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Do-It-Yourself or Do-It-Together: How digital technologies affect creating alone or with others?

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Abstract:

The literature is rather inconclusive when it comes to asserting whether digital technologies tend to favor collaboration (Do-It-Together, DIT) or creating alone (Do-It-Yourself, DIY) in creative production. In this paper, we argue that providing an answer to that question implies adopting a micro-perspective, which ties individual creators' usage of different types of digital technologies, and their choices of DIT or DIY. Using data from a sample of French musicians, we find that while the use of some digital technologies is clearly associated with artists creating alone, other digital technologies have a more ambiguous association with DIY or DIT. We then uncover the boundary conditions of the association of these ambiguous technologies with DIY and DIT behaviors by showing how individual characteristics of the creators moderate this association.

Key words: creativity; digital technology; collaboration; music industry; DIY; DIT

1. Introduction

Digital technologies pervade our lives, and digitization is considered the most important force in the current transformation of economic and social activities (Berger et al., 2019; Nambisan et al., 2019; Gong and Ribiere, 2020). In particular, the use of digital technologies is having a profound impact on work practices, reconfiguring how individuals perform their work in many companies and sectors (Barley, 1990; Orlikowski, 2000; Yoo et al., 2012; Leonardi, 2012; Nambisan et al., 2017). More specifically, digital technologies have been shown to strongly affect creative work practices in innovation, design, and in the arts (Orlikowski, 2000; Leonardi, 2011; Mangematin et al., 2014; Nambisan et al., 2019; Chandna and Salimath, 2020).

A key question is how digital technologies actually affect creative work practices. One aspect that has attracted considerable attention is the extent to which these technologies induce individuals to work more collaboratively (e.g. Ding et al., 2010). This questioning is underpinned by the significant decrease in coordination costs enabled by the use of digital technologies (Brynjolfsson and Hytt, 2000). The problem, however, is that the literature offers conflicting insights on the impact of digital technologies on creative work practices, some suggesting that they make collaboration in creative work (Do-It-Together, DIT) more likely (Wuchty et al., 2007; Agrawal and Goldfarb, 2008; Forman and Van Zeebroeck, 2012), while others emphasize that they favor the return to more individualized practices (Do-It-Yourself, DIY¹) (Kuznetsov and Paulus, 2010; Tanenbaum et al., 2013). In fact, most studies depict the effects of digital technologies in contexts where agents' uses of technology are constrained or biased towards one effect. For instance, the use of digital technologies to collaborate is typically studied in the context of academic or R&D communities, where collaboration is a

¹ In this paper, the term "Do-It-Yourself" is used in its etymological sense of solo creation. However, the reality of solo creation could also, in some cases, have the connotation of amateur/non-professional/bricolage activity.

common practice (e.g. Forman and Van Zeebroeck, 2012). The use of digital technologies for DIY is typically studied in relation to the Maker ideology, where individuals aim at regaining autonomy in what they do (e.g. Tanenbaum et al., 2013). Therefore, we do not know much about whether, in contexts where creators have agency in their choice of DIT or DIY, digital technologies tend to be used to support one or the other. In this paper, we aim to shed light on this puzzle, namely whether digital technologies tend to be leveraged by creators to collaborate with others or, in contrast, to be able to complete their work alone. Shedding light on this puzzle is fundamental because the answer to this question has significant consequences for the organization of work among creators, for the democratization of creative work and, more generally, for the future of work itself (Brown, 2009; Cappelli and Keller, 2013).

In order to unravel this enigma, we build on recent literature that suggests that digital technologies be portrayed as an actor-dependent, rather than an actor-independent, enabler (von Briel et al., 2018; Chalmers et al., 2019). In this perspective, understanding the effect of digital technologies on patterns of behaviors requires paying attention to the ways in which individuals actually engage with these technologies, and assumes that agents may be heterogeneous in their usage of technology (Yoo et al., 2010; Leonardi, 2013). We thus argue that, in order to explain the seemingly conflicting pattern reported in the literature and to advance knowledge on the effects of digital technologies on creative work practices, it makes more sense to focus on whether, how, and why digital technologies might be leveraged in different ways in a population of comparable individuals rather than focusing solely on aggregate patterns of technology usage (Van Alstyne and Brynjolfsson, 2005; Ding et al., 2010; Chalmers et al., 2019; Nasiri et al., 2020; Davidsson et al., 2020; Uzzi et al., 2013).

Based on data collected from a sample of French artists, we show that digital technologies may be leveraged differently; some artists use them to work alone whereas

others employ them to work with others. We show that this variance depends on artists' attributes such as their age, reputation in their field, and breadth of talent or expertise because these attributes – and possibly others – tend to be associated with specific work problematics. Digital technologies thus enable individuals to address these problematics, often situated in time – for instance, a limited breadth of talent, a lack of professional connections, or the need to collaborate with people at distance. Because the artists in our sample have agency over their use of digital technologies yet differ in multiple respects, they are found, in any given period of time, to employ digital technologies for various purposes. Thus, our micro-founded perspective contributes to the literature by offering an explanation to the puzzle that digital technologies are found to favor both individualized work practices and collaborative practices in any given period of time.

