gray (1981, 1987) suggested that H. J. Eysenck's personality dimensions neuroticism (N) and extraversion (E) (e.g. Eysenck, 1967, 1981) reflect interindividual differences in two basic emotional systems: The *behavioral inhibition system (BIS)*, which mediates the responses to conditioned signals of punishment, and the *behavioral approach system (BAS)*, which mediates the responses to conditioned signals of reward.
Gray supposes interindividual differences in BIS- and BAS-sensitivity as basic dimensions of personality that lie about 30° rotated* from N and E in a common, twodimensional factor space. As a consequence, N should be positively related to BIS- and positively to BAS-senstivity, while E should be negatively related to BIS- and positively to BAS-sensivity.

*45° in earlier versions of the model



Position of BIS- and BAS-sensivity in a common factor space with N and E (cf. Pickering, Corr & Gray, 1999, p. 360)

Personality measures

The personality dimensions of Gray's and Eysenck's theories where assessed using the following personality measures:

ARES-scales (Hartig & Moosbrugger, 2000)

The German-language ARES-scales (Action Regulating Emotion Systems), constructed according to central ideas of Carver & Whites' (1991) BIS/BAS-scales, assess BIS- and BAS-sensitivity.

Two scales for BIS-sensivity:		Two scales for BAS-sensivity:	
- BIS1 Anxiety	(13 items; $\alpha = .92$)	- BAS1 Drive	(10 items; $\alpha = .89$)
- BIS2 Frustration	(10 items; $\alpha = .91$)	- BAS2 Reward sensitivity	(11 items; $\alpha = .83$)

EPP-D (Eysenck, Wilson & Jackson, 1998)

The German version of the Eysenck Personality Profiler (EPP-D) assesses neuroticism and extraversion on primary trait level.

Four scales for neuroticism:		Four scales for extraversion:	
- N1 Inferiority	(14 items; $\alpha = .62$)	- E1 Active	(13 items; $\alpha = .77$)
- N2 Unhappy	(13 items; $\alpha = .81$)	- E2 Sociable	(14 items; $\alpha = .77$)
- N3 Anxious	(13 items; $\alpha = .82$)	- E3 Assertive	(11 items; $\alpha = .70$)
- N4 Obsessive	(10 items; $\alpha = .64$)	- E4 Ambitious	(14 items; $\alpha = .74$)

Hypotheses & Methods

Questions

The target of the study was to investigate
1) if BIS- and BAS-sensivity and neuroticistic and extraverted traits lie in a common, twodimensional factor space and
2) if there is support for the assumption of a systematic deviation of BIS- and BAS-sensivity from N and E in their common factor space.

Sample

- $N = 243$ german participants, mostly undergraduate psychology students.
- 19% male, 81% female
- age ranges from 17 to 77 years, $MD = 26$.

Canonical analysis: The canonical correlation between both sets of scales was computed to test the statistical significance of their overall relation and to estimate the common variance of both sets.

Factor analysis: To investigate the dimensionality of Eysenck's and Gray's personality constructs, the correlation structure of EPP-D- and ARES-scales was analysed in a principal factors analysis.

Linear regression: Stepwise linear regression was used to test which specific BIS- and BAS-scales predict the primary E- and N-traits and if the directions of the influences conform with Gray's model.

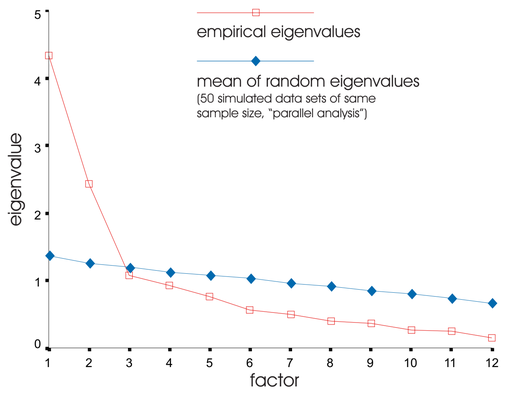
Canonical analysis

Canonical $R = .82$; $\chi^2 = 430.01$; $df = 32$ $p < .001$

The canonical correlation of both variable sets accounts for 45.93% of variance in the ARES- and 31.14% of variance in the EPP-D-scales.

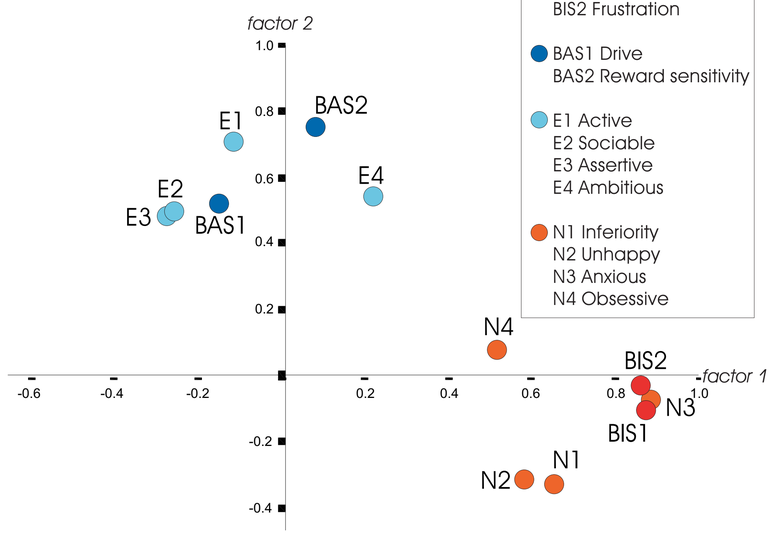
Results of the canonical analysis show that the canonical correlation between ARES- and EPP-D-scales is highly significant and explains an considerable amount of variance in both variable sets.

