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**Author(s):** Sirola, Anu; Savolainen, Iina; Oksanen, Atte

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## Who uses the dark web? Cross-national and longitudinal evidence on psychosocial, behavioral, and individual predictors

Anu Sirola<sup>a,\*</sup>, Iina Savolainen<sup>b</sup>, Atte Oksanen<sup>b</sup><sup>a</sup> The Department of Social Sciences and Philosophy, University of Jyväskylä, Finland<sup>b</sup> Faculty of Social Sciences, Tampere University, Finland

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### ABSTRACT

The dark web is known for illicit and unregulated content, making it crucial to gain a better understanding of dark web users. This article reports two studies analyzing the role of psychosocial well-being, problematic online behaviors, personality traits, and institutional trust in dark web use. Study 1 utilized cross-sectional data from 18 to 75-year-old respondents from six European countries. Dark web use was examined in relation to psychological distress, social belonging, excessive social media use, online identity bubbles, and institutional trust. In Study 2, the associations were scrutinized using longitudinal survey data from Finnish respondents aged 18 to 75, expanding the focus to problem gambling and personality traits. Logistic regression models were used for the analyses. In Study 1, excessive social media use, involvement in online bubbles, poor social relationships, and male gender were associated with dark web use across European countries. Country differences were found regarding institutional trust, psychological distress, and sociodemographic factors. The results of Study 2 supported the findings regarding excessive online use and showed that gambling problems and certain personality traits predicted dark web use. The dark web attracts excessive online users and those burdened with psychosocial issues, as well as individuals with certain personality traits.

### 1. Introduction

The anonymous web (i.e., the dark web or darknet) is a hidden part of the Internet, most typically accessed via The Onion Router network (TOR), which has approximately 2.5 million daily users (Montasari & Boon, 2023). Layered encrypting technologies provide high online privacy and anonymity, making tracking users nearly impossible (Moore & Rid, 2016). Downloading and using TOR is legal in many countries (Kaur & Randhawa, 2020), but high anonymity encourages some individuals to propagate and consume illegal content and services, such as illicit drug trading (Maddox et al., 2016; Nurmi et al., 2017), terroristic propaganda (Weimann, 2016), child pornography (Kloess & van der Bruggen, 2023; Moore & Rid, 2016), and illegal gambling (Choi et al., 2020). The unregulated nature of the dark web allows for the propagation of such illicit content and flourishing of conspiracy ideas and networks (Kwon et al., 2017; Topor, 2019) that would get banned from public social media (Burki, 2020). The most popular content and the uses of the hidden services in the dark web are illegal (Moore & Rid, 2016; Owen & Savage, 2015), but some users utilize TOR due to the benefits of anonymous online surfing, freedom of speech, and access to information,

particularly in politically repressive countries (Chertoff, 2017; Jardine, 2018). Despite some benefits of high anonymity, the dark web is a risky environment, and these risks might manifest among vulnerable individuals, such as excessive online users and those with compromised psychosocial well-being.

Research on the anonymous web has predominantly focused on “black markets” (e.g., drug markets) as well as other illicit activities and communities located in the dark web (e.g., ElBahrawy et al., 2020; Kermitsis et al., 2021; Kloess & van der Bruggen, 2023). During the COVID-19 pandemic, concerns were raised about illicit COVID-19-related products, such as vaccines and forged certificates available on dark web marketplaces (Bracci et al., 2022; Broadhurst et al., 2020; Catalani et al., 2023). However, there is a notable lack of research on underlying characteristics among dark web users in general. Gaining an understanding of dark web users and their underlying sociopsychological characteristics is necessary given the risky nature of content and networks located in the dark web (Kloess & van der Bruggen, 2023; Rama et al., 2023). To understand better and mitigate the risks of the dark web, it is important to understand what kinds of online users are likely to utilize such platforms.

\* Corresponding author at: Seminaarinkatu 15, PO Box 35, FI-40014, University of Jyväskylä, Finland.

E-mail address: [anu.r.s.sirola@juu.fi](mailto:anu.r.s.sirola@juu.fi) (A. Sirola).

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In this article, we report two studies investigating the use of the dark web and associated factors from a social psychological perspective, utilizing cross-national and longitudinal datasets. We examine the role of psychosocial well-being, problematic online behaviors, personality traits, and institutional trust among dark web users. Although these associations have been studied in relation to regular social media use (Erfani & Abedin, 2018), it is important to expand the focus on dark web users. Due to the many risks of and deviant content in the dark web, we approach the use of the dark web as a form of risky online activity that is likely to attract users with marginalized interests and overlap with other risky (online) behaviors. This study provides valuable insight into the limited knowledge of dark web users and their underlying characteristics, vulnerabilities, and online behaviors.

### 1.1. Anonymity and online communities in the dark web: social psychological perspectives

Digital platforms provide means for social connection and spending time in various online activities, but some individuals are more vulnerable to developing risky online behaviors. Psychological distress (e.g., symptoms of stress, anxiety, and depression) is linked to various types of risky online behaviors such as problematic use of the internet, smartphone, and social media (Chen et al., 2020; Marino et al., 2018; McNicol & Thorsteinsson, 2017). Individuals with psychological distress can engage in problematic online behaviors to regulate their negative emotions (Brailovskaia et al., 2020) and to seek content that fits their emotional mindset (Lee & Hancock, 2024). However, the role of psychological distress has not been studied in dark web use. Because the dark web is generally a risky online environment characterized by deviant and marginalized content (Moore & Rid, 2016), psychological distress can act as a trigger, priming individuals to engage in such online behavior. Thus, we hypothesize:

**H1.** Higher psychological distress is positively associated with dark web use. (Study 1 and 2).

Social belonging is one of the basic psychological needs (Baumeister & Leary, 1995; Ryan & Deci, 2017), and lonely individuals are often motivated to seek social connection from social media and online communities (O'Day & Heimberg, 2021; Sirola et al., 2019). Individuals who have marginalized or deviant interests, such as antisocial ideas and conspiracy beliefs, are prone to experience loneliness and social exclusion in offline relationships (Graeupner & Coman, 2017; Zwar et al., 2022). Perceived loneliness is a risk factor for various problematic online behaviors (O'Day & Heimberg, 2021; Savolainen et al., 2020), also dark web use (Sirola et al., 2022). Therefore, it is likely that dark web users have weak social belonging in the offline realm, making the following hypothesis worth testing:

**H2.** Social belonging is negatively associated with dark web use. (Study 1 and 2).

Because access to the dark web is not possible with common browsers or search engines, it requires more technological skills than regular social media use. Therefore, the dark web is likely to attract users who are highly engaged in online activities and skilled technology users in general, which might manifest in problematic and excessive online habits such as heavy social media use. There is evidence that the use of the dark web and surface web (e.g., regular social media platforms) overlaps among active users (Demant et al., 2019; Kwon & Shao, 2021; Sirola et al., 2022). Excessive social media users are also more likely to encounter risky online content, such as information on how to access the dark web (Kwon & Shao, 2021). Based on these research evidence covered, we hypothesize:

**H3.** Excessive online behaviors are positively associated with dark web use. (Study 1 and 2).

Social media platforms have facilitated the need to find like-minded

networks and information that fits one's worldview, but content and communities located in the dark web are likely to be more harmful. Whereas mainstream social media, such as Facebook and (the former) Twitter, aims to regulate illegal and misleading content (Burki, 2020; Gongane et al., 2022), the unregulated and anonymous nature of the dark web makes it possible to propagate such content and to form communities around deviant interests. In dark web communities, individuals can find a sense of belonging and validation of their interests that deviate from cultural or social norms (Gehl, 2016; Kloess & van der Bruggen, 2023; Maddox et al., 2016; Weimann, 2016) and form strong bonds and collective identities (Bilgri, 2018). High anonymity serves as a safeguard to communicate with like-minded others and might attract users who do not find validation for their thoughts and identities in offline networks.

The tendency to interact and identify with like-minded others is likely to create online identity bubbles that are characterized by shared identities, homophilic networks, and reliance on shared information (Kaakinen et al., 2020; Keipi et al., 2017). A notable risk of online identity bubbles is exposure to one-sided and even harmful information which is a particular risk in the dark web (Kwon et al., 2017; Topor, 2019). Online identity bubbles that are formed around deviant interests may reinforce harmful attitudes and behaviors (Del Vicario et al., 2016; Wolfowicz et al., 2023), and anonymity plays a key role in group processes, such as social influence (Lieberman & Schroeder, 2020). In the dark web, high anonymity facilitates identity-driven online behavior and social influence which might manifest in online identity bubbles. Furthermore, online identity bubbles are associated with active and excessive engagement in online behaviors (Kaakinen et al., 2020) that is typical among dark web users (Sirola et al., 2022). Therefore, we hypothesize:

**H4.** Involvement in online identity bubbles is positively associated with dark web use. (Study 1 and 2).

The dark web can also provide an attractive and seemingly more reliable environment to find and disseminate information that is not regulated by institutional interests, such as conspiracy networks (Kwon et al., 2017; Topor, 2019). Some individuals are suspicious about public institutions, such as health authorities, police, and mainstream media, wishing to find alternative information about and explanations of occurring events (Douglas et al., 2017). This is especially true during crisis situations, when there is an elevated need to make sense of the occurring events and connect with like-minded others who share similar ideas and beliefs (van Prooijen & Douglas, 2017). During the COVID-19 pandemic, institutional distrust and anti-vaccine stances were associated with the use of dark web platforms as information sources (Sirola et al., 2022). Moreover, illicit COVID-19-related products, such as forged certificates, were widely available in dark web marketplaces, attracting individuals who wished to bypass safety restrictions public institutions and health authorities had established (Bracci et al., 2022; Broadhurst et al., 2020; Catalani et al., 2023).

Expressing distrust towards authorities and institutions is also prevalent in dark web's drug communities that are formed around strong collective trust and mutually shared identities (Bilgri, 2018). In such cases, user-orientated information coming from one's in-group might be seen as more reliable and useful than information coming from official authorities.

