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Access to digital culture as a driver of social and cultural openness: European evidence

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Digital technologies provide people with an excellent opportunity to access cultural expressions from all over the world. Research has shown that while cultural participation is linked to wellbeing and various societal values, it is stratified. Despite evidence of unequal access, digital technology use, and cultural participation, and of a relationship between cultural openness and social openness, no research has addressed the sequential relationship among these factors and their degree of stratification. We explore the social mechanism governing the relationship between access to digital cultural, cultural openness, and social openness in Europeans, using new survey data from a nine-country European research project and multivariate modeling. In investigating whether this social mechanism is unique or differs according to social inequality indicators such as gender, age, education, and country of residence, we found the following: (1) access to digital culture positively influences both cultural and social openness; (2) cultural openness functions as a bridge between access to digital culture and social openness; and (3) the underlying social mechanism is not unique but varies according to age, education, and country of residence. We conclude by describing the implications of our findings for inclusive cultural policies.

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Introduction

Accessing digital cultural expressions forms a new social system that influences individuals' experiences and opportunities and significantly impacts society (Uzelac, 2010). However, digital culture is a double-edged sword. On the one hand, because people have access to a greater variety of cultural expressions from anywhere in the world, they are more easily exposed to their preferred cultural expressions—fostering what Weingartner (2021) and Norris (2001) have referred to as a "democratization" of culture and the "normalization thesis", respectively—and supposedly reflecting a narrowing of the digital divide. On the other hand, the fact that access to digital culture is stratified exacerbates social stratification and defines cultural hierarchies regarding people's access to culture (Katz-Gerro, 1999, Ateca-Amestoy, 2008, Dimaggio and Markus, 2010, Mihelj et al., 2019, Weingartner, 2021). This second proposition has been formalized by Norris (2001) as the "stratification thesis". However, which of the two propositions better explains reality has not been empirically tested.

Access to digital culture has benefits in terms of life satisfaction and wellbeing (Bartikowski et al., 2018, Fanea-Ivanovici and Pana, 2020). It is therefore of interest to governments and policymakers (Burri, 2016)—directly, because perceived satisfaction with life is positively correlated with exposure to cultural expressions (Bygren et al., 1996, 2009, Grossi et al., 2011, Wheatley and Bickerton, 2017) and indirectly, because exposure to a greater variety of cultures may positively influence openness to different cultures and social groups (McCrae, 1996, Brock, 2012, Gibbs et al., 2013, Brandt et al., 2015, 2015, Porter et al., 2017, Nai et al., 2018, Limov, 2020, Wolstenholme et al., 2020). However, if social inequality is transposed to access to digital culture, the benefits may be unequally distributed in and between societies. Since research into the digital divide has shown that not only is access to digital platforms unequally distributed, but also attitudes, skills, and benefits (van Deursen and van Dijk, 2014), there is support for Norris's (2001) stratification thesis regarding the individual and societal benefits of digital access to cultural expressions.

While evidence exists regarding the stratification of access to digital culture, evidence is sparse regarding the link with cultural and social openness. However, as far as we are aware, while there is evidence regarding the link between exposure to diverse cultures and social openness (McCrae, 1996, de Jong et al., 2006, Acerbi, 2016, Porter et al., 2017, Nai et al., 2018, Schwaba et al., 2018, Poort et al., 2023), there is none regarding the stratification of the sequential relationship between access to digital culture and cultural and social openness.

We explore the social mechanism that governs the relationship between access to digital culture and cultural and social openness using survey data for residents in nine European countries (Croatia, Denmark, Finland, France, the Netherlands, Serbia, Spain, Switzerland, and the United Kingdom), collected within a European Union (EU) research project INVENT. For our analysis we use partial least square structural equation modeling (PLS-SEM) (Wold, 1985, Hair et al., 2022), widely used to study the network of relationships between concepts that cannot be directly measured. We further explore whether the social mechanism is unique or depends on different sources of social inequality. In particular, we explore whether gender, age, education, and country of residence contribute to defining different social groups, thereby providing evidence in favor of Norris' stratification thesis. In line with our objectives, therefore, we aim to answer the following research questions:

1. The sequential relationship hypothesis: Does access to digital culture foster cultural openness and social openness among Europeans?
2. Stratification of the sequential relationship: Are the relationships between access to digital cultural, cultural openness, and social openness among Europeans governed by a unique social mechanism?

The paper is organized as follows. In Section " Theoretical framework", we conceptualize the cultural and social openness constructs and access to digital cultural as their driver, we review the primary sources of social inequality in cultural participation, and we establish our research hypotheses. In Section "Research design", we describe our data and the methods used for analysis. In Section "Results", we report our tests for assessing social inequality and our main findings. Finally, we discuss our findings and the implications for inclusive cultural policies.

Theoretical framework

Digital culture access, cultural openness, and social openness. Digital culture access (DCA) refers to internet-based access to audiovisual productions (music and films), e-books, newspapers, blogs, webs, communication tools (instant messaging, emails), and social media platforms for self-expression. DCA instantaneously provides information with fewer geographical constraints, rapid data transport, and effortless reproduction of the original with no loss of quality (Burri, 2010, Marenghi et al., 2016). Unlike traditional means of accessing cultural content and oral communications, digital culture can also help preserve cultural expressions (Acerbi, 2016). As a result, the impact of digital access on how we communicate, create, consume, and preserve culture is believed to be stronger than in the pre-digital age (Doerr et al., 2012).

