

# Development of a Custom Gene Panel for the Detection of Genetic Traits Associated with Differential Susceptibility of Individuals to Environmental Features - A Project Overview



Hana Minařík, M. Sc. Psychologie  
(Clinical Molecular Genetics & Epigenetics/Developmental Psychology)

## Objective

The interindividual susceptibility to environmental experiences of humans is determined through genes and manifests in the sensitivity of the nervous system. Genes enhance or weaken the relation between environmental conditions and environmental sensitivity, so that genes could have an impact on emotional, motivational, and behavioural variables.

Our project is located at the interface between the research field of clinical molecular genetic and developmental psychology and describes interactions between human genetics and the environment (G×E). That means that interactions occur when the effect of the environment depends on a person's genotype or, equivalently, when the effect of a person's genotype depends on the environment (Duncan, 2011).

Our construct is the differential susceptibility theory that suggests that people's development and emotional affect is differentially susceptible to experiences or

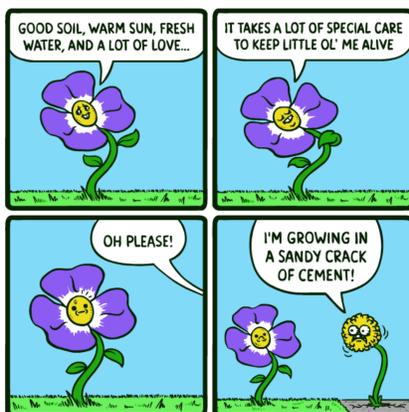
qualities of the environment.

We are interested in how people deal with microenvironmental demands on basis of their susceptibility in connection with their genetics.

Our thoughts are that genes could have a moderator effect, that influences the relationship of perceived demands and differential susceptibility.

To measure differential susceptibility we screen how people handle with demands and resources, we implement a test battery to measure our construct objective and take a look to the genetics through a restricted genome wide association study (GWAS). As internal standard we measure the construct of ambiguity that helps us to assess the subjective screening data as well as the objective data of the test battery.

The results should give an impression how genes moderate the connection between the differential susceptibility of people and how they deal with demands.



## Scientific Issues

1. People react interindividual different to objective demands in the field of perception, heuristic differentiation of complex systems, valuation, and coping strategies.
2. Genes have a moderator effect on the connection between differential susceptibility and the experience of interindividual demands.
3. The construct of ambiguity gives indication about the quality of our measured data.

## Materials and Methods

### Test subjects

We would like to include min. 50 participants in the evaluation (native speakers, European socialization, normal or corrected vision capacity). Therefore they have to give their informed consent.

Exclusion criteria: Current mental diseases, psychotropic medication.

### Methodological Procedure

#### 1. Screening

The screening will be implemented as longitudinal study on two time points.

The questionnaire of *psychosocial resources and coping with social change* (Silbereisen & Tomasik, 2006) is the basis of the screening.

The underlying theory is the *process of coping through modelling of optimisation in primary and secondary control* (Heckhausen & Schulz, 1993).

We adapt the questionnaire to have a more selective view on how participants cope with demands and resources in the microcontextual fields of work, family/intimate relationship, and with SARS-Cov-2. This is the connection with the underlying model of *social change and individual development* (Silbereisen & Tomasik, 2015).

The OPS-Questionnaire (Heckhausen & Schulz, 1998) gives information about how individuals deal with their resources and vulnerabilities.

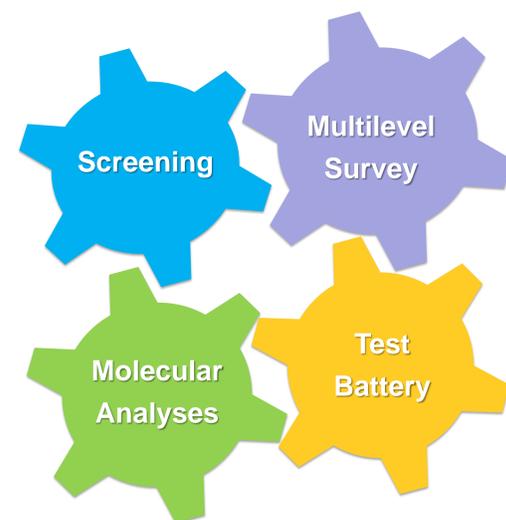
#### 2. Molecular Analyses

Due to the pandemic situation we have the problem to collect the DNA-material so that we decided to let the participants collect the specimens by themselves. We arranged homepackages that includes the buccal swabs, a detailed instruction for the collection and further informations.

For the restricted GWAS we preselected 146 genes associated with the regulation of serotonin and dopamine, stress response, learning and cognition, and others devoted to current literature.

In the ZBAF research laboratory (Prof. Jan Postberg) of the HELIOS university hospital Wuppertal the purification and quality control of the specimens take place.

For the exome sequencing the purified specimens were shipped to BGI (Shenzhen, China). The data analyses will be complemented.



#### 3. Psychological Test Battery

In order to assess the relation between characteristics of the genotype and cognition strategies the molecular data were correlated with the psychological data out of a test battery that has to be implemented.

1. Perception: Awareness (Sustained Attention Task), perception threshold (acustical, visual), orientation (habituation-dishabituation-paradigm), success and failure (heart rate, gambling task)
2. Heuristic differentiation of complex systems: Nonlinear Cybernetic Task
3. Valuation: Challenge and threat (profit and loss), approximation and rejection (approach avoidance test)
4. Coping strategies: through tasks that measures frustration tolerance (different levels of difficulty)

#### 4. Multilevel Survey

This is a short survey about 5 minutes. It will be sent in time intervals of two weeks about three month to the participants.

We have connected this survey to collect objective data that can be compared with subjective evaluated demands that we get through the online screening.

The multilevel survey should collect on the one side informations like the usage of the corona-warn-app, but also on the other side about the construct of ambiguity.

## Outlook

Currently, we are in the process of recruitment. The next step would be to start with the online screening. Then, we have to analyse the results and cluster extreme groups to get first informations. For the molecular analyses we have to send the study packages to the participants and parallel we start with the multilevel survey. After that, we have to arrange the test battery, so that we can start therewith parallel to timepoint two of the screening.

## References

- Duncan, L. E., & Keller, M. C. (2011). A critical review of the first 10 years of candidate gene-by-environment interaction research in psychiatry. *American Journal of Psychiatry*, 168(10), S. 1041-1049. doi:10.1176/appi.ajp.2011.11020191.
- Heckhausen, J., & Schulz, R. (1993). Optimisation by Selection and Compensation: Balancing Primary and Secondary Control in Life Span Development. *International Journal of Behavioral Development*, 16(2), S. 278-303. doi:10.1177/016502549301600210
- Heckhausen, J., Schulz, R., & Wrosch, C. (1998). Developmental regulation in adulthood: Optimization in Primary and Secondary Control - a multiscale questionnaire (OPS-Scales). *Unpublished Technical Report, Max Planck Institute for Human Development and Education, Berlin, Germany.*
- Silbereisen, R. K., Pinquart, M., Reitzle, M., Tomasik, M. J., Fabel, K., & Grüner, S. (2006). Psychosocial Resources and Coping With Social Change. *Gesellschaftliche Entwicklungen nach dem Systemumbruch*(19).
- Silbereisen, R. K., & Tomasik, M. J. (2015). Social and Economic Change: Psychological Challenges for Individuals. (W. J.D., Hrsg.) *Elsevier*, 22, 147-155.