Based on the above reasoning, we propose the following hypothesis:

**H5.** Higher institutional trust is negatively associated with dark web use. (Study 1).

In the online environment, various risk behaviors are likely to accumulate. Online gambling is a type of potentially problematic and addictive online behavior that is known to overlap with excessive internet use (Jouhki et al., 2022). Online gambling opportunities are widely available and advertised online, active online users being likely to encounter such content (Guillou-Landreat & Gallopel-Morvan, 2021).

Illegal gambling sites are available on the dark web as well, utilizing cryptocurrencies for anonymous money laundering (Choi et al., 2020). During the COVID-19 pandemic, utilizing dark web platforms was associated with increased online gambling engagement, indicating that dark web users are susceptible to various co-occurring risk behaviors in the online realm (Sirola et al., 2022). Therefore, we propose the following hypothesis:

**H6.** Excessive gambling is associated with dark web use. (Study 2).

Studies have suggested that personality traits are related to one's social media use and motivations because online behavior is an extension of a person's real-world behavior and therefore could shape how they use the online realm. However, studies have yielded mixed findings and explanations (Akbari et al., 2022; Bowden-Green et al., 2020; Bowden-Green et al., 2021). There is evidence that openness to experiences and extroversion are associated with problematic online behaviors (Dalvi-Esfahani et al., 2019; Gámez-Guadix & De Santisteban, 2018) whereas emotional stability (i.e., low neuroticism; Moeller et al., 2022; Terracciano et al., 2008) may protect individuals from engaging in or encountering online problem behaviors (Van de Weijer & Leukfeldt, 2017) because it is associated with healthier decision making and the ability to cope with life's challenges in a more constructive way (Chen, 2023). However, the role of personality in dark web use has not been studied. It is plausible that personality traits explain the tendency to use the dark web as well, but the associations might work differently from public social media, making these associations worth investigating. Therefore, we ask, are some personality traits more typical among dark web users? (RQ1, Study 2).

## 1.2. Research overview

In this paper, we examine dark web use and its associated factors using cross-national (Study 1) and longitudinal (Study 2) designs. The purpose of Study 1 was to explore the role of psychological distress, social belonging, institutional trust, excessive social media use, and involvement in online identity bubbles in the dark web use in six countries: Finland, France, Germany, Ireland, Italy, and Poland. With Study 2, we expand the focus by looking at the associations of personality traits, psychological distress, social belonging, involvement in online identity bubbles, excessive internet use, and problem gambling using Finnish longitudinal data.

Our countries of interest represent various European regimes and regions, including North (Finland), Central (France and Germany), West (Ireland), East (Poland), and South (Italy). These nations also vary in their levels of technological development and people's digital skills, with Finland having the largest share of people with basic or above basic digital skills (79 %), followed by Ireland (69 %) and France (62 %). The share of people with basic or above digital skills is somewhat smaller in Germany (49 %), Italy (46 %), and Poland (43 %; Eurostat, 2023; Petrosyan, 2023). Sixty-five percent of people in the EU participate in social networks (Eurostat, 2023). Germany and Finland rank high in dark web use (Tor Metrics, 2023). France, Italy, and Poland also have relatively high user rates, ranging from 7 to 10 %, respectively (Petrosyan, 2022a). The most common reasons for using the dark web are anonymity and access to content otherwise unavailable in a given geopolitical location (Petrosyan, 2022b). Our cross-national context provides valuable and much needed insight into potential country differences among dark web users. Given that the dark web has active users around the world (Petrosyan, 2022a), the cross-national context provides comprehensive evidence of dark web use and associated factors in various countries, enabling us to approach dark web use as the global challenge it is.

Longitudinal examination of dark web use is also scarce, and more research is needed on dark web users over time to understand why individuals engage in such activities and how their motivations may change. Because the dark web is a dynamic and evolving environment, a longitudinal perspective allows us to track potential changes and trends

in its use over time.

## 2. Study 1: cross-national investigation

### 2.1. Methods

#### 2.1.1. Participants and procedure

Study 1 was based on *Self & Technology EU-6* surveys collected in six European countries, with participants aged 18 to 75 in each: Finland ( $N = 1541$ , 49.71 % male,  $M_{age} = 46.35$ ), France ( $N = 1561$ , 47.66 % male,  $M_{age} = 46.88$ ), Germany ( $N = 1529$ , 49.77 % male,  $M_{age} = 47.36$ ), Ireland ( $N = 1112$ , 48.56 % male,  $M_{age} = 46.77$ ), Italy ( $N = 1530$ , 48.95 % male,  $M_{age} = 47.67$ ), and Poland ( $N = 1533$ , 48.53 % male,  $M_{age} = 45.69$ ). The samples exhibit high similarity to Eurostat's (2022) data concerning age and gender distribution in the 18–75-year age bracket for the respective countries' populations (Bergdahl et al., 2023). Therefore, applying analytical weights was unnecessary.

PI, prof. Atte Oksanen and the research group designed the study and the surveys. The questionnaires were created in each target country's official language. The survey was initially designed in English and translated by professional translators proficient in the respective languages, with accuracy validated through a back-translation process involving native speakers. When available, validated scales were employed.

Norstat, a provider of data solutions, collected the data. Participants were volunteer members of Norstat's online panels. Norstat oversees and evaluates the quality of its panels by consistently comparing the profiles of its members with official statistics of the panels' countries. The participants completed the survey through online submissions, facilitated by Norstat's online survey software, after receiving email invitations. Invitations to participate were sent out to those Norstat panel members who matched the study's target population; adults between 18 and 75 years, residing in the chosen countries. Across the surveyed countries, the response rates were as follows: Finland (40.0 %), France (13.5 %), Germany (16.5 %), Ireland (18.0 %), Italy (23.0 %), and Poland (27.3 %). The average response times per survey in minutes were 21.30 for Finland, 20.90 for France, 21.43 for Germany, 21.02 for Ireland, 18.70 for Italy, and 22.48 for Poland. To ensure data quality, we followed a preregistered data quality protocol (Oksanen et al., 2021) encompassing checks for response speed, attention, and patterned responses, such as straight-lining. Additionally, we verified the scales' and sub-scales' internal consistency.

The study protocol underwent scrutiny by the academic ethics committee of the Tampere Region (decision number 115/2022) in September 2022, which confirmed the comprehensive addressing of ethical considerations. Participants were fully informed about the study's objectives and participated voluntarily. The study adheres to the General Data Protection Regulation of the European Union.

#### 2.1.2. Measures

**Anonymous web.** We asked about using the anonymous web (i.e., the dark web) with a single-item question concerning how often participants used the anonymous web (e.g., TOR network). Response options were *never*, *less than once a month*, *monthly*, *weekly*, *once a day*, and *many times a day*. We created a dummy variable regarding whether respondents had used the dark web (0 = no, 1 = yes).

**Sociodemographic variables** were measured using a dummy variable for male gender (0 = female or other, 1 = male), age under 30 years (0 = no, 1 = yes), having at least a bachelor's degree (0 = no, 1 = yes), occupational status (0 = not working, 1 = working), and having a high income. We used a cutoff of gross monthly income of 5000 euros per month for all euro countries and 10,500 zlotys in Poland for high income (0 = no, 1 = high monthly income). We selected these cutoffs based on the general median income in the countries.

**Psychological distress** was measured with the Mental Health Inventory (MHI-5), which is a brief 5-item version of the original 38-item

inventory. The MHI-5 is a widely validated screener for psychological well-being and distress in general populations (Berwick et al., 1991; Cuijpers et al., 2009), and also validated by using clinical interviews, often regarded as the gold standard (Rumpf et al., 2001). It includes questions about how often during the last month participants have felt a certain way, such as “so down in the dumps that nothing could cheer you up” and “calm and peaceful.” The participants responded on a scale from 0 to 5 (“none of the time,” “a little of the time,” “some of the time,” “a good bit of the time,” “most of the time,” “all of the time”). We reverse coded two items, and the possible total score ranged from 5 to 30. The MHI-5 showed good internal consistency, based on McDonald's omega ( $\omega = 0.87$ , Finland,  $\omega = 0.83$ , France,  $\omega = 0.86$ , Germany,  $\omega = 0.85$ , Ireland,  $\omega = 0.84$ , Italy,  $\omega = 0.79$ , Poland).

**Closeness to family and friends** was measured with 9 items from the Social and Emotional Loneliness Scale for Adults (SELSA; DiTommaso & Spinner, 1993; DiTommaso et al., 2004). The SELSA has been shown to have a three-factor structure consistent with three distinct subscales. We used 3 items for each subscale included in the measure. Measures included statements such as “My family really cares about me” (family subscales), “I can depend upon my friends for help” (social subscale), and “I have a romantic partner with whom I share my most intimate thoughts and feelings” (romantic subscale). Response options ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The possible total score ranged from 9 to 63. The measure has been validated in several countries and shown to be a suitable measure for assessing loneliness resulting from deficits in social relationships (Thompson & Pollet, 2024). The measure had good internal consistency in our samples ( $\omega = 0.86$ , Finland,  $\omega = 0.81$ , France,  $\omega = 0.82$ , Germany,  $\omega = 0.82$ , Ireland,  $\omega = 0.84$ , Italy,  $\omega = 0.85$ , Poland).

**Excessive social media use** was measured with the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2017; Brailovskaia & Margraf, 2022; Schmidt et al., 2022). This psychometrically validated and reliable scale contains six items, each assessing the fundamental aspects of addiction, including salience, mood alteration, tolerance, withdrawal, conflict, and relapse (Andreassen et al., 2017; Monacis et al., 2017; Zarate et al., 2023). The items (e.g., “How often during the last year have you felt an urge to use social media more and more?”) are evaluated on a scale ranging from 1 (*very rarely*) to 5 (*very often*). The possible total score ranged from 6 to 30, and the scale showed good internal consistency ( $\omega = 0.88$ , Finland,  $\omega = 0.86$ , France,  $\omega = 0.87$ , Germany,  $\omega = 0.88$ , Ireland,  $\omega = 0.86$ , Italy,  $\omega = 0.89$ , Poland).