Cultural openness (CO) refers to the willingness and ability of individuals and societies to engage with and embrace different cultures and perspectives (Ollivier, 2008). Research has demonstrated that digital technologies have expanded access to cultural content, facilitated cultural exchange, and promoted CO (Burri, 2016, Marenghi et al., 2016). Since the relationship between DCA and CO is multifaceted, it is understood through several dimensions. DCA increases exposure to diverse cultural expressions (music, film, literature, and art) from around the world, has boosted communication among people, has enhanced education and awareness to many different cultures, provides evidence to challenge traditional cultural norms and hierarchies, and, by giving voice to cultural and social minorities, allows for a more diverse range of cultural expressions. All in all, DCA contributes to the globalization of cultural expressions.

The evidence thus suggests that DCA shapes CO as a window and bridge to a broader cultural world. Furthermore, research into CO evolution suggests that more extensive cultural repertoires favor greater openness in individuals and groups (Acerbi et al., 2009). Therefore, since digital culture fosters access to more extensive cultural repertoires, we can expect DCA to positively affect openness to different cultures.

H1: Access to digital culture positively affects cultural openness.

Social openness (SO) refers to people's general propensity to share and accept other people's beliefs, norms, and customs (Porter et al., 2017). Research has shown that DCA increases access to cultural content, facilitates cross-cultural understanding, and fosters cultural exchange, thereby promoting SO (Limov, 2020). This multifaceted relationship can be explored through various angles. For instance, DCA enhances social connectivity and exposure to a wide array of social norms and behaviors, facilitates the development of empathy and understanding, facilitates participation in global communities, and cultivates a sense of global citizenship. Social media platforms, by increasing

engagement with diverse social groups, provides a window to a broader social world, although they can also create echo chambers of similar world views. Social psychology, management, migration, communication, and media research studies all support the idea that digital engagement enhances SO (Castles, 2002, Gruzd et al., 2011, Poyntz and Hoechsmann, 2011, Brock, 2012, Gibbs et al., 2013, Kim and Sintas, 2020, Limov, 2020, Kim and López Sintas, 2021, Poort et al., 2023).

DCA and SO are linked in that digital platforms and technology can significantly affect how people interact and engage with each other (Gibbs et al., 2013). While biases can be perpetuated and stereotypes can be reinforced if people only interact with similar others (Gruzd et al., 2011), DCA can promote SO by providing new and diverse ways of accessing transnational media productions and connecting and communicating with different others (Kim and Sintas, 2020, Kim and López Sintas, 2021); social media platforms, for instance, connect people with others from different backgrounds and perspectives and enable the sharing of experiences and ideas (Brock, 2012, Blank, 2017, Blank and Lutz, 2017), while video conferencing and instant messaging make it easy for people to communicate and collaborate across borders and time zones (Howlett, 2021). On average, we can expect that DCA will positively affect SO to people of different social origins.

H2: Access to digital culture positively affects social openness.

CO and SO are closely related in that they both reflect the willingness and ability of individuals and societies to engage with and embrace diversity (Schwaba et al., 2018) and to understand different cultures, customs, traditions, languages, religions, and ways of life. Although CO and SO are rooted in a general openness to experience (reflecting intellectual curiosity, creativity, and a preference for novelty), exposure to diverse cultural expressions can lead to more positive attitudes towards cultural differences. CO and SO also involve openness to experiencing new and unfamiliar things, to interacting with people from different cultures, social classes, and identities, and to forming meaningful connections with others. Similarly, SO promotes inclusivity and reduces social prejudices, facilitating smoother interactions in diverse social settings (Lai et al., 2013).

Both CO and SO are essential to creating inclusive and tolerant societies (Brandt et al., 2015). CO allows people to understand and appreciate cultural diversity, while SO enables people to connect with and relate to individuals from diverse backgrounds (McCrae, 1996). Together, CO and SO can contribute to a more tolerant and considerate social climate (Nai et al., 2018). Note that openness—CO and SO—is not just a question of exposure to different cultures but also of actively seeking and engaging with diversity and being willing to learn from it (de Jong et al., 2006). CO and SO are thus closely linked and potentially reinforce each other, as fostering one can increase the other, leading to a more inclusive, tolerant, and interconnected society. Understanding and nurturing CO and SO can thus benefit individuals and communities in our increasingly interconnected world. Consequently, CO will influence SO and facilitate interaction between people from different cultural and social backgrounds.

H3: Cultural openness positively affects social openness.

Sources of inequality. Since access to digital devices and the internet can significantly impact an individual's ability to participate in and benefit from culture, DCA is closely linked to social inequality. Not everyone has equal access to digital devices and the internet, and, to take advantage of digital devices, people must have the motivation and digital skills to use the internet strategically, and not merely for entertainment (van Deursen and van Dijk, 2014). Regarding internet use, as an alternative to the normalization thesis, Norris proposed the stratification thesis (Norris, 2001), which states that economic, cultural, and social resources and opportunities for DCA are unequally distributed among individuals and social groups. To date, the more significant differences have been found to be between more and less well-educated people, between men and women, between youth and adults (Broos and Roe, 2006), and between more and less socioeconomically developed countries (Lamberti et al., 2021). People from marginalized communities, due to limited access to digital devices and the internet, are thus disproportionately affected by social inequality. Consequently, the social mechanism that relates DCA with CO and SO may function differently depending on gender, age, education, and country of residence as sources of heterogeneity.

Gender. Research has found that men compared to women have greater access to digital devices and the internet, are more motivated to do so, and spend more time online (Morahan-Martin, 1998, Antonio and Tuffley, 2014, Dixon et al., 2014). However, although the gender gap is particularly acute in developing countries, differences are reduced to vanishing point as countries develop socioeconomically (Marzano and Lubkina, 2019). Gender disparity is, therefore, an empirical matter that depends on the social context. If there are gender differences in DCA, then the relationship between DCA, CO, and SO will be different for men and women:

H4a. Gender differences affect the relationship between access to digital culture, cultural openness, and social openness.

