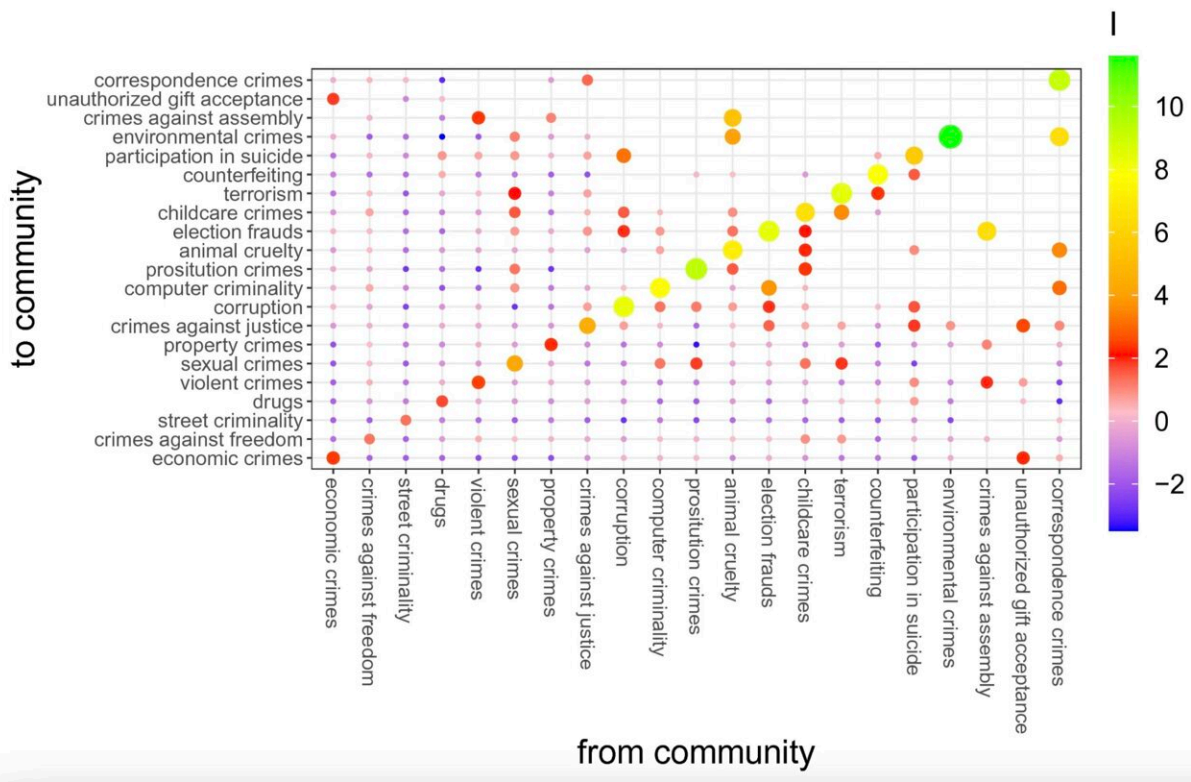


New scientific methods for analyzing criminal careers

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The bigger and greener the node, the more exchange takes place. Specialization is more likely to occur with types of crime such as prostitution or environmental crime than with others. Credit: Complexity Science Hub

Researchers at the Complexity Science Hub have examined 1.2 million criminal incidents and developed an innovative method to identify

patterns in criminal trajectories. The study is [published](#) in the journal *Scientific Reports*.

When it comes to preventing future crimes, it is essential to understand how past criminal behavior relates to future offenses. One key question is whether criminals tend to specialize in specific types of crimes or exhibit a generalist approach by engaging in a variety of illegal activities.

Despite the potential significance of systematically identifying patterns in criminal careers, especially in preventing recurrent offenses, there is a scarcity of comprehensive empirical studies on this subject.

"To address this gap, we conducted an exhaustive examination of over 1.2 million criminal incidents," elaborates Stefan Thurner of the Complexity Science Hub. This comprehensive dataset encompassed all criminal reports filed against individuals over six years in a small Central European country.

Specialists with certain features

Criminal offenders who specialize in specific types of crimes typically are older and more frequently female than individuals involved in a broader range of offenses.

"These individuals, referred to as specialists, also tend to operate within a more confined geographic area, suggesting their dependence on local knowledge and potentially receiving support from individuals within that [specific region](#), as opposed to offenders with a wider focus," Thurner explains one of the study's results. Furthermore, the researchers observed that these specialists tend to collaborate in tighter-knit local networks, increasing the likelihood of recurring partnerships.

Data-driven clustering

In developing this method, researchers initially categorized all offenses into 21 categories, including corruption and sexual crimes, for example. "Subsequently, we clustered the criminal offenders based on the crimes they committed," explains Georg Heiler from CSH.

To this anonymized dataset, the scientists added socio-demographic information such as age and gender, as well as details about the nature and severity of the committed offenses and the geographical region where they occurred. "The resulting clustering allows for data-driven categorization of crimes, revealing patterns of criminal behavior," Thurner says.

Strengths of the method

Regardless of the type and frequency of crimes, this new method's strength lies in the fact that each cluster may consist of varying numbers of [crime](#) types and offenses. The fact that some offenses (such as fraud or drug possession) occur more frequently than others (like counterfeiting or data misuse) does not influence the results.

The method also takes into account how often individuals commit specific types of offenses. Researchers found, among other things, that a transition between certain types of crimes occurs significantly more often than others. "This suggests that specialization in certain categories is more likely than in others," Thurner notes. These include, for example, environmental crimes, terrorism, or prostitution crimes.

Preventing repeat offenses

According to a report by [Statistics Austria](#), the reconviction rate in 2022

was 30%.

Of the 581,000 individuals involved in this study, nearly a quarter committed more than one offense. If these repeat offenders specialize in specific crimes like burglaries, drug-related offenses, or hacking, this knowledge could assist law enforcement agencies in better anticipating criminal developments. Tailored measures in the areas of policing, prevention, and rehabilitation could have an even greater impact.

The close collaboration between law enforcement agencies and science has already demonstrated in previous projects how the development of new tools based on [scientific methods](#) can support police work in terms of resource allocation, planning, and execution of actions, as well as the efficiency, relevance, and quality of results. This is, of course, done while adhering to all legal standards, especially national and international data protection standards.

"While this dataset has the usual limitation of not containing information about undetected or unsolved crimes, we hope that with this method, we can support the work of [law enforcement agencies](#) from a scientific standpoint," Thurner concludes.

More information: Georg Heiler et al, A large-scale empirical investigation of specialization in criminal career, *Scientific Reports* (2023). [DOI: 10.1038/s41598-023-43552-6](https://doi.org/10.1038/s41598-023-43552-6)

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