**Involvement in social media identity bubbles** was measured with the Identity Bubble Reinforcement Scale (IBRS-9; Kaakinen et al., 2020). The validated scale comprises nine items and includes three subscales that reflect the composition of online identity bubbles: social identification, homophily, and information bias (Kaakinen et al., 2020). The IBRS-9 assesses individuals' experiences and behaviors related to their interactions on social media and online networks (e.g., “In social media, I prefer interacting with people who are like me”). The participants responded on a scale from 1 (*does not describe me at all*) to 7 (*describes me completely*). The possible total score ranged from 9 to 63, and the scale showed excellent internal consistency ( $\omega = 0.91$ , Finland,  $\omega = 0.93$ , France,  $\omega = 0.93$ , Germany,  $\omega = 0.93$ , Ireland,  $\omega = 0.93$ , Italy,  $\omega = 0.95$ , Poland).

**Institutional trust** was measured with 6 items measuring trust in societal institutions. Participants were asked, “How much do you trust the following?” Items concerned the police, judicial system, media, universities, defense forces, and parliament. Similar questions have been widely utilized in former studies measuring institutional trust in European context (e.g., Grönlund & Setälä, 2012; Sønderskov & Dinesen, 2016). Response options ranged from 1 (*I do not trust at all*) to 7 (*I trust completely*). The possible total score ranged from 6 to 42, and the scale showed good internal consistency ( $\omega = 0.88$ , Finland,  $\omega = 0.88$ , France,  $\omega = 0.89$ , Germany,  $\omega = 0.89$ , Ireland,  $\omega = 0.88$ , Italy,  $\omega = 0.82$ , Poland).

### 2.1.3. Statistical analyses

We conducted all analyses with Stata 17. We report descriptive

statistics of study variables (see Table 1). We conducted main analyses with logistic regression that enables to investigate predictors and potentially confounding factors in dark web use as a binary outcome (users vs. non-users). We report regression coefficients (B) and their standard errors (SE), odds ratios (OR) and *p* values for statistical significances. Tables also report pseudo-coefficients of determination (Cragg-Uhler's pseudo- $R^2$ ) for each model. We detected no issues with multicollinearity.

## 2.2. Results

Descriptive analysis showed that nearly 10 % of participants in all countries had accessed the dark web using networks such as TOR. The sample from Ireland had the lowest percentage of dark web users (9.08 %), and the sample from Germany the highest (15.89 %).

Tables 2 and 3 report logistic regression analyses conducted in six countries. Higher psychological distress (H1) was associated with dark web use only in Ireland ( $B = 0.08$ ,  $p = 0.006$ ). In all countries, users of the dark web reported lower closeness to family and friends ( $p < 0.05$  in every sample) (H2). Excessive social media use (H3) and involvement in social media identity bubbles (H4) were associated with a higher likelihood of using the dark web in all countries. Higher institutional trust (H5) was negatively associated with dark web use in Finland ( $B = -0.04$ ,  $p = 0.004$ ). Therefore, these individuals were less likely to use dark web sites. In contrast, institutional trust had a positive relationship with dark web use in the French ( $B = 0.03$ ,  $p = 0.015$ ) and Polish ( $B = 0.03$ ,  $p = 0.005$ ) samples. More trusting people were also more likely to use the dark web.

Regarding sociodemographic factors, males were more likely to be users of the dark web in all countries ( $p < 0.001$ ). Dark web use was also more common among younger adults (<30-years of age) in Finland ( $B = 1.19$ ,  $p < 0.001$ ), France ( $B = 0.55$ ,  $p = 0.006$ ), Poland ( $B = 0.57$ ,  $p = 0.002$ ), and Italy ( $B = 0.40$ ,  $p = 0.051$ ). Having a bachelor's degree or higher was more common among dark web users in all countries, but in Italy, the result was not statistically significant ( $p = 0.083$ ). In Finland ( $B = 0.79$ ,  $p < 0.001$ ), Italy ( $B = 0.43$ ,  $p = 0.017$ ), and Poland ( $B = 0.39$ ,  $p = 0.030$ ), dark web use was more common among those who were working.

## 3. Study 2: longitudinal investigation

### 3.1. Methods

#### 3.1.1. Participants

For Study 2, we used the five-wave *Gambling in the Digital Age* survey data. This survey uses a sample of 18- to 75-year-old Finnish speakers in mainland Finland ( $N = 1530$ ,  $M_{\text{age}} = 46.67$ , 49.41 % male). We collected the data at five points at 6-month intervals: April 2021 (T1), October–November 2021 (T2,  $n = 1198$ , response rate 78.30 %), April–May 2022 (T3,  $n = 1095$ , response rate 71.57 % out of T1), October–November 2022 (T4,  $n = 1004$ , response rate 65.62 % out of T1), and April–May 2023 (T5,  $n = 934$ , response rate 61.05 % of T1). The participants were from all areas of mainland Finland. Of the participants, 35.29 % were from the Helsinki-Uusimaa region, 21.50 % from Southern Finland, 24.84 % from Western Finland, and 18.37 % from Northern and Eastern Finland. Based on nonresponse analyses, there are no major deviations in gender, geographical area, income, education, marital status, or occupational status (Oksanen et al., 2022). However, those who responded to all five surveys are, on average, slightly older (51.22 % vs. 46.67 %).

As in Study 1, we followed a preregistered data quality protocol (Oksanen et al., 2021) to guarantee the quality of data after each data collection phase. The academic ethics committee of the Tampere Region reviewed the study protocol in March 2021. Participation was voluntary, and participants gave their consent for their participation. We informed the participants about the aims of the study. We conducted the

**Table 1**  
Descriptive statistics of Study 1 variables.

Categorical variables	Range	Finland	France	Germany	Ireland	Italy	Poland
		%	%	%	%	%	%
Anonymous web	0/1	9.21	12.30	15.89	9.08	14.58	15.13
Male	0/1	49.71	47.66	49.77	48.56	48.95	48.53
Under 30 years of age	0/1	19.73	16.78	12.88	11.51	14.90	17.48
BA degree	0/1	26.80	36.64	29.43	50.72	38.69	54.47
Works	0/1	54.25	56.12	60.82	64.66	56.93	65.82
High income	0/1	8.57	5.64	11.58	16.73	2.75	3.98

  

Continuous variables	Range	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Psychological distress	5–30	14.87 (2.41)	14.94 (4.94)	13.38 (4.84)	13.21 (4.79)	14.83 (4.83)	14.67 (4.58)
Closeness to family and friends	9–63	47.89 (11.78)	43.11 (11.64)	46.84 (12.07)	47.36 (11.65)	45.67 (11.70)	44.55 (11.95)
Excessive social media use	6–30	11.10 (4.99)	10.77 (5.01)	10.79 (4.96)	11.46 (5.12)	11.46 (4.91)	11.66 (5.34)
Social media identity bubbles	9–63	33.61 (11.72)	30.94 (13.36)	31.57 (13.36)	31.31 (13.34)	34.51 (12.65)	32.02 (13.60)
Institutional trust	6–42	29.55 (6.60)	23.45 (7.73)	24.67 (7.83)	25.29 (7.38)	23.85 (7.65)	20.37 (6.72)

**Table 2**  
Logistic regression models on using anonymous web among Finnish, French, and German participants.

	Finland				France				Germany			
	B	SE (B)	OR	p	B	SE (B)	OR	p	B	SE (B)	OR	p
Male	1.60	0.23	4.96	<0.001	0.87	0.18	2.38	<0.001	1.25	0.17	3.48	<0.001
Under 30 years of age	1.19	0.22	3.29	<0.001	0.55	0.20	1.74	0.006	0.18	0.21	1.19	0.397
BA degree	0.48	0.21	1.62	0.023	0.61	0.18	1.83	0.001	0.64	0.16	1.90	<0.001
Works	0.79	0.21	2.21	<0.001	0.24	0.19	1.27	0.205	0.22	0.17	1.24	0.199
High income	0.40	0.32	1.49	0.212	0.02	0.34	1.02	0.949	−0.02	0.23	0.98	0.914
Psychological distress	0.07	0.04	1.07	0.060	0.01	0.02	1.01	0.710	0.02	0.02	1.02	0.321
Closeness to family and friends	−0.02	0.01	0.98	0.005	−0.02	0.01	0.98	0.016	−0.02	0.01	0.98	0.002
Excessive social media use	0.07	0.02	1.07	0.002	0.12	0.02	1.12	<0.001	0.06	0.02	1.06	0.001
Social media identity bubbles	0.02	0.01	1.02	0.035	0.03	0.01	1.03	0.001	0.02	0.01	1.02	0.001
Institutional trust	−0.04	0.01	0.96	0.004	0.03	0.01	1.03	0.015	−0.01	0.01	0.99	0.321
Model n	1526				1501				1474			
Model pseudo-R2	0.224				0.250				0.167			

**Table 3**  
Logistic regression models on using anonymous web among Irish, Italian, and Polish participants.

	Ireland				Italy				Poland			
	B	SE (B)	OR	p	B	SE (B)	OR	p	B	SE (B)	OR	p
Male	1.71	0.27	5.54	<0.001	0.92	0.17	2.52	<0.001	0.93	0.16	2.54	<0.001
Under 30 years of age	0.56	0.31	1.75	0.073	0.40	0.20	1.49	0.051	0.57	0.18	1.76	0.002
BA degree	0.58	0.25	1.78	0.021	0.28	0.16	1.33	0.083	0.33	0.16	1.39	0.040
Works	0.05	0.26	1.06	0.835	0.43	0.18	1.54	0.017	0.39	0.18	1.47	0.030
High income	−0.11	0.32	0.89	0.718	0.82	0.39	2.26	0.035	0.03	0.36	1.03	0.942
Psychological distress	0.08	0.03	1.08	0.006	0.01	0.02	1.01	0.710	0.01	0.02	1.01	0.457
Closeness to family and friends	−0.03	0.01	0.97	0.017	−0.02	0.01	0.98	0.021	−0.02	0.01	0.98	0.031
Excessive social media use	0.09	0.02	1.09	<0.001	0.13	0.02	1.14	<0.001	0.08	0.02	1.08	<0.001
Social media identity bubbles	0.03	0.01	1.03	0.005	0.03	0.01	1.03	<0.001	0.03	0.01	1.03	<0.001
Institutional trust	0.01	0.02	1.01	0.418	0.01	0.01	1.01	0.372	0.03	0.01	1.04	0.005
Model n	1099				1516				1514			
Model pseudo-R2	0.230				0.228				0.188			

study in accordance with the European Union's General Data Protection Regulation.