Age. As mobile digital technologies are used increasingly for leisure and education purposes, uptake of laptops, smartphones, and tablets has gradually differentiated young people from older adults (Livingstone, 2007). Because young people have more leisure time and better digital devices, they also have greater DCA (Khan et al., 2016) and so will show greater CO. Additionally, since young people's greater need to communicate is greater (López-Sintas et al., 2012), the influence of DCA and CO on SO will be more substantial than for the adults (McCrae, 1996, Helson et al., 2002, Ghirlanda et al., 2013).

H4b. The relationship between access to digital culture, cultural openness, and social openness is stronger for younger Europeans.

Education. Research has found that, compared to use the internet and digital devices for more hours daily in their leisure time. Use of the digital technologies is also different (van Deursen and van Dijk, 2014): less well-educated people use them more for entertainment (games, mainly), while well-educated people use them more to create and maintain social relations (Helsper and van Deursen, 2017). Since sharing information with friends, relatives, and strangers seems to be associated with cultural activities (Brake, 2014, van der Zeeuw et al., 2019, van Deursen et al., 2021), the social mechanism of openness may differ for both social groups, particularly the relationship between CO and SO.

H4c. The relationship between access to digital culture, cultural openness, and social openness is stronger for well-educated Europeans.

Country of residence. Cross-country research has not only identified differences in individual access to the internet (Lamberti et al., 2020), but also has reported evidence that national culture influences both CO and SO (Acerbi et al., 2009, Acerbi, 2016). Openness is thus not only a personal trait but also depends on country differences. In Hofstede's theory of cultural dimensions (Hofstede Insights, 2023), individualism is positively related to openness, while uncertainty avoidance and power distance are

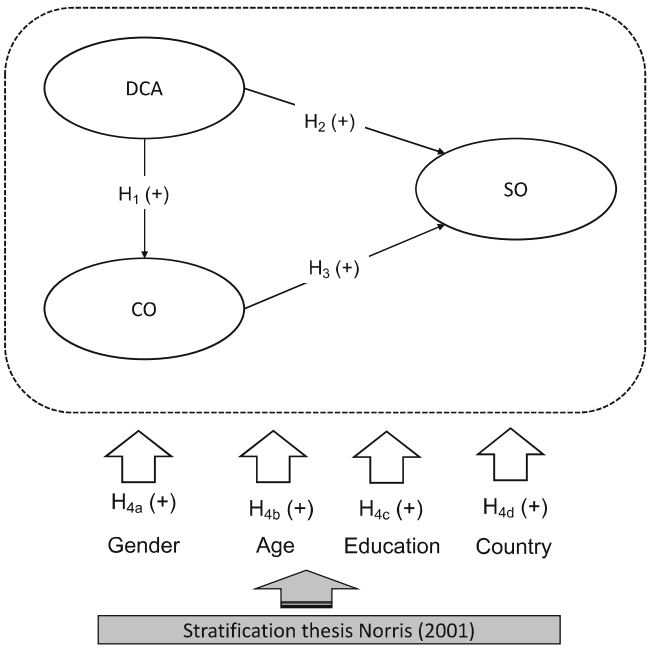

Fig. 1 Model Path Diagram. Path diagram illustrating the social mechanism that governs the relationship between Digital Cultural Access (DCA), Cultural Openness (CO), and Social Openness (SO).

negatively related to openness (de Jong et al., 2006). According to cultural evolution research, the long-term maintenance of openness in individuals and groups is positively related to learning from many social models and a larger cultural repertoire (Acerbi et al., 2009, Acerbi, 2016). In more individualistic cultures, the fact that individuals are exposed to a more extensive set of cultural and social variations means that we can expect country-level variations in the social mechanism underpinning DCA, CO, and SO.

H4d. The relationship between access to digital culture, cultural openness, and social openness is stronger for Europeans living in more individualistic countries.

Figure 1 shows our model, which, reflecting the literature, depicts DCA as a driver of CO, and both DCA and CO as drivers of SO. In addition, the relationship between DCA, CO, and SO is affected by four sources of inequality (gender, age, education, and country of residence).

Research design

Sample. The data for this study were collected within the framework of a EU research project INVENT in the spring of 2021. The survey was simultaneously fielded in nine countries: Croatia (HR), Denmark (DK), Finland (FI), France (FR), the Netherlands (NL), Serbia (RS), Spain (ES), Switzerland (CH), and the United Kingdom (UK). Data collection, coordinated by national survey agencies, aimed to collect responses from a representative sample of the adult population aged 18 years and older. A minimum of 1200 respondents per country completed a questionnaire that included questions related to, e.g., sociodemographic background, attitudes to and participation in culture and cultural activities, media use, life satisfaction, and opinions on Europe and cosmopolitanism. For the purpose of this study, we selected variables relevant to the assessment of DCA, CO, and SO.

Concerning missing data, 1777 observations missing from the survey were omitted after determining that differences in frequencies were minimal. The final sample included 9962 individuals and no weights were applied in the analysis. Concerning sociodemographic and country variables, of the respondents, 55.52% were female, 49.30% were aged 46–64 years, and 46.06% had tertiary education, while frequencies were similar for the country data (around 10%) except for the UK (17.52%) (Fig. 2). Technical details of the survey are provided in Appendix A (e.g., see Appendix A, Supplementary Information)[1].