We then turn to a review of the literature and the deployment of our framework. Next, we explain our methodology and display our findings. Last, we discuss our results and contribution.

2. Theory and hypotheses

Creating alone versus creating with others

The term “creative worker” has been coined to describe a person whose occupation involves a significant input of creativity. Hereafter, we consider creative work as the output of creative practices that Bakhshi et al. (2013, p. 24) associate with “*a role within the creative process that brings cognitive skills to bear to bring about differentiation to yield either novel, or significantly enhanced products whose final form is not fully specified in advance.*” According to Howkins (2001), creative work is related to industries such as the cultural industries (publishing, film, music video games, ...) as well as advertising, R&D, and software.

Creative work may be undertaken alone, consistent with the figure of the lone inventor or lone genius (e.g. Barron and Harrington, 1981; Kearney, 1998), or simply the figure of the individualistic persona (e.g. Hui and Villareal, 1989; Ng, 2001). Collaboration, however, is a frequent pattern in the creative process, whether in science or in the arts (e.g. Uzzi and Spiro, 2005; Wuchty et al., 2007; Mangematin et al., 2014; Rüling and Duymedjian, 2014; Haeussler and Sauermaier, 2020). For instance, in songwriting, which constitutes our empirical setting, while outstanding creative abilities may be found in a single person known as a “soloist”², artists also enjoy the possibility of working with people with different expertise and creative thinking styles (Clydesdale, 2006)³. Indeed, anecdotal evidence on hits that entered the Top of the Charts in the US show that the average number of songwriters increased from 2.4 per track in 2000 to 4 in 2020.^{4,5} Fundamentally, collaboration in creative work pushes the boundaries of individual creativity (e.g. Amabile, 1988; Taggar, 2002).

Particularly puzzling is the role of digital technologies in affecting what can be done alone versus what can be done with others. As “*products or services that are either embodied in information and communication technologies or enabled by them*” (Lyytinen et al., 2016, p. 49), digital technologies consist of tools and systems that offer communication, collaboration, and computing capabilities (Nambisan, 2017). Digital technologies, as a key external enabler (e.g. Yoo et al., 2010; Lusch and Nambisan, 2015; Chalmers et al., 2019), have been assumed to profoundly change established forms of creative endeavors by changing the ways creators can produce their work (e.g. Mangematin et al., 2014; Nambisan et al., 2019). In particular, it has been emphasized that digital technologies have a number of effects

² Michael Jackson wrote the music and lyrics of most of his hits alone. Bob Dylan did the same, composing for himself or for others (e.g. Joan Baez).

³ This was the case for the Beatles with most of the songs written by John Lennon & Paul McCartney.

⁴ "How the DNA of a hit has changed over 20 years", Mark Mulligan, July 13, 2020, <https://musicindustryblog.wordpress.com/author/musicindustryblog/>

⁵ This pattern is not specific to songwriting; Jones (2009) indeed shows a global trend towards more collaborative work in science. Technological progress leads to an accumulation of knowledge which in turn leads innovators to focus on a narrower expertise and prompts them to work in teams.

that ease the creative process. Specifically, they can ease access to, as well as assemblage and combination of, previous knowledge, thus facilitating individual creativity. Digital technologies also assist creators in their work by supplementing lacking competences (Boden, 2005). Through these affordances, digital technologies show potential to give more autonomy to creators, fostering a return to individualized practices (Kuznetsov and Paulus, 2010; Tanenbaum et al., 2013) and the democratization of creative work (Sapsed and Tschang, 2014; Waldfogel, 2018). For instance, in music, ‘bedroom’ artists “are no longer secret” and have flourished (Taha, 2011; Tingen, 2012) as the cost of experimenting has strongly decreased and barriers to entry in the music industry have dropped (Tanenbaum et al., 2013).

It is argued however, in contrast, that the digitization of resources facilitates ‘bricolage’ and informal collaboration among creative people, (Rüling and Duymedjian, 2014), as well as supports collaboration in creative communities (e.g. Forman and Van Zeebroeck, 2012; Chandna and Salimath, 2020). More generally, digital technologies facilitate coordination among creative individuals thus creating incentives for more collaboration (e.g. Wuchty et al., 2007; Agrawal and Goldfarb, 2008; Forman and Van Zeebroeck, 2012; Kiel et al., 2017).