3.1.2. Measures

**Anonymous web.** We asked about using the anonymous web (i.e., the dark web) with a question concerning how often participants used the anonymous web (e.g., TOR). The measure was similar to that in Study 1. Response options were *never, less than once a month, monthly, weekly, once a day, and many times a day*. We created a dummy variable for use of the dark web (0 = no, 1 = yes).

**Psychological distress** was measured with the Mental Health Inventory (MHI-5; (Berwick et al., 1991; Cuijpers et al., 2009)), as in Study 1. The MHI-5 showed good internal consistency in all time points ( $\omega =$

0.89,  $T_1$ ,  $\omega = 0.88$ ,  $T_2$ ,  $\omega = 0.87$ ,  $T_3$ ,  $\omega = 0.88$ ,  $T_4$ ,  $\omega = 0.89$ ,  $T_5$ ) and has shown good psychometric properties also in other studies in Finland (Elovainio et al., 2020).

**Closeness to family and friends** was measured with 9 items from the Social and Emotional Loneliness Scale for Adults (DiTommaso et al., 2004; DiTommaso & Spinner, 1993), as in Study 1. It showed good internal consistency across the timepoints ( $\omega = 0.87$ ,  $T_1$ ,  $\omega = 0.85$ ,  $T_2$ ,  $\omega = 0.86$ ,  $T_3$ ,  $\omega = 0.88$ ,  $T_4$ ,  $\omega = 0.88$ ,  $T_5$ ).

**Excessive internet use** was measured employing the Compulsive Internet Use scale (Meerkerk et al., 2009). This scale consists of 14 items designed to gauge aspects of compulsive or addictive behavior in the context of internet use. They encompass issues such as a loss of control, preoccupation, and withdrawal symptoms (Meerkerk et al., 2009).

Respondents rated their responses on a 5-point scale, ranging from 0 (*never*) to 4 (*very often*), with higher scores indicating a higher degree of compulsive internet usage. The possible total score ranged from 0 to 56 (0 to 53 in the data), and the scale showed excellent internal consistency ( $\omega = 0.95$ ,  $T_1$ ,  $\omega = 0.95$ ,  $T_2$ ,  $\omega = 0.95$ ,  $T_3$ ,  $\omega = 0.95$ ,  $T_4$ ,  $\omega = 0.95$ ,  $T_5$ ).

**Excessive gambling** was measured with the nine-item Problem Gambling Severity Index (PGSI) that is a validated and widely utilized scale assessing various aspects of problematic gambling and its negative effects in non-clinical settings (Currie et al., 2010; Ferris & Wynne, 2001; Holtgraves, 2009). The original version of the PGSI measure asked about gambling behavior and related harms over a 12-month period. In our study, we collected data every six months, so we adjusted the questions to inquire about gambling and its consequences over the past six months (e.g., “Thinking about the last six months, have you bet more than you could really afford to lose?”). The participants responded on a four-point scale: 0 (*never*), 1 (*sometimes*), 2 (*most of the time*), and 3 (*almost always*). Higher scores indicate a greater likelihood of experiencing gambling problems. The possible total score ranged from 0 to 27, and the scale showed excellent internal consistency ( $\omega = 0.95$ ,  $T_1$ ,  $\omega = 0.94$ ,  $T_2$ ,  $\omega = 0.94$ ,  $T_3$ ,  $\omega = 0.94$ ,  $T_4$ ,  $\omega = 0.94$ ,  $T_5$ ).

**Involvement in social media identity bubbles** was measured using the IBRS-9 (Kaakinen et al., 2020), as in Study 1. The possible total score ranged from 9 to 63, and the scale showed excellent internal consistency in the sample ( $\omega = 0.90$ ,  $T_1$ ,  $\omega = 0.91$ ,  $T_2$ ,  $\omega = 0.91$ ,  $T_3$ ,  $\omega = 0.91$ ,  $T_4$ ,  $\omega = 0.92$ ,  $T_5$ ).

**Big-Five personality traits** were measured with the 15-item Big Five Inventory for personality that is a psychometrically valid and reliable short measure for capturing different aspects of personality (Hahn et al., 2012). The inventory consists of a series of statements and questions related to the five fundamental dimensions of personality: openness, agreeableness, conscientiousness, extraversion, and neuroticism. All items had responses on a scale from 1 to 7, leading to five scales ranging from 3 to 21. Respondents rated themselves on the scale to indicate the extent to which each statement or question reflects their personality. A higher score on a subscale indicates stronger agreement with the statements reflecting a given personality trait. Internal consistency of the traits varied from acceptable (openness:  $\alpha = 0.70$ ; conscientiousness  $\alpha = 0.60$ ; agreeableness:  $\alpha = 0.55$ ; neuroticism:  $\alpha = 0.78$ ) to good (extraversion:  $\alpha = 0.85$ ).

**Sociodemographic variables** included a dummy variable for male gender (0 = female or other, 1 = male), age under 30 years (0 = no, 1 = yes), having at least a bachelor's degree (0 = no, 1 = yes), occupational status (0 = not working, 1 = working), and having high income. We used

a cutoff of gross monthly income of 5000 euros or more per month for high income (0 = no, 1 = high monthly income).

### 3.1.3. Statistical analyses

We conducted all analyses with Stata 17. We report descriptive statistics of study variables (see Table 4). We conducted the main analyses using multilevel random-effects logistic regression that allowed us to examine the predictors of dark web use while accounting for the longitudinal nested data structure. We report regression coefficients (B) and their standard errors (SE), Z values for effect size, and p values for statistical significance. We ran multilevel fixed effects regression models additionally, but insignificance of the effects referred to a random-effects approach. The detected effects are mostly between persons and not within persons. We detected no issues with multicollinearity.

## 3.2. Results

The descriptive results (Table 4) showed that the proportions of participants using the dark web (e.g. TOR) varied from 5.28 % to 7.88 % during the 2021–2023 follow-up period. Overall, 11.25 % of the participants had used the dark web during 2021–2023 at least once.

Table 5 reports the results of our multilevel random-effects logistic regression model. The model included 1095 individuals and 5027

**Table 5**  
Random-effects logistic regression model on using anonymous web among Finnish participants in 2021–2023.

	B	SE (B)	Z	p
Male	1.81	0.47	3.81	<0.001
Under 30 years of age	1.86	0.49	3.80	<0.001
BA degree	-0.72	0.42	-1.69	0.090
Works	0.71	0.35	2.04	0.041
High income	-0.58	0.65	-0.90	0.370
Psychological distress	0.02	0.04	0.57	0.570
Closeness to family and friends	0.01	0.01	0.67	0.503
Excessive internet use	0.04	0.02	2.23	0.025
Excessive gambling	0.19	0.04	4.34	<0.001
Social media identity bubbles	0.03	0.02	2.00	0.046
BF: openness	0.21	0.06	3.48	<0.001
BF: conscientiousness	-0.20	0.07	-2.71	0.007
BF: extraversion	-0.23	0.05	-4.28	<0.001
BF: agreeableness	-0.22	0.07	-3.10	0.002
BF: neuroticism	-0.16	0.06	-2.58	0.010
Model n	1095			
Model observations (T1–T5)	5027			

**Table 4**  
Descriptive statistics of Study 2 variables.

Categorical variables	Range	T1, %	T2, %	T3, %	T4, %	T5, %	
Anonymous web	0/1	7.88	5.28	6.23	6.06	5.78	
Male	0/1	49.98	-	-	-	-	
Under 30 years of age	0/1	21.37	-	-	-	-	
BA degree	0/1	40.23	-	-	-	-	
Works	0/1	51.81	50.08	51.64	49.61	55.98	
High income	0/1	7.96	7.35	7.66	8.19	8.48	
Continuous variables	Range	T1, M (SD)	T2, M (SD)	T3, M (SD)	T4, M (SD)	T5, M (SD)	Within-person differences, SD
Psychological distress	5–30	12.56 (4.74)	12.33 (4.49)	12.59 (4.53)	12.39 (4.42)	12.33 (4.63)	1.94
Closeness to family and friends	9–63	48.13 (11.82)	47.74 (11.80)	47.48 (11.69)	47.93 (11.91)	48.09 (11.82)	11.83
Excessive internet use	0–53	9.09 (9.91)	8.76 (9.88)	8.74 (9.94)	8.38 (9.36)	9.02 (10.11)	9.54
Excessive gambling	0–27	1.29 (3.49)	1.17 (3.20)	1.26 (3.50)	1.07 (2.98)	1.11 (3.10)	3.12
Social media identity bubbles	9–63	30.56 (11.07)	30.55 (11.33)	30.55 (11.18)	30.41 (11.16)	31.01 (11.35)	11.24
BF: openness	3–21	-	-	13.83 (3.49)	-	-	-
BF: conscientiousness	3–21	-	-	14.01 (3.10)	-	-	-
BF: extraversion	3–21	-	-	13.24 (4.27)	-	-	-
BF: agreeableness	3–21	-	-	14.18 (3.02)	-	-	-
BF: neuroticism	3–21	-	-	11.99 (3.99)	-	-	-

observations from 2021 to 2023. Excessive internet use ( $B = 0.04, p = 0.025$ ) (H3), excessive gambling ( $B = 0.19, p < 0.001$ ) (H6), and involvement in social media identity bubbles ( $B = 0.03, p = 0.046$ ) (H4) had small but significant associations with using the dark web over time, supporting our hypotheses.