Sample size, according to the literature, is crucial for quantitative studies using a PLS approach. Determined by model complexity, sample size for PLS is based on the power of analysis. According to Gefen et al. (2011) and the table developed by Green (1991), for a power of 80%, medium effect size, and $p = 0.05$, the minimum sample size needs to be 85; hence, for our sample of 9962 individuals, size was not an issue. Furthermore, in terms of sources of heterogeneity (gender, age, education, and country of residence), the smallest segment—observed for Finland ($n \approx 700$, 7.03%)—was higher than the threshold of 85, and so further ensures the adequacy of sample size for the considered groups.

Measurements. The DCA scale—measured through the question, *How often do you do the following on the internet?*—was answered, using a five-point Likert scale (1 = almost never to 5 = almost daily), according to level of involvement in four online cultural activities: *(1) Communicate/share cultural expressions; (2) Seek cultural information; (3) Watch online cultural expressions;* and *(4) Listen to music*.

The CO and SO scales were both measured according to Cleveland et al. (2014) using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Regarding CO, respondents were asked to express their agreement/disagreement with the following four statements: *(1) At cultural events I like to talk to people who have a different background from me; (2) At cultural events I often feel a sense of belonging and togetherness with other participants; (3) It is great to participate in cultural events and activities with a very diverse group of people;* and *(4) Culture connects people and bridges political, social, and religious divides*. As for SO, respondents were asked to rate their agreement/disagreement with the following four statements: *(1) I am interested in learning more about people who live in other countries; (2) I enjoy exchanging ideas with people from other cultures and countries; (3) I like to learn about other ways of life;* and *(4) I enjoy being with people from other countries and learning about their unique views and approaches*.

Table 1 reports the scales, indicators, and indicator labels, together with mean and standard deviation (SD) values, as graphically illustrated in Appendix B.

Statistical analysis. As we were interested in exploring the relationship between our three scales—DCA, CO, and SO—as defined using a set of items available from our survey, we applied a causal structural equation model (SEM) approach. In particular, we estimated our model using the partial least square structural equation modeling (PLS-SEM) technique (Wold, 1985, Hair et al., 2022). PLS-SEM connects a set of observed variables (i.e., indicators or manifest variables) with constructs (i.e., latent variables) through a system of linear relationships (Hair et al., 2017). Each latent variable is estimated using specific linear combinations of the manifest variables, and simultaneously, the relationships between latent variables are quantified by applying a set of sequential multiple linear regressions. Two models are computed: the measurement (outer) model, relating manifest variables to latent variables, and the structural (inner) model, which reflects the strength and direction of the relationships among the latent variables. Each set of indicators is related either reflectively or formatively to its own latent variable. Indicators are reflective when it is hypothesized that the latent variable generates the indicators, while indicators are formative when the latent variable

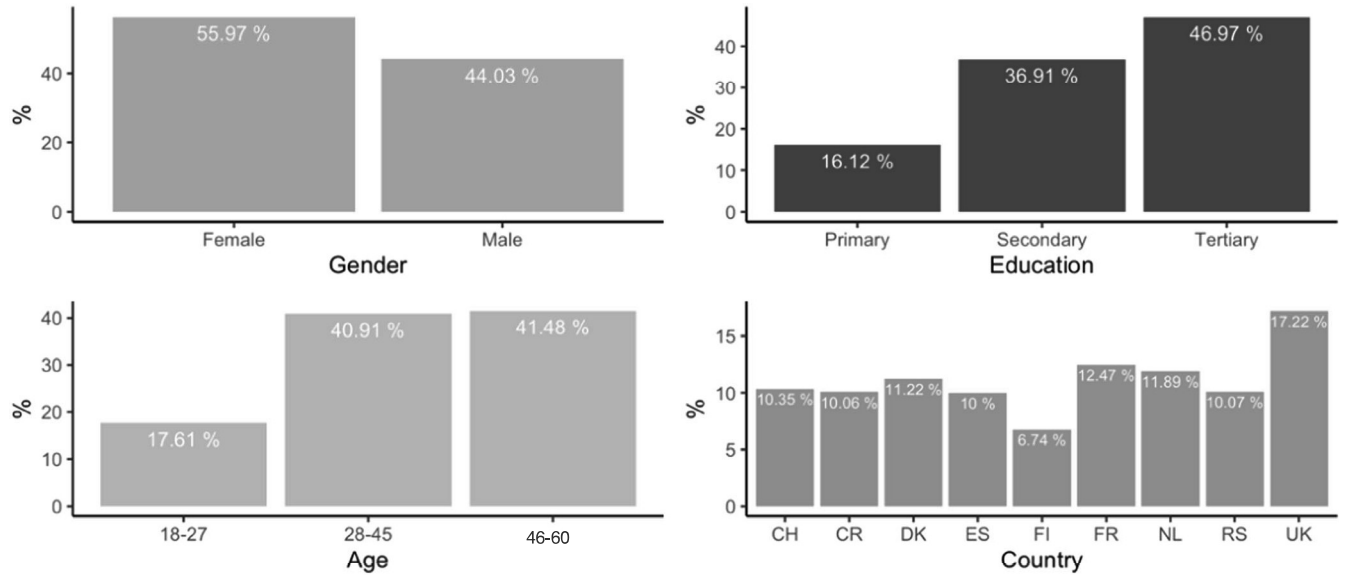

Fig. 2 Descriptive Statistics. Bar plot distributions showcasing sociodemographic and country-level indicators.

is generated by the indicators. Reflective indicators, but not formative indicators, need to be highly correlated, as each indicator describes a different aspect of the latent variable. The primary reason for using PLS-SEM is that it accommodates both reflective and formative constructs, offering a flexibility in model specification that might not be possible with traditional covariance-based SEM (Henseler et al., 2009). Note that, in our analysis, DCA is formative, while CO and SO are reflective. Another justification for using PLS-SEM is that it is often preferred for exploratory research and theory development, as emphasized by Hair et al. (2017), and is particularly useful for the exploration of new theoretical relationships when the theoretical foundation is still evolving (as is the case in our study).