Factor analysis



Plot of eigenvalues for the common factor space of EPP- and ARES-subscales. The first two factors account for 56% of the total observed variance.

The comparison of empirical with simulated random eigenvalues (parallel analysis) indicates that no more than two nontrivial factors account for the common variance of ARES- and EPP-D-subscales. A graphical inspection (scree-test) also clearly indicates a two-factorial solution.



Factor loadings of EPP- and ARES-subscales in common factor space (pricipal factors analysis with varimax-rotation).

Loadings of the two varimax-rotated factors reveal one common factor for BIS-sensivity and neuroticism (factor 1) and one for BAS-sensivity and extraversion (factor 2). BIS- and N-scales form one, BAS- and E-scales another variable cluster; factor loadings indicate no systematic deviation of BIS- and BAS-sensivity from N- and E-traits.

Stepwise linear regression

BIS- and BAS-scales were used to predict each N- and E-scale in stepwise regressions. The table shows the standardized regression weights β for the predictors that were entered in the respective regression model with $p \leq 5\%$.

	BIS1 Anxiety	BIS2 Frustration	BAS1 Drive	BAS2 Reward sensivity	R^2
N1 Inferiority	.577			-.130	.355
N2 Unhappy		.443		-.297	.328
N3 Anxious	.425	.387			.599
N4 Obsessive	.441				.191
E1 Active	-.231			.500	.311
E2 Sociable	-.184		.374		.191
E3 Assertive	-.592	.275		.302	.261
E4 Ambitious			-.225	.523	.183

significant β's supporting Gray's model; significant β's inconsistent with Gray's model

Consistently with Gray's theory extraverted traits are negatively related to BIS- and positively related to BAS-sensivity. However, neuroticistic traits, which Gray's model would expect to be positively related to BAS-sensivity, show no or negative relations with the ARES-BAS-subscales.

References

Carver, C. S. & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology, 67,* 319-333.

Eysenck, H. J. (1967). *The biological basis of personality.* Springfield, Ill.: Charles Thomas.

Eysenck, H. J. (1981). General features of the model. In H. J. Eysenck (Ed.). *A model for personality,* 1-37. Berlin, Heidelberg, New York: Springer.

Eysenck, H., Wilson, G. & Jackson, C. (1998). *Eysenck Personality Profiler - German adapted version.* (Deutsche Bearbeitung des Manuals: Stephan Bulheller und Hartmut Häcker. Mit einem Beitrag zur Konstruktvalidierung von H. Moosbrugger, A. Fischbach und K. Schermelleh-Engel. Manual, Fragebogen und Auswertungsprogramm). Frankfurt am Main: Swets.

Gray J. A. (1981). A critique of Eysenck's theory of personality. In H. J. Eysenck (Ed.). *A model for personality,* 246-276. Berlin, Heidelberg, New York: Springer.

Gray, J. A. (1987). *The psychology of fear and stress.* Cambridge: Cambridge University Press.

Hartig, J. & Moosbrugger, H. (2000). *ARES - Action Regulating Emotion Systems. Skalen zur Erfassung der Sensitivität Handlungsregulierender Emotionssysteme.* Frankfurt/M.: Arbeiten aus dem Institut der J.W. Goethe-Universität, Heft 2000/10.

Pickering, A. D., Corr, P. J. & Gray, J. A. (1999). Interactions and reinforcement sensivity theory: A theoretical analysis of Rusting and Larsen (1997). *Personality and Individual Differences, 26,* 357-365.

Summary and Conclusion

The factor structure of ARES- with EPP-D-scales supports the assumption that BIS and BAS sensitivity lie in a common, twodimensional factor space with E and N. The results of the canonical analysis also demonstrate that scores for BIS- and BAS-sensivity share an highly significant amount of variance with E- and N-measures.

However, factor loadings show *no systematic deviation* of BIS-and BAS- from E- and N-variable clusters, thus yielding no support for Gray's assumption of a rotated position of BIS- and BAS-sensivity relative to E and N. The primary and secondary factor loadings as well as the regression weights for extraverted traits in stepwise linear regression mostly conform with the assumption of E being a conglomerate of high BAS- and low BIS-sensivity. But while N and BAS-sensivity should be positively correlated in Gray's model, regression analysis showed zero correlations or weakly negative β's between BAS-sensivity and neuroticistic traits.

Overall, the results rather support Carver & Whites' (1991, p. 320) view, "that the metaphor of the 45° rotation may have outlived his usefulness". The question raises if neuroticism *directly* reflects interindividual differences in BIS-sensitivity.