Regarding the role of personality in dark web use (RQ1), all personality traits had significant associations with using the dark web. Openness had a positive association with dark web use ( $B = 0.21, p < 0.001$ ), with individuals higher in this trait being more likely to use it than others. Conscientiousness ( $B = -0.20, p = 0.007$ ), extraversion ( $B = -0.23, p < 0.001$ ), agreeableness ( $B = -0.22, p = 0.002$ ), and neuroticism ( $B = -0.16, p = 0.010$ ) were negatively related to dark web use, these individuals being less likely to use such sites. Of the socio-demographic factors, male gender and being under 30 years of age were strongly associated with dark web use ( $B = 1.81, p < 0.001$ ;  $B = 1.86, p < 0.001$ , respectively).

#### 4. Discussion

The aim of this study was to examine dark web use and associated factors, namely problematic online behaviors, psychosocial risk factors, personality traits, and institutional trust, utilizing cross-national and longitudinal data. This was among the first studies to investigate dark web users' characteristics, focusing on European context. The proportion of dark web users was relatively low in our studied countries, Germany ranking highest (15.89 %) and Ireland the lowest (9.08 %). Most of the hypotheses were supported, but we found some cross-country differences.

According to the results of Studies 1 and 2, various forms of problematic online behaviors, such as excessive social media use and compulsive Internet use, were associated with dark web use. These results support our hypothesis (H3) and indicate that dark web users are likely to be excessive online users who are engaged in other problematic online behaviors as well. These findings were similar across European countries and align with prior research showing that dark web use and public social media use overlaps (Demant et al., 2019; Kwon & Shao, 2021; Sirola et al., 2022). Additionally, involvement in online identity bubbles was associated with the dark web use in Studies 1 and 2. Therefore, dark web users are likely to identify strongly with like-minded communities and rely on shared information in these online networks.

Institutional trust was negatively associated with dark web use in Finland, which provides partial support for our hypothesis (H5) and aligns with prior cross-country research (Sirola et al., 2022). Therefore, Finnish dark web users are likely to have suspicious beliefs about institutions, and the dark web might provide an attractive alternative to seek information and content that fits one's belief system. In Poland and France, higher institutional trust was associated with the dark web use, and trust did not play a role among Irish, German, or Italian dark web users. These cross-national differences might reflect the wider societal and cultural context of the studied countries, but also underlying motives in dark web use. For example, Finnish dark web users are highly represented in drug marketplaces (Demant et al., 2019; Nurmi et al., 2017) and members of such communities often express distrust towards authorities (Bilgrei, 2018). Also, data used in this research were collected in the aftermath of the COVID-19 pandemic which might be reflected in the results. European countries differed widely regarding their societal response to the pandemic and consequent mortality rates (Oksanen et al., 2020). Individuals who experienced distrust towards official institutions might have perceived dark web platforms more reliable sources of information because they are not regulated by institutional interests (Sirola et al., 2022). However, some people who trust institutions may still wish to access restricted information that is not readily available on traditional channels, especially if trust in institutions is more based on heuristic credibility (i.e., implicit cues of authority such as visual symbols like the nation's flag; Neal et al., 2016).

Regarding psychosocial risk factors, poor social relationships with family and friends were associated with the dark web use across the studied European countries, which supports our hypothesis (H2) and the literature on the role of loneliness in problematic online behaviors (O'Day & Heimberg, 2021; Sirola et al., 2019). To fulfill the basic psychological need to belong (Baumeister & Leary, 1995; Ryan & Deci, 2017), lonely individuals might utilize dark web communities to seek social support and validation for their interests and identities, especially if these interests deviate from the cultural or social norm (Gehl, 2016; Kloess & van der Bruggen, 2023; Maddox et al., 2016; Weimann, 2016). Psychological distress predicted dark web use only in Ireland, but in the other countries, the effect remained nonsignificant. Even though psychological distress is often accompanied by excessive online behaviors (Chen et al., 2020; Marino et al., 2018; McNicol & Thorsteinsson, 2017), our findings do not fully support this idea in relation to dark web use and therefore do not confirm our first hypothesis (H1) other than in terms of the Irish sample. This finding indicates that Irish dark web users may have risky behavioral patterns such as mood modification, high investment, and addictive tendencies that are known risk factors for problematic Internet use and related distress (Brailovskaia et al., 2020; Keles et al., 2020; Marino et al., 2018).

The results of Study 2, based on Finnish participants, mostly aligned with the results of Study 1, providing longitudinal evidence on underlying factors associated with the dark web use and expanding the focus on problem gambling and personality traits. Excessive Internet use, involvement in online identity bubbles, and problem gambling were associated with the dark web use, as hypothesized (H3, H4, H6). The association between excessive gambling and dark web use has been found in prior research as well (Sirola et al., 2022), suggesting that dark web users have co-occurring problem behaviors. The dark web provides illegal gambling sites mainly operated by bitcoin (Choi et al., 2020), but users might also utilize other online gambling platforms. Contrary to the results of Study 1, the results of Study 2 did not provide longitudinal evidence of the role of poor social relationships predicting dark web use among Finnish individuals.

The results regarding the big-five personality traits among Finnish respondents (Study 2) showed that openness to experiences was positively associated with the dark web use, which is plausible given that this trait has been associated with problematic online behaviors (Dalvi-Esfahani et al., 2019). Open individuals have also been found to engage more in divergent thinking, which is characterized by creativity and exploring multiple perspectives (Käckenmester et al., 2019), also involving unconventional and unique ideas that may diverge from regular thoughts or norms (Acar & Runco, 2019), which align with our results regarding openness. Extraversion, agreeableness, neuroticism, and conscientiousness had negative associations with dark web use. Although low neuroticism is often perceived as a protective factor against problematic online behaviors (Van de Weijer & Leukfeldt, 2017), our findings do not support this idea in relation to dark web use.

Regarding sociodemographic factors, male gender was consistently associated with dark web use, supporting prior research (Sirola et al., 2022). Younger adults (under 30) were more likely users of the dark web in all countries but Germany and Ireland. Italy stood out from the other countries regarding the role of education and income level because it was the only country where high education (at least bachelor's degree) was not associated with dark web use and high income was associated with dark web use. Higher education's role in dark web use across five of the examined six countries is noteworthy. Accessing the dark web can be challenging, and higher education, especially in fields such as computer science, information technology, and cybersecurity, might contribute to a better understanding of the technical aspects involved, thus attracting individuals with at least a bachelor's degree. Regarding participants' occupation, working status was associated with dark web use in Finland, Italy, and Poland.

To sum up, our cross-national and longitudinal research provided robust evidence of co-occurring excessive online behaviors and male



gender as risk factors for dark web use across studied European countries. However, our findings also indicate that dark web users are not a homogenous group but rather have diverse characteristics in terms of individual, psychosocial, and behavioral inclinations. Our findings support and contribute to a scarce body of literature regarding characteristics of dark web users (Sirola et al., 2022). Found cross-country differences can reflect underlying motives of dark web use in various countries and regimes (Petrosyan, 2022b), opening new research avenues for more detailed investigation.

#### 4.1. Theoretical and practical implications

Our study has contributed to the ongoing discussion of problematic online behaviors and related risks, such as online identity bubbles (Kaakinen et al., 2020; Keipi et al., 2017), expanding the focus from public social media to the dark web. Even though social psychological mechanisms of online communities are likely similar, the unregulated and anonymous nature of the dark web makes these communities and identity bubbles riskier than public social media. The dark web provides an attractive alternative to form online communities around marginalized or deviant interests that would be prohibited in public social media (Burki, 2020). Moreover, such interests may not experience understanding and validation in offline relationships, and loneliness often motivates people to seek such social resources from the online realm (O'Day & Heimberg, 2021; Sirola et al., 2019). In the dark web, like-minded online communities provide social support, validation, and normalization for deviant interests and identities (Gehl, 2016; Kloess & van der Bruggen, 2023; Maddox et al., 2016; Weimann, 2016). High anonymity further facilitates such group processes (Lieberman & Schroeder, 2020) that might manifest in consequent risks, such as online identity bubbles. This, in turn, can reinforce potentially harmful beliefs or behaviors. Studying the dark web as part of online social behavior offers an important and unique viewpoint on human interaction, societal norms, community formation, and shaping behavior in encrypted online spaces.

The study also has practical implications regarding the use of various online platforms and associated risks. In the digital era of information abundance and flourishing false information, it is crucial to understand what kinds of online sources are utilized and relied on. In online environments, false information is likely to spread more quickly and gain more visibility compared to verified information, affecting public well-being and safety (Vosoughi et al., 2018; Wang et al., 2019). Even though most public social media users never end up using the dark web, our findings provide evidence that the use of the dark web and public social media overlap among active online users (Demant et al., 2019; Kwon & Shao, 2021; Sirola et al., 2022). These users might spread content and unreliable information, such as conspiracy beliefs from the dark web to public social media platforms, thus gaining visibility and audience. Accordingly, users who are banned from social media platforms for spreading misinformation or illegal content might migrate to the dark web to continue such activity (Jardine, 2019). Understanding the social psychological mechanisms, such as the need to seek social belonging and validation from like-minded networks, can help explain why some users end up entering risky online environments, such as the dark web.