The effects of individual social indicators and country indicators were analyzed using multigroup analysis (MGA) (Hair et al., 2017), which investigates the effect of a categorical variable in PLS-SEM as follows: (1) it divides data into groups according to the social and country indicators; (2) it estimates a specific PLS-SEM model for each group; and (3) it evaluates differences between group coefficients. Of the several tests available to compare differences (Hair et al., 2017), we used PLS-MGA (Henseler et al., 2009).

Before applying MGA, to reduce the number of country comparisons we identified the most significant groups running exploratory pathmox analysis (Lamberti et al., 2016, 2017), a binary segmentation procedure that produces a tree with different models in the resulting nodes. The aim is to identify groups that differ most regarding the relationships between constructs. The whole dataset, associated with the root (parent) node, is recursively partitioned through an iterative procedure that aims to identify the categorical variable levels yielding the two most significantly different PLS-SEMs, which are then associated with two child nodes detected at each step. Use of pathmox analysis combined with MGA to reduce groups has been recently formalized by Lamberti (2021).

Also before applying MGA, we evaluated measurement invariance, necessary to compare PLS-SEM coefficients estimated for different groups, as it ensures that latent variables are measured in the same way across groups emerging at different levels (sociodemographic and country groups). We used the measurement invariance of composite models (MICOM) procedure (Henseler et al., 2016) to verify that: (1) the same latent variables are equally parameterized and estimated across groups (configural invariance); (2) the correlation between latent variable scores across groups is sufficiently high (close to 1) (compositional invariance); and (3) the means and variances of the latent variable scores across groups are equal (full measurement invariance). The first condition is assured when latent variables are parametrized similarly in defining groups, and the second and the third conditions are assured by performing a test based on permutations (where the null hypotheses is that compositional invariance and full measurement invariance exists). For our study, the threshold for testing compositional and full measurement invariance was set to a conservative $p = 0.01$.

MGA can be performed when at least the first two conditions are met. A practical guideline for applying the MICOM procedure is provided by Hair et al. (2017), while Henseler et al. (2016) provide more details on methodological aspects.

Results

Does access to digital culture foster cultural openness and social openness among Europeans? A global analysis. The global model results are reported in Fig. 3. In line with Hair et al. (2017), common reliability indexes were computed for each latent variable to ensure the validity of the measurement model (see Appendix C, Supplementary Information, for details). As reported in Fig. 3, DCA affects CO ($\beta = 0.264$, $CI_{95\%}[0.244;0.285]$) and, to a lesser extent, SO ($\beta = 0.112$, $CI_{95\%}[0.095;0.130]$), and as expected, CO affects SO ($\beta = 0.635$, $CI_{95\%}[0.620;0.650]$). The coefficient of determination, $R^2 = 0.453$, reflects moderate predictive power.

Are the relationships between access to digital culture, cultural openness, and social openness among Europeans governed by a unique social mechanism? A multigroup analysis. Before running the MGA, we faced the problem of having a large number of groups to compare for the country variable. Since MGA is based on binary comparisons, analysing nine countries would have required 36 comparisons, which would have produced results difficult to interpret. We therefore grouped the countries following Lamberti (2021), applying pathmox analysis to identify different groups distinguished by different relationships among constructs according to one or more categorical variables

Table 1 Measurement descriptions.

Construct	Statements	Labels	Mean	SD
Digital cultural access (DCA)		Communicating/sharing cultural expressions	1.95	1.27
		Seeking cultural information	2.96	1.29
		Watching online cultural expressions	3.2	1.7
		Listening to music	2.92	1.56
Cultural openness (CO)	At cultural events, I like to talk to people who have a different background from me	Talking to people	2.51	1.09
	At cultural events, I often feel a sense of belonging and togetherness with other participants	Feeling belongingness	2.48	1.02
	It is great to participate in cultural events and activities with a very diverse group of people	Participating with diverse people	2.27	1.02
	Culture connects people and bridges political, social, and religious divides	Bridging divides	2.07	1
Social openness (SO)	I am interested in learning more about people who live in other countries	Learning about people	2.11	1.03
	I enjoy exchanging ideas with people from other cultures and countries	Exchanging ideas	2.22	1.06
	I like to learn about other ways of life	Learning about ways of life	1.99	0.98
	I enjoy being with people from other countries and learning about their unique views and approaches	Being with diverse people	2.22	1.05

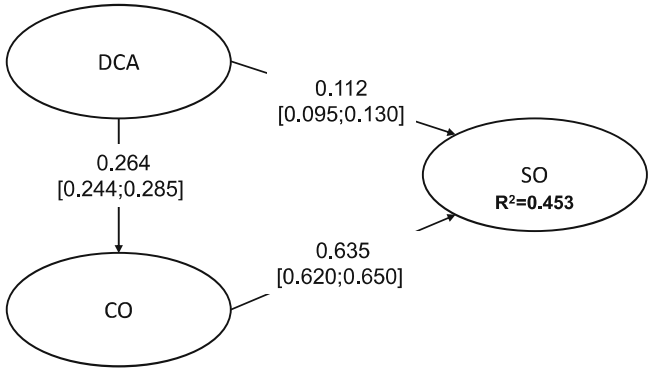

Fig. 3 Model Path Diagram Results. Estimation results of the model relating Digital Cultural Access (DCA), Cultural Openness (CO), and Social Openness (SO). The significance of the coefficients is reported in parentheses, including confidence intervals. The R^2 value for the target variable, SO, is highlighted in bold.

