

Lena Kästner

To What Degree Do Genes and Environment Influence Psychoactive Substance Use?

— During early adolescence psychoactive substance use (PSU) is mainly influenced by shared familiar environments¹ whereas genetic factors play the major role in middle adulthood, as Kendler et al. [1] report in a recent study. I will briefly outline the experimental setup, researchers' motivation, their results and the interpretation they offer for these. Finally I will come to comment on restrictions and possible extensions.

What was done?

Kendler et al. interviewed 1796 white male-male twins born in Virginia (aged 24-62) about their average consumption of four psychoactive substances (PS)—alcohol, caffeine, cannabis and nicotine—during each year of their lifetimes. Only the data concerning ages 9 to 35 was analyzed (756 twin pairs, 469 monozygotic (MZ) 287 dizygotic (DZ)); except for alcohol (ages 9 to 40, 452 pairs).

Interviews were guided by a life history calendar and mainly held via telephone—including 142 short-term re-tests after 29 days and long-term re-tests after 51 months for all subjects to ensure reliability.

Why was it done?

Using the above procedure, Kendler et al. aimed at determining the relative importance of environmental and genetic influences on PSU from early adolescence through middle adulthood. More specifically, they asked (1) what the developmental pattern of those influences on PSU is, (2) whether they vary across substances, and (3) how genes and environment contribute to correlations in use of different PS and whether this pattern changes throughout development.

What did they find?

They found that caffeine was used earliest, and by eventually over 90% of the subjects. From 10 to 18 years of age, environmental influences gradually decreased while genetic influences increased, from 9 to 14 year of age, before they stabilized. Nicotine use started next and affected maximally 45% of the sample. At the age of 13, environmental influences were strong and disappeared at around 30 when genetic influences (while rising rapidly between 15 and 19) stabilized. Alcohol use started slightly later and reached a peak of 80% at the age of 22 before it slightly decreased. From age 14 to the late 20s, environmental influences played a key role while genetic factors displayed rising importance from 15 to 23

¹Note that environmental influences can last longer than the actual exposure to it.

years of age. Cannabis use began latest and effected less than 27% of the sample. From 14 years of age to the late 20s environmental factors played a major role while genes did at ages 32 and later. For all substances, stronger correlations of PSU were found in MZ than in DZ twins.

Further analysis revealed no correlations for caffeine with other substances, except for nicotine (rising with age). The strongest correlation was found between alcohol and cannabis which slightly decreased with age; nicotine-alcohol and nicotine-cannabis correlations displayed a similar pattern.

What does it mean?

Returning to the initial questions, Kendler et al. conclude that (1) familiar environments have the strongest influence during early adolescence while this decreases with age and finally disappears; the reverse pattern is found for genetic factors.² (2) This holds generally across substances, while ages at which the shift from environmental to genetic dominant influence occurs differ. Finally, (3) for correlations between use of different substances a similar general effect was observed: shared environmental influences decrease with age while genetic influences increase.

What's wrong/ left?

After I have presented how Kendler et al. reach their conclusions, let me give a few remarks. First, the present paper did not mention *any* gene screening or analysis techniques which casts considerable doubt on the reliability of their results. Note that genetic identity can even in MZ twins not be taken for granted. Second, one should keep in mind that the current study was limited to white male-male twins born in Virginia. It would be interesting to compare the data with a female sample or, especially since age for legal use of e.g. alcohol differs across countries, a sample from another nation to see whether or not the same pattern can be observed. My third worry is a general one: did participants really tell the truth? Though there were re-tests, one cannot ensure that all information was correct. Fourth, the decreased sample size at higher ages might have introduced recall biases and reduced accuracy. Fifth, PSU assessment was coarse (estimates of daily amounts were taken for an entire month or year) and vague (different sizes of cups, joints etc.). Though difficult to realize, detailed protocols on PSU would provide better data. Moreover, individual sensitivity to PS and possibly clinical backgrounds were not considered in the general results. Finally, a useful extension of this study could be to consult participants' families and thereby gain more information about both genetic and environmental influences on PSU.

References

- [1] Kendler, K.S. et al. (2008). Genetic and Environmental Influences on Alcohol, Caffeine, Cannabis, and Nicotine Use From Early Adolescence to Middle Adulthood. *Genetic Psychiatry*, 65(6), 673-682.

²The authors also suggest an alternative interpretation according to which environmental influences stay constant but are gradually replaced by genetic ones.