#### 4.2. Limitations and future research

We must acknowledge some limitations. We did not ask about the motives or reasons for dark web use. This study focused on risks associated with use of the dark web, but some users utilize the anonymous

web for high online privacy and freedom of speech. We also did not investigate the frequency of dark web use or whether such use is more active or passive. Some users might use dark web platforms out of curiosity but not actively participate in these communities. Researchers should explore dark web users' underlying motives and specific platforms used, such as drug markets, online gambling sites, and platforms that share alternative and conspiracy views, such as anti-vaccine content. Also, it would be important to study whether and to what extent the use of various platforms located in the dark web overlaps and how actively users utilize these platforms. Even though this study included cross-national data, all the countries were European. It would be important to study country-specific dark web use and underlying motives in more detail, as well as to explore and compare dark web use in culturally diverse contexts, such as politically repressive countries. More detailed studies are needed to understand how risks of the dark web manifest among users and how underlying motives shape online behavior and consequent risks.

#### 4.3. Conclusion

The dark web attracts technologically advanced and active online users who have psychosocial issues, such as problematic Internet use habits, poor close relationships, and gambling problems. Males are more likely users than women, and some personality traits, such as openness to experiences, are common among dark web users. The risks of the dark web are different from those of other social media platforms due to wide availability of illicit and deviant content as well as unreliable and unregulated information. In dark web communities, users can find social belonging and validation for their marginalized interests, which can lead to formation of harmful online identity bubbles. Online group processes facilitated by high anonymity are likely to reinforce risks encountered in dark web communities.

#### CRediT authorship contribution statement

**Anu Sirola:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Conceptualization. **Iina Savolainen:** Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Atte Oksanen:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

Data will be made available on request.

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**Appendix A. Zero-order correlation coefficients of the Study 1 variables**

Finland	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.18	1.00									
3. Under 30 years of age	0.18	-0.03	1.00								
4. BA degree	0.05	0.02	-0.06	1.00							
5. Works	0.07	0.07	-0.15	0.08	1.00						
6. High income	0.02	0.15	-0.13	0.18	0.11	1.00					
7. Psychological distress	0.09	-0.09	0.20	-0.01	-0.04	-0.06	1.00				
8. Closeness to family and friends	-0.10	-0.07	-0.05	0.01	0.11	0.07	0.06	1.00			
9. Excessive social media use	0.13	-0.18	0.35	0.00	-0.04	-0.10	0.28	-0.02	1.00		
10. Social media identity bubbles	0.07	-0.20	0.21	0.01	-0.04	-0.10	0.17	0.13	0.48	1.00	
11. Institutional trust	-0.11	-0.10	-0.06	0.14	-0.01	0.06	-0.04	0.30	0.00	0.16	1.00

  

France	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.14	1.00									
3. Under 30 years of age	0.17	0.02	1.00								
4. BA degree	0.13	0.02	0.07	1.00							
5. Works	0.06	0.06	-0.11	0.17	1.00						
6. High income	0.03	0.03	-0.06	0.21	0.09	1.00					
7. Psychological distress	0.07	-0.16	0.13	-0.02	0.00	-0.06	1.00				
8. Closeness to family and friends	0.00	-0.01	0.02	0.13	0.12	0.10	-0.25	1.00			
9. Excessive social media use	0.33	0.02	0.29	0.10	0.07	0.01	0.28	0.07	1.00		
10. Social media identity bubbles	0.24	-0.01	0.18	0.09	0.06	0.04	0.08	0.17	0.53	1.00	
11. Institutional trust	0.12	0.04	-0.01	0.11	0.04	0.08	-0.16	0.23	0.13	0.23	1.00

  

Germany	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.21	1.00									
3. Under 30 years of age	0.07	0.01	1.00								
4. BA degree	0.14	0.08	0.01	1.00							
5. Works	0.05	0.03	-0.12	0.20	1.00						
6. High income	0.04	0.16	-0.08	0.25	0.17	1.00					
7. Psychological distress	0.08	-0.08	0.15	-0.05	-0.10	-0.14	1.00				
8. Closeness to family and friends	-0.09	-0.08	-0.05	0.12	0.15	0.10	-0.30	1.00			
9. Excessive social media use	0.17	-0.05	0.24	0.10	0.04	0.00	0.33	0.00	1.00		
10. Social media identity bubbles	0.14	-0.02	0.12	0.10	0.00	0.01	0.09	0.08	0.48	1.00	
11. Institutional trust	0.01	0.07	-0.02	0.16	0.03	0.11	-0.18	0.22	0.04	0.16	1.00

  

Ireland	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.17	1.00									
3. Under 30 years of age	0.08	-0.11	1.00								
4. BA degree	0.07	0.00	-0.06	1.00							
5. Works	0.06	0.10	-0.01	0.25	1.00						
6. High income	0.01	0.17	-0.13	0.21	0.14	1.00					
7. Psychological distress	0.15	-0.10	0.22	-0.05	0.05	-0.16	1.00				
8. Closeness to family and friends	-0.10	-0.02	-0.07	0.06	0.07	0.07	-0.35	1.00			
9. Excessive social media use	0.21	-0.13	0.25	0.08	0.10	-0.11	0.36	-0.06	1.00		
10. Social media identity bubbles	0.16	-0.05	0.13	0.07	0.07	-0.04	0.13	0.06	0.48	1.00	
11. Institutional trust	-0.02	0.00	-0.14	0.12	-0.02	0.14	-0.29	0.31	-0.03	0.09	1.00

  

Italy	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.14	1.00									
3. Under 30 years of age	0.12	0.03	1.00								
4. BA degree	0.07	0.00	0.05	1.00							
5. Works	0.09	0.17	-0.17	0.20	1.00						
6. High income	0.08	0.04	-0.01	0.13	0.07	1.00					
7. Psychological distress	0.09	-0.13	0.17	0.00	-0.01	-0.02	1.00				
8. Closeness to family and friends	-0.04	0.00	-0.08	0.06	0.07	0.03	-0.37	1.00			
9. Excessive social media use	0.30	-0.04	0.24	0.04	0.04	-0.01	0.31	-0.07	1.00		

(continued on next page)

(continued)

Italy	1	2	3	4	5	6	7	8	9	10	11
10. Social media identity bubbles	0.21	-0.01	0.17	0.00	0.04	0.05	0.05	0.19	0.47	1.00	
11. Institutional trust	0.05	0.03	-0.10	0.03	0.02	0.03	-0.24	0.34	0.06	0.29	1.00
Poland	1	2	3	4	5	6	7	8	9	10	11
1. Anonymous Web	1.00										
2. Male	0.15	1.00									
3. Under 30 years of age	0.14	0.00	1.00								
4. BA degree	0.04	0.05	-0.11	1.00							
5. Works	0.09	0.14	-0.01	0.16	1.00						
6. High income	0.03	0.07	-0.01	0.11	0.10	1.00					
7. Psychological distress	0.10	-0.05	0.21	-0.07	0.05	0.01	1.00				
8. Closeness to family and friends	-0.04	-0.06	-0.03	0.06	0.05	-0.01	-0.35	1.00			
9. Excessive social media use	0.25	-0.03	0.30	-0.04	0.07	-0.02	0.35	-0.08	1.00		
10. Social media identity bubbles	0.20	-0.03	0.13	-0.02	0.03	0.02	0.10	0.15	0.46	1.00	
11. Institutional trust	0.10	-0.05	-0.06	0.10	0.01	0.01	-0.13	0.22	0.09	0.27	1.00

**Appendix B. Zero-order correlation coefficients of the Study 2 variables at T3**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Anonymous Web	1.00															
2. Male	0.10	1.00														
3. Under 30 years of age	-0.06	-0.42	1.00													
4. BA degree	0.19	0.42	-0.13	1.00												
5. Works	0.25	0.23	-0.14	0.37	1.00											
6. High income	0.05	0.06	0.09	0.27	0.08	1.00										
7. Psychological distress	0.12	-0.06	-0.02	-0.12	0.06	-0.11	1.00									
8. Closeness to family and friends	0.13	0.18	-0.04	0.34	0.06	0.16	-0.05	1.00								
9. Excessive internet use	-0.04	-0.07	0.04	-0.05	-0.09	0.02	0.05	-0.07	1.00							
10. Excessive gambling	0.03	-0.03	0.15	0.08	0.04	0.06	0.05	0.04	0.14	1.00						
11. Social media identity bubbles	-0.03	-0.09	0.04	-0.07	-0.04	-0.03	0.15	-0.10	0.22	0.11	1.00					
12. BF: openness	0.05	-0.02	0.10	0.06	0.01	0.13	-0.09	0.00	0.08	-0.06	-0.02	1.00				
13. BF: conscientiousness	-0.11	-0.36	0.29	-0.32	-0.11	0.00	-0.06	-0.17	0.03	0.09	0.01	0.18	1.00			
14. BF: extraversion	-0.10	-0.31	0.27	-0.11	0.00	0.07	-0.11	-0.13	-0.01	0.01	0.03	0.27	0.29	1.00		
15. BF: agreeableness	-0.06	-0.24	0.26	-0.07	-0.05	0.11	-0.15	-0.02	0.00	-0.02	-0.04	0.14	0.23	0.24	1.00	
16. BF: neuroticism	0.00	0.60	-0.19	0.34	0.11	0.10	-0.22	0.19	-0.07	0.01	-0.12	-0.02	-0.26	-0.35	-0.19	1.00

**References**

Acar, S., & Runco, M. A. (2019). Divergent thinking: New methods, recent research, and extended theory. *Psychology of Aesthetics, Creativity, and the Arts, 13*(2), 153–158. <https://doi.org/10.1037/aca0000231>

Akbari, M., Seydavi, M., Jamshidi, S., Marino, C., & Spada, M. M. (2022). The big-five personality traits and their link to problematic and compensatory Facebook use: A systematic review and meta-analysis. *Addictive Behaviors, 107*, 603.

Andreassen, C. S., Pallesen, S., & Griffiths, M. D. (2017). The relationship between addictive use of social media, narcissism, and self-esteem: Findings from a large national survey. *Addictive Behaviors, 64*, 287–293.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529.