Table 2 Country groups as identified by pathmox analysis.

Group	Size	%	Label
Spain, Croatia, France, Serbia	4091	39.69	G1
Finland, Netherlands	1889	20.09	G2
Switzerland, Denmark, United Kingdom	3982	40.21	G3

(Lamberti et al., 2016). Pathmox identified a first significant difference (F-stat = 251.926, $p < 0.001$) that separated Croatia, Spain, France, and Serbia from Finland, the Netherlands, Switzerland, Denmark, and the United Kingdom, and a second difference (F-stat = 54.376, $p < 0.001$) that separated Finland and the Netherlands from Switzerland, Denmark, and the United Kingdom. The final outcome was three country groups (G1, G2, and G3), as shown in Table 2.

Furthermore, following Hair et al. (2017), we confirmed configural invariance, i.e., that DCA, CO, and SO were defined using the same set of indicators in all groups. We also verified compositional invariance in most cases; for the very few exceptions, since the original correlation was greater than 0.9, we could globally assume compositional invariance. In testing for full measurement invariance, we found differences that, in most cases, confirmed the existence of different segments according to gender, age, education, and country of residence. Results of the MICOM invariance procedure steps (2) and (3) are reported in Appendix D (e.g., see Appendix D, Supplementary Information). Finally, according to Cheah et al. (2023), the measurement model properties of the compared groups were assured (results available upon request).

Results for the variables considered in the MGA are presented in Table 3 (H4a, gender), Table 4 (H4b, age), Table 5 (H4c, education), and Table 6 (H4d, country of residence). Shown are the path coefficients and *p*-values for differences between the compared groups. Differences were considered significant for $p < 0.01$, and *NS* indicates non-significance.

Note that no significant differences were found for gender (Table 3). For age (Table 4), we found that the effect of DCA on SO was significantly greater for younger Europeans (18–27 and 38–45 years) than for older Europeans (46–65 years), while the effect of DCA on both CO and SO decreased with age.

Regarding education (Table 5), we found that the effect of DCA on SO was significantly greater for Europeans with secondary and tertiary education compared to Europeans with primary education. Note also that the effect of DCA on both CO and SO increased as education level rose.

Finally, concerning the country groups (Table 6), we found that the effect of DCA on CO was significantly lower for countries located in group G1 (Spain, Croatia, France, and Serbia) than in G2 (Finland, the Netherlands) or in G3 (Switzerland, Denmark, and the United Kingdom).

Discussion

Regarding the sequential relationships between digital culture access and both cultural and social openness *(Does access to digital culture foster cultural openness and social openness among Europeans?*), our global analysis points to a positive relationship, supporting our hypotheses H1, H2, and H3, and contributing global evidence to previous partial findings (McCrae, 1996, Acerbi et al., 2009, Burri, 2010, Gibbs et al., 2013, Brandt et al., 2015, Marenghi et al., 2016, Blank, 2017, Blank and Lutz, 2017, Porter et al., 2017, Schwaba et al., 2018). The evidence suggests that the more Europeans are exposed to other cultures through digital technologies, the more open they become to other cultures and other social groups, according to the social mechanism described in Fig. 4. Digital culture access influences the volume and variety of cultural expressions that people are exposed to, shaping how they communicate, create, and access culture (Burri, 2010, Doerr et al., 2012). Through digital media, people can access series and films produced in any culture (for instance, Korean productions), not just those broadcast by popular platforms, and can connect with others from different cultures who share their tastes (Favell et al., 2014, Favell and Recchi, 2019, Kim and Sintas, 2020, Kim and López Sintas, 2021). The fact that digital culture access influences cultural openness, and in turn, enhances social openness suggests that cultural openness may be a strong mediator between digital culture access and social openness.

The crucial role played by cultural openness in the relationship between digital culture access and social openness is illustrated in Fig. 3, which shows that social openness is not only directly affected by digital culture access, but is also indirectly affected through cultural openness, and moreover, that the indirect effect is stronger than the direct effect. Cultural openness thus has a dual effect on social openness: (1) a direct effect that is six times the direct effect of digital cultural access on social openness, and (2) an indirect effect through the influence of digital cultural access on social openness. Note, however, that the predictive capacity of digital culture access and cultural openness on social openness ($R^2 = 0.453$) may be explained by other factors, such as

Table 3 Multigroup analysis results for gender.

Path Sample N	Female (F) 5531	Male (M) 4431	*p*	Sig. diff.
DCA → CO	0.256	0.281	0.896	NO
DCA → SO	0.129	0.098	0.047	NO
CO → SO	0.624	0.644	0.901	NO

DCA digital culture access, *CO* cultural openness, *SO* social openness.

Table 4 Multigroup analysis results for age.

	Coeff.			MGA test					
Path	18–27	28–45	46–65	18–27 vs 28–45 p	Sig. diff.	18–27 vs 46–65 p	Sig. diff.	28–45 vs 46–65 p	Sig. diff.
Sample *N*	1520	3531	4911						
DCA → CO	0.287	0.248	0.26	0.102	NO	0.18	NO	0.707	NO
DCA → SO	0.167	0.137	0.083	0.124	NO	<0.001	YES	0.004	YES
CO → SO	0.637	0.602	0.654	0.069	NO	0.791	NO	0.002	YES

DCA digital culture access, *CO* cultural openness, *SO* social openness.

Table 5 Multigroup analysis results for education.