Bergdahl, J., Latikka, R., Celuch, M., Savolainen, I., Mantere, E. S., Savela, N., & Oksanen, A. (2023). Self-determination and attitudes toward artificial intelligence: Cross-national and longitudinal perspectives. *Telematics and Informatics, 82*, 102013.

Berwick, D. M., Murphy, J. M., Goldman, P. A., Ware, J. E., Jr., Barsky, A. J., & Weinstein, M. C. (1991). Performance of a five-item mental health screening test. *Medical Care, 29*(2), 169–176.

Bilgeli, O. R. (2018). Broscience: Creating trust in online drug communities. *New Media & Society, 20*(8), 2712–2727.

Bowden-Green, T., Hinds, J., & Joinson, A. (2020). How is extraversion related to social media use? A literature review. *Personality and Individual Differences, 164*, Article 110040.

Bowden-Green, T., Hinds, J., & Joinson, A. (2021). Understanding neuroticism and social media: A systematic review. *Personality and Individual Differences, 168*, Article 110344.

Bracci, A., Nadini, M., Aliapoulos, M., McCoy, D., Gray, I., Teytelboym, A., & Baronchelli, A. (2022). Vaccines and more: The response of dark web marketplaces to the ongoing COVID-19 pandemic. *PLoS One, 17*(11), Article e0275288.

Brailovskaia, J., & Margraf, J. (2022). Addictive social media use during Covid-19 outbreak: Validation of the Bergen social media addiction scale (BSMAS) and investigation of protective factors in nine countries. *Current Psychology, 1-19*. <https://doi.org/10.1007/s12144-022-03182-z>

Brailovskaia, J., Schillack, H., & Margraf, J. (2020). Tell me why are you using social media (SM)! Relationship between reasons for use of SM, SM flow, daily stress, depression, anxiety, and addictive SM use—an exploratory investigation of young adults in Germany. *Computers in Human Behavior, 113*, Article 106511.

Broadhurst, R., Ball, M., & Jiang, C. J. (2020). Availability of COVID-19 related products on Tor darknet markets. *Australasian Policing, 12*(3), 8–13.

Burki, T. (2020). The online anti-vaccine movement in the age of COVID-19. *The Lancet Digital Health, 2*(10), e504–e505.

Catalani, V., Townshend, H. D., Prilutskaya, M., Chilcott, R. P., Metastasio, A., Banayoti, H., & Corazza, O. (2023). Illicit COVID-19 products online: A mixed-method approach for identifying and preventing online health risks. *PLoS One, 18*(6), Article e0287231.

Chen, I. H., Pakpour, A. H., Leung, H., Potenza, M. N., Su, J. A., Lin, C. Y., & Griffiths, M. D. (2020). Comparing generalized and specific problematic smartphone/internet use: Longitudinal relationships between smartphone application-based addiction and social media addiction and psychological distress. *Journal of Behavioral Addictions, 9*(2), 410–419.

Chen, Y. N. (2023). The relationship between personality traits, emotional stability and mental health in art vocational and technical college students during epidemic prevention and control. *Psychology Research and Behavior Management, 16*, 2857–2867. <https://doi.org/10.2147/PRBM.S417243>

Chertoff, M. (2017). A public policy perspective of the dark web. *Journal of Cyber Policy, 2*(1), 26–38.

Choi, S., Choi, K. S., Sungu-Eryilmaz, Y., & Park, H. K. (2020). Illegal gambling and its operation via the darknet and bitcoin: An application of routine activity theory. *International Journal of Cybersecurity Intelligence & Cybercrime, 3*(1), 3–23.

Cuijpers, P., Smits, N., Donker, T., Ten Have, M., & de Graaf, R. (2009). Screening for mood and anxiety disorders with the five-item, the three-item, and the two-item mental health inventory. *Psychiatry Research, 168*(3), 250–255.

Currie, S. R., Casey, D. M., & Hodgins, D. C. (2010). *Improving the psychometric properties of the problem gambling severity index*. Canadian Consortium for Gambling Research.