	Coeff.			MGA test					
Path	Primary	Secondary	Tertiary	P vs S p	Sig. diff.	P vs T p	Sig. diff.	S vs T p	Sig. diff.
Sample *N*	(P) 1703	(S) 3671	(T) 4588						
DCA → CO	0.214	0.268	0.276	0.031	NO	0.014	NO	0.647	NO
DCA → SO	0.035^{NS}	0.118	0.117	<0.001	YES	<0.001	YES	0.482	NO
CO → SO	0.659	0.626	0.635	0.064	NO	0.134	NO	0.715	NO

^{NS} = non-significant.
DCA digital culture access, *CO* cultural openness, *SO* social openness.

Table 6 Multigroup analysis results for the country groups.

Path	ES/HR/FR/RS	FI/NL	CH/DK/UK	G1 vs G2	Sig. diff.	G1 vs G3	Sig. diff.	G2 vs G3	Sig. diff.
Sample *N*	(G1) 4091	(G2) 1889	(G3) 3982						
DCA → CO	0.238	0.341	0.296	<0.001	YES	0.004	YES	0.056	NO
DCA → SO	0.128	0.079	0.12	0.018	NO	0.346	NO	0.967	NO
CO → SO	0.618	0.653	0.741	0.957	NO	0.803	NO	0.153	NO

Croatia (HR), Denmark (DK), Finland (FI), France (FR), Netherlands (NL), Serbia (RS), Spain (ES), Switzerland (CH), United Kingdom (GB).
DCA digital culture access, *CO* cultural openness, *SO* social openness.

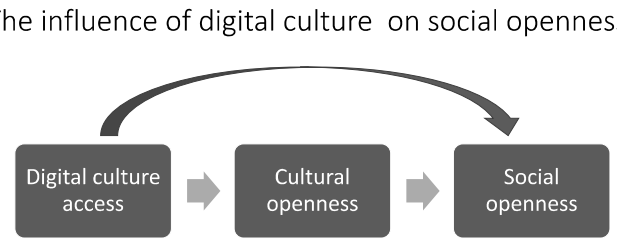

Fig. 4 Constructs' Causal Relationships. Illustration of the social mechanism driving the causal relationships between Digital Cultural Access (DCA), Cultural Openness (CO), and Social Openness (SO).

Table 7 Contribution of indicators defining digital culture access (DCA) by age.

DCA weights	Age 18–27	Age 28–45	Age 46–65
Sample N	1520	3531	4911
Communicating/sharing cultural expressions	0.385	0.314	0.243
Seeking cultural information	0.731	0.811	0.919
Watching online cultural expressions	0.227	0.070^{NS}	0.056^{NS}
Listening to music	0.130^{NS}	0.144	-0.079^{NS}

^{NS} = non-significant.
DCA digital culture access, *CO* cultural openness, *SO* social openness.

personality (McCrae, 1996, Brandt et al., 2015, Porter et al., 2017, Poort et al., 2023) and context (Nai et al., 2018).

Bringing us to our second research question (*Are the relationships between access to digital cultural, cultural openness, and social openness among Europeans governed by a unique social mechanism?)*, the evidence suggests that the linking social mechanism in the stratification of the sequential relationship between digital culture access and cultural and social openness is not unique. Our MGA study indicates that this mechanism is socially stratified within and across European countries, corroborating the stratification thesis (Norris, 2001). Since digital culture has become increasingly crucial to participation in modern society (education, work, job-seeking, communications with friends and family, access to information, access to culture, etc), digital culture stratification may contribute to reproducing social inequalities. Note, however, that differences were only significant for age, education, and country of residence. Unlike other research for less developed countries (Marzano and Lubkina, 2019), we found no difference in relation to gender.

Concerning age, we found significant differences between the 18–27 and 28–45 versus the 45–65 age cohorts, but especially between the youngest and oldest cohorts, supporting hypothesis H4b. For the youngest group, the greater effect of digital culture access on social openness may be explained by the greater communication needs of this social group. Research has found that young individuals have a stronger need to communicate with their peers (Douglas and Isherwood, 1996), and, consequently, they make greater use of digital devices and the internet for communication and are exposed more to the cultural expressions of their social epoch (López-Sintas et al., 2012). Table 7 shows that younger people use the internet more for communication and sharing, watching videos, and listening to music, while older people use the internet more for information-seeking.

Regarding education, we found that the effect of digital culture access on social openness was almost four times greater for Europeans with secondary and tertiary education, supporting hypothesis H4c and corroborating research reporting internet use differences according to education. Regarding less well-educated individuals, those without regular access use the internet to tackle particular tasks (Helsper and van Deursen, 2017), while those with regular access use the internet more for entertainment. In contrast, well-educated individuals use the internet to create and maintain social relations and to share information with friends, family, and even strangers (Brake, 2014, van der Zeeuw et al., 2019, van Deursen et al., 2021).

As for country of residence, we found systematic differences in the social mechanism for G1 (Croatia, Spain, France, and Serbia), G2 (Finland and the Netherlands), and G3 (Switzerland, Denmark, and the United Kingdom). The most meaningful differences concern the effect of digital culture access on cultural openness, which was strongest for G1 and weakest for G2. This can be explained in terms of Hofstede's theory of cultural dimensions (Hofstede Insights, 2023), scored between 0 (minimum) and 120 (maximum); the individualism trait is stronger in Finland, the Netherlands, the United Kingdom, Switzerland, and Denmark (scores between 63 and 80), and weaker in Spain, Croatia, and Serbia (scores between 25 and 51), with France (score 71) as an outlier. The correlations between Hofstede's individualism scores and country groups suggest that digital culture access and cultural openness are greater in more individualistic countries, supporting hypothesis H4d.