- Dalvi-Esfahani, M., Niknafs, A., Kuss, D. J., Nilashi, M., & Afrough, S. (2019). Social media addiction: Applying the DEMATEL approach. *Telematics and Informatics*, 43, Article 101250.
- Del Vicario, M., Vivaldo, G., Bessi, A., Zollo, F., Scala, A., Caldarelli, G., & Quattrociocchi, W. (2016). Echo chambers: Emotional contagion and group polarization on Facebook. *Scientific Reports*, 6(1), 37825.
- Demant, J., Bakken, S. A., Oksanen, A., & Gunnlaugsson, H. (2019). Drug dealing on Facebook, snapchat and Instagram: A qualitative analysis of novel drug markets in the Nordic countries. *Drug and Alcohol Review*, 38(4), 377–385.
- DiTommaso, E., Brannen, C., & Best, L. A. (2004). Measurement and validity characteristics of the short version of the social and emotional loneliness scale for adults. *Educational and Psychological Measurement*, 64(1), 99–119.
- DiTommaso, E., & Spinner, B. (1993). The development and initial validation of the social and emotional loneliness scale for adults (SELSA). *Personality and Individual Differences*, 14(1), 127–134.
- Douglas, K. M., Sutton, R. M., & Cichocka, A. (2017). The psychology of conspiracy theories. *Current Directions in Psychological Science*, 26(6), 538–542.
- ElBahrawy, A., Alessandretti, L., Rusnac, L., Goldsmith, D., Teytelboym, A., & Baronchelli, A. (2020). Collective dynamics of dark web marketplaces. *Scientific Reports*, 10(1), 18827.
- Elovanio, M., Hakulinen, C., Pulkki-Råback, L., Aalto, A. M., Virtanen, M., Partonen, T., & Suvisaari, J. (2020). General health questionnaire (GHQ-12), Beck depression inventory (BDI-6), and mental health index (MHI-5): Psychometric and predictive properties in a Finnish population-based sample. *Psychiatry Research*, 289, Article 112973.
- Erfani, S. S., & Abedin, B. (2018). Impacts of the use of social network sites on users' psychological well-being: A systematic review. *Journal of the Association for Information Science and Technology*, 69(7), 900–912.
- Eurostat. (2022). *Population on 1 January by age and sex*. Available at: [https://ec.europa.eu/eurostat/databrowser/view/DEMO\\_PJAN\\_custom\\_6208249/bookmark/table?lang=en&bookmarkId=0e993324-e6a6-4579-81e3-70a0e0921458](https://ec.europa.eu/eurostat/databrowser/view/DEMO_PJAN_custom_6208249/bookmark/table?lang=en&bookmarkId=0e993324-e6a6-4579-81e3-70a0e0921458).
- Ferris, J. A., & Wynne, H. J. (2001). *The Canadian problem gambling index* (pp. 1–59). Ottawa, ON: Canadian Centre on Substance Abuse.
- Gómez-Guadix, M., & De Santisteban, P. (2018). "Sex pics?": Longitudinal predictors of sexting among adolescents. *Journal of Adolescent Health*, 63(5), 608–614.
- Gehl, R. W. (2016). Power/freedom on the dark web: A digital ethnography of the dark web social network. *New Media & Society*, 18(7), 1219–1235.
- Gongane, V. U., Munot, M. V., & Anuse, A. D. (2022). Detection and moderation of detrimental content on social media platforms: Current status and future directions. *Social Network Analysis and Mining*, 12(1), 129.
- Graeupner, D., & Coman, A. (2017). The dark side of meaning-making: How social exclusion leads to superstitious thinking. *Journal of Experimental Social Psychology*, 69, 218–222.
- Grönlund, K., & Setälä, M. (2012). In honest officials we trust: Institutional confidence in Europe. *The American Review of Public Administration*, 42(5), 523–542.
- Guillou-Landreat, M., & Gallopel-Morvan, K. (2021). Gambling marketing strategies and the internet: What do we know? A systematic review. *Frontiers in Psychiatry*, 12, Article 583817.
- Hahn, E., Gottschling, J., & Spinath, F. M. (2012). Short measurements of personality—validity and reliability of the GSOEP big five inventory (BFI-S). *Journal of Research in Personality*, 46(3), 355–359.
- Holtgraves, T. (2009). Evaluating the problem gambling severity index. *Journal of Gambling Studies*, 25, 105–120.
- Jardine, E. (2018). Tor, what is it good for? Political repression and the use of online anonymity-granting technologies. *New Media & Society*, 20(2), 435–452.
- Jardine, E. (2019). *Online content moderation and the dark web: Policy responses to radicalizing hate speech and malicious content on the Darknet* (First Monday).
- Jouhki, H., Savolainen, I., Sirola, A., & Oksanen, A. (2022). Escapism and excessive online behaviors: A three-wave longitudinal study in Finland during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 19(19), 12491.
- Kaakinen, M., Sirola, A., Savolainen, I., & Oksanen, A. (2020). Shared identity and shared information in social media: Development and validation of the identity bubble reinforcement scale. *Media Psychology*, 23(1), 25–51.
- Käckenmester, W., Bott, A., & Wacker, J. (2019). Openness to experience predicts dopamine effects on divergent thinking. *Personality Neuroscience*, 2, Article e3.
- Kaur, S., & Randhawa, S. (2020). Dark web: A web of crimes. *Wireless Personal Communications*, 112, 2131–2158.
- Keipi, T., Näsi, M., Oksanen, A., & Räsänen, P. (2017). *Online hate and harmful content: Cross-national perspectives*. Taylor & Francis.
- Keles, B., McCrae, N., & Grealish, A. (2020). A systematic review: The influence of social media on depression, anxiety and psychological distress in adolescents. *International Journal of Adolescence and Youth*, 25(1), 79–93.
- Kermitsis, E., Kavallieros, D., Myttas, D., Lissaris, E., & Giataganas, G. (2021). Dark web markets. *Dark Web Investigation*, 85–118.
- Kloess, J. A., & van der Bruggen, M. (2023). Trust and relationship development among users in dark web child sexual exploitation and abuse networks: A literature review from a psychological and criminological perspective. *Trauma, Violence, & Abuse*, 24(3), 1220–1237.
- Eurostat. (2023). *Digitalisation in Europe - 2023 edition*. Retrieved from <https://ec.europa.eu/eurostat/web/interactive-publications/digitalisation-2023#peop-le-online>.
- Kwon, K. H., Priniski, J. H., Sarkar, S., Shakarian, J., & Shakarian, P. (2017, July). Crisis and collective problem solving in dark web: An exploration of a black hat forum. In *Proceedings of the 8th International Conference on Social Media & Society* (pp. 1–5).
- Kwon, K. H., & Shao, C. (2021). Dark knowledge and platform governance: A case of an illicit e-commerce community in reddit. *American Behavioral Scientist*, 65(6), 779–799.
- Lee, A. Y., & Hancock, J. T. (2024). Social media mindsets: A new approach to understanding social media use and psychological well-being. *Journal of computer-mediated. Communication*, 29(1), zmad048.
- Lieberman, A., & Schroeder, J. (2020). Two social lives: How differences between online and offline interaction influence social outcomes. *Current Opinion in Psychology*, 31, 16–21.
- Maddox, A., Barratt, M. J., Allen, M., & Lenton, S. (2016). Constructive activism in the dark web: Cryptomarkets and illicit drugs in the digital 'demimonde'. *Information, Communication & Society*, 19(1), 111–126.
- Marino, C., Gini, G., Vieno, A., & Spada, M. M. (2018). The associations between problematic Facebook use, psychological distress and well-being among adolescents and young adults: A systematic review and meta-analysis. *Journal of Affective Disorders*, 226, 274–281.
- McNicol, M. L., & Thorsteinsson, E. B. (2017). Internet addiction, psychological distress, and coping responses among adolescents and adults. *Cyberpsychology, Behavior, and Social Networking*, 20(5), 296–304.
- Meerkerk, G. J., Van Den Eijnden, R. J., Vermulst, A. A., & Garretsen, H. F. (2009). The compulsive internet use scale (CIUS): Some psychometric properties. *Cyberpsychology & Behavior*, 12(1), 1–6. <https://doi.org/10.1089/cpb.2008.0181>
- Moeller, J., von Keyserlingk, L., Spengler, M., Gaspard, H., Lee, H. R., Yamaguchi-Pedroza, K., & Arum, R. (2022). Risk and protective factors of college students' psychological well-being during the COVID-19 pandemic: Emotional stability, mental health, and household resources. *Aera Open*, 8, Article 23328584211065725.
- Monacis, L., de Palo, V., Griffiths, M. D., & Sinatra, M. (2017). Social networking addiction, attachment style, and validation of the Italian version of the Bergen social media addiction scale. *Journal of Behavioral Addictions*, 6(2), 178–186. <https://doi.org/10.1556/2006.6.2017.023>
- Montasari, R., & Boon, A. (2023, January). An analysis of the dark web challenges to digital policing. In H. Jahankhani (Ed.), *Cybersecurity in the age of smart societies: Proceedings of the 14th international conference on global security, safety and sustainability, London, September 2022* (pp. 371–383). Cham: Springer International Publishing.
- Moore, D., & Rid, T. (2016). Cryptopolitik and the Darknet. *Survival*, 58(1), 7–38.
- Neal, T. M. S., Shockey, E., & Schilke, O. (2016). The "dark side" of institutional trust. In E. Shockey, T. M. S. Neal, B. H. Bornstein, & L. M. PlytkiZillig (Eds.), *Interdisciplinary perspectives on trust: Towards theoretical and methodological integration* (pp. 177–192). NY: Springer.
- Nurmi, J., Kaskela, T., Perälä, J., & Oksanen, A. (2017). Seller's reputation and capacity on the illicit drug markets: 11-month study on the Finnish version of the silk road. *Drug and Alcohol Dependence*, 178, 201–207.
- O'Day, E. B., & Heimberg, R. G. (2021). Social media use, social anxiety, and loneliness: A systematic review. *Computers in Human Behavior Reports*, 3, Article 100070.
- Oksanen, A., Kaakinen, M., Latikka, R., Savolainen, I., Savela, N., & Koivuola, A. (2020). Regulation and trust: 3-month follow-up study on COVID-19 mortality in 25 European countries. *JMIR Public Health and Surveillance*, 6(2), Article e19218.
- Oksanen, A., Latikka, R., Oksa, R., Savela, N., Savolainen, I., Celuch, M., & Vuorinen, I. (2021). Emerging technologies lab data quality protocol. *Open Science Framework*. <https://osf.io/h4d82/>.
- Oksanen, A., Mantere, E., Vuorinen, I., & Savolainen, I. (2022). Gambling and online trading: emerging risks of real-time stock and cryptocurrency trading platforms. *Public Health*, 205, 72–78.
- Owen, G., & Savage, N. (2015). The tor dark net. *Global Commission on Internet Governance Paper Series*, 20(2015), 1–20. [https://www.cigionline.org/sites/default/files/no20\\_0.pdf](https://www.cigionline.org/sites/default/files/no20_0.pdf).
- Petrosyan, A. (2022a). *Share of internet users who have used technologies that allow access to the dark web as of February 2019, by country*. Statista: Retrieved from <https://www.statista.com/statistics/1015229/dark-web-access-technology-usage-by-country/>.
- Petrosyan, A. (2022b). *Most common reasons for users to access the dark web worldwide as of February 2019*. Statista: Retrieved from <https://www.statista.com/statistics/1015244/global-dark-web-usage-reasons/>.
- Petrosyan, A. (2023). *Digitalization level of the European Union in 2022, by country*. Statista: Retrieved from <https://www.statista.com/statistics/1245595/eu-digitalization-level/>.
- Rama, R., Nair, V. K., Nedungadi, P., Ray, I., & Achuthan, K. (2023). Darkweb research: Past, present, and future trends and mapping to sustainable development goals. *Heliyon*, 9(11), Article e22269.
- Rumpf, H. J., Meyer, C., Hapke, U., & John, U. (2001). Screening for mental health: Validity of the MHI-5 using DSM-IV Axis I psychiatric disorders as gold standard. *Psychiatry Research*, 105(3), 243–253.
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: Guilford Press.
- Savolainen, I., Oksanen, A., Kaakinen, M., Sirola, A., & Paek, H. J. (2020). The role of perceived loneliness in youth addictive behaviors: Cross-national survey study. *JMIR Mental Health*, 7(1), Article e14035.
- Schmidt, H., Brandt, D., Bischof, A., Heidbrink, S., Bischof, G., Borgwardt, S., & Rumpf, H. J. (2022). Think-aloud analysis of commonly used screening instruments for internet use disorders: The CIUS, the IGDT-10, and the BSMAS. *Journal of Behavioral Addictions*, 11(2), 467–480.
- Sirola, A., Kaakinen, M., Savolainen, I., & Oksanen, A. (2019). Loneliness and online gambling-community participation of young social media users. *Computers in Human Behavior*, 95, 136–145.

- Sirola, A., Nuckols, J., Nyrhinen, J., & Wilska, T. A. (2022). The use of the dark web as a COVID-19 information source: A three-country study. *Technology in Society, 70*, Article 102012.
- Sønderskov, K. M., & Dinesen, P. T. (2016). Trusting the state, trusting each other? The effect of institutional trust on social trust. *Political Behavior, 38*, 179–202.
- Terracciano, A., Löckenhoff, C. E., Zonderman, A. B., Ferrucci, L., & Costa, P. T., Jr. (2008). Personality predictors of longevity: Activity, emotional stability, and conscientiousness. *Psychosomatic Medicine, 70*(6), 621–627. <https://doi.org/10.1097/PSY.0b013e31817b9371>
- Thompson, A., & Pollet, T. V. (2024). An exploratory psychometric network analysis of loneliness scales in a sample of older adults. *Current Psychology, 43*(6), 5428–5442.
- Topor, L. (2019). Dark hatred: Antisemitism on the dark web. *Journal of Contemporary Antisemitism, 2*(2), 25–42.
- Tor Metrics. (2023). Top-10 countries by relay users. *The Tor Project*. Retrieved from: <https://metrics.torproject.org/userstats-relay-table.html>.
- Van de Weijer, S. G., & Leukfeldt, E. R. (2017). Big five personality traits of cybercrime victims. *Cyberpsychology, Behavior, and Social Networking, 20*(7), 407–412.
- Van Prooijen, J. W., & Douglas, K. M. (2017). Conspiracy theories as part of history: The role of societal crisis situations. *Memory Studies, 10*(3), 323–333.
- Vosoughi, S., Roy, D., & Aral, S. (2018). The spread of true and false news online. *Science, 359*(6380), 1146–1151.
- Wang, Y., McKee, M., Torbica, A., & Stuckler, D. (2019). Systematic literature review on the spread of health-related misinformation on social media. *Social Science & Medicine, 240*, Article 112552.
- Weimann, G. (2016). Going dark: Terrorism on the dark web. *Studies in Conflict & Terrorism, 39*(3), 195–206.
- Wolfowicz, M., Weisburd, D., & Hasisi, B. (2023). Examining the interactive effects of the filter bubble and the echo chamber on radicalization. *Journal of Experimental Criminology, 19*(1), 119–141.
- Zarate, D., Hobson, B. A., March, E., Griffiths, M. D., & Stavropoulos, V. (2023). Psychometric properties of the Bergen social media addiction scale: An analysis using item response theory. *Addictive Behaviors Reports, 17*, Article 100473.
- Zwar, L., König, H. H., & Hajek, A. (2022). Conspiracy mentality among informal caregivers as a risk factor for caregiver burden, mental health, perceived loneliness and social isolation during the COVID-19 pandemic: Findings of a representative online study from Germany. *Quality of Life Research, 31*(11), 3139–3151.