Limitations. Our study has limitations regarding both theoretical and methodological aspects. First, our study relies entirely on self-reported measures, implying the existence of potential biases: due to the cultural diversity of the sample, particularly regarding varying interpretations of concepts like cultural and social openness; and due to social desirability expressed in the responses. Second, there is the possibility of selection bias since almost all country survey data were collected from online panels, and since our analysis is based on cross-sectional data, causal inference regarding temporal changes is limited. Finally, the accuracy of the scales could be improved using better measurement models, but especially the accuracy of the digital culture access scale, which was measured by a proxy that considers only four items; future studies will focus on this research line.

Implications for cultural policies. The EU Agenda for Culture calls for a more in-depth analysis of culture's impact on the European way of life. Our research provides evidence on which to base European-wide and country-level cultural policies that spread cultural and social values and increase citizen wellbeing.

Our findings point to a divide in terms of the impact of digital culture access on cultural openness in the EU. This impact is lower in Mediterranean countries (Spain, Croatia, France and Serbia), in part due to lower digital development (Lamberti et al., 2021) and a higher relative cost for accessing digital culture due to lower incomes. To foster the diversity of European cultures, EU policies should aim to reduce the digital divide among EU countries and, with their cooperation, create a free platform that makes digital cultural expressions accessible across the EU.

At the country level, the evidence suggests that policies should aim to mitigate socioeconomic differences as a means of reducing the stratification of social and cultural values, so as to foster social cohesion between increasingly heterogeneous European societies (McCrae, 1996). In the social mechanism shaping the link between digital culture access and cultural and social openness, we found the main sources of stratification to be education and age. Consequently, cultural policies should be addressed particularly to less privileged and younger social groups. We already know that digital technology use differs among social groups; for

instance, people living in rural areas use the internet to solve particular problems (Awan and Gauntlett, 2012, Li and Ranieri, 2013); less well-educated people use digital technologies for gaming and entertainment (van Deursen and van Dijk, 2014, Helsper and van Deursen, 2017); and more privileged people use digital technologies to access diverse cultural expressions, like cooking, music, series and films from other countries, and languages (Brake, 2014, van der Zeeuw et al., 2019, van Deursen et al., 2021). Addressing deficits in rural areas requires improving digital access and speed to enhance use for functional, communication and entertainment purposes. Addressing younger and less privileged groups requires increasing the variety of cultural expressions they are exposed to. Digital cultural platforms should also make the cultural expressions of migrants' countries of origin available, as a means of enhancing appreciation of different cultures and reducing the cultural distance between host and origin countries. In addition, countries like Spain, France, Italy, and Germany should rethink their dubbing policies, so as to expose people to other languages (Danan, 1991).

Conclusions

In this research, we present a model that examines the sequential relationships between digital culture access, cultural openness, and social openness. Our findings indicate that digital culture access has twice the impact on cultural openness as it does on social openness, suggesting that cultural openness may serve as a significant mediator between digital culture access and social openness. Moreover, the fact that those relationships are stratified both between and within countries reflects varying social appreciations of culture and contributes to increased heterogeneity in European societies. Our results underscore the need for digital cultural policies to be developed at both the EU and country levels in order to bridge the cultural divide across European countries.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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Note

1 Supplementary Information is available on:https://osf.io/q6ksv

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Conceptualization: Giuseppe Lamberti, Jordi Lopez-Sintas, and Tally Katz-Gerro; Methodology: Giuseppe Lamberti; Formal analysis and investigation: Giuseppe Lamberti; Writing—original draft preparation: Giuseppe Lamberti, Jordi Lopez-Sintas, and Tally Katz-Gerro; Writing—review and editing: Giuseppe Lamberti, Jordi Lopez-Sintas, and Tally Katz-Gerro; Funding acquisition: Jordi Lopez-Sintas, and Tally Katz-Gerro.

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Competing interests

The authors declare no competing interests.

Ethical approval

Approval number or ID: ETH2122-0577. *Date of approval:* 19th May 2022. *Scope of approval:* verify whether the research proposal of research project INVENT sufficiently respects the safety and rights of participants and recognizes the responsibilities of the researcher(s) involved and of their host and sponsoring organizations. *Approved by:* ESHCC Research Ethics Review Committee. The study received ethical approval on two levels. First, it was checked by the ethical review board of the universities (Erasmus University Rotterdam, Universitat Autònoma de Barcelona, University of Haifa, University of Copenhagen, Tampere University, University of Zürich, Institute of Social Sciences Ivo Pilar, Centre for Empirical Cultural Studies of South-east Europe, École Normale Supérieure Paris-sarclay) of the countries involved in the EU project (Croatia, Denmark, Finland, France, Netherlands, Serbia, Spain, Switzerland, and United

Kingdom). Second, the study was reviewed by the coordinating institution of the project INVENT following the requirements and standards of the European Commission.

Informed consent

Informed consent was sought from all study participants (written, i.e., hard-copy or digital). Participants were all mentally competent adults (i.e., aged 18+ years) and able to give their legal consent. Before any consent to participation was sought, prospective participants were provided with information about the study, as follows: (1) aim of the study and methods to be used; (2) institutional affiliation of the research and source of the funding; (3) criteria based on which participants were selected for the study; (4) the setting in which participants were asked to participate (survey, semi-structured interviews) and the duration and type of questions asked; (5) right to withdraw their participation in the research at any time, without reprisals; (6) the way that the provided information was used in the research reports; (7) procedures that ensured privacy, anonymity, and the confidentiality of the information provided; and (8) full contact details of the Data Protection Officer of the Coordinator in the event that questions might arise after the interview. Standard consent forms were developed for each type of participant and research technique.

Additional information

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