While these observations suggest that digital technologies may be associated with both engaging alone (Do-It-Yourself, DIY) and collaborating with others (Do-It-Together, DIT) in creative endeavors, the literature has surprisingly rarely addressed the issue of when, why or how they may favor one or the other (e.g. Mangematin et al., 2014); therefore, what might motivate creators to use digital technologies to DIY or to DIT remains somewhat of a mystery (e.g. Rüling and Duymedjian, 2014; Nambisan et al., 2019; Chen et al., 2021). In this respect, we concur with recent research that, in order to unravel this mystery, we must assume that digital technologies are, as an enabler, actor-dependent rather than actor-independent (von Briel et al., 2018; Chalmers et al., 2019), which might thus offer some creators opportunities

to DIY – and DIT to others – depending on their personal situation or individual characteristics (Ding et al., 2010). In this regard, we expect individual characteristics to offer insights on why, at a specific moment in time, creators might be more likely to use digital technologies to work either autonomously or with others, and thereby differently benefiting from potential effects on creative work. Moreover, given that individual creators are likely to differ along a number of individual characteristics at any moment in time, we expect variance, at any given moment in time, in how individuals use digital technologies in creative work, thus explaining that digital technologies might simultaneously support both DIY and DIT, in a given population of creative workers or other types of professionals⁶.

Combination benefits vs. coordination costs

In order to investigate why creators might use digital technologies differently (leading digital technologies to be associated with DIY or DIT), we propose to return to the essence of creative production.

Creative production essentially consists of assembling and combining knowledge inputs (e.g. Schumpeter, 1934; Amabile, 1988; Nonaka, 1994; Hall et al., 2001; Uzzi et al., 2013) – typically through a unique combination of newly produced and reused inputs (e.g. Mukherjee et al., 2016). Music composing and songwriting, our empirical setting, epitomizes this very process of combining new elements with reused inputs. Askin and Mauskapf (2017) point out that successful songs “*must strike a balance between being recognizable and being different. Those that best manage this similarity-differentiation trade-off will attract more audience attention and experience more success.*” Likewise, in the podcast Song Exploder⁷, musicians dissect their songs and explain their creative process. More often than not,

⁶ That a given individual might use digital technologies differently over time, because her/his individual characteristics have changed, will be covered in the ‘Discussion’ part of the paper.

⁷ <https://songexploder.net/about>

inspiration from previous songs is acknowledged⁸, to the point of occasionally leading to accusations of plagiarism⁹.

Creative combinations of knowledge inputs may be undertaken by individual creators since creativity is primarily an individual attribute (e.g. Barron and Harrington, 1981; Amabile, 1996). However, as solo creation is limited by individual creativity, collaboration (DIT) is often pursued as a way to conduct creative work (Nonaka and Takeuchi, 1995). Collaboration provides access to a larger pool of knowledge inputs and implies greater combination possibilities, and thus potentially enhanced outputs (Singh and Fleming, 2010; Bennett, 2011; Long and Barber, 2017) and higher novelty (Nieto and Santamaría, 2007). It also benefits from the division of labor between specialized skills (Becker and Murphy, 1992). However, while collaboration amounts to higher combination possibilities, it comes at the expense of communication and coordination costs of various sorts: the costs of setting up a relationship, search costs, and transaction costs (e.g.; Bakos and Brynjolfsson, 1997; Bercovitz and Feldman, 2011; Staats et al., 2012). Hence, there is a trade-off between the benefits of enhanced knowledge combinations and the costs of coordinating the contributions of various knowledge holders (Vural et al., 2013; Aggarwal et al., 2014; Deichmann and Jensen, 2018).

Strikingly, most of the literature frames collaboration as hinging on its benefit exceeding its cost (e.g. Cummings and Kiesler, 2007; Bercovitz and Feldman, 2011), without considering the alternative conditions and possibilities of solitary creation. While there may indeed be an incentive to collaborate, once collaborating is shown to provide a net benefit, individual preferences and contextual factors being otherwise equal, this nevertheless ignores

⁸ Darmon Albarn (from the band Gorillaz), who composed the song Andromeda, explains that “Billie Jean” by Michael Jackson and “I Can't Go for That” by Hall and Oates were two of his favorite tunes, and he thought that he could somehow chemically channel the greatness of those into his own music. <http://songexploder.net/gorillaz/minute-2:10>. (Cited by Mueller, 2019).

⁹ “You stole my song! 4 historical examples of music plagiarism”, by Deana Sumanac-Johnson, CBC News, June 14, 2016, <http://www.cbc.ca/news/entertainment/music-plagiarism-analysis-1.3634429>

the agency of creators in changing the ‘economics’ of DIY versus DIT by adopting technologies that could help them enhance the potentialities of DIY for creative work.

The role of digital technologies

We claim that the adoption of digital technologies affects creators’ incentives to DIT versus DIY in creative work by having an effect on both coordination costs as well as the respective combination opportunities associated with collaborative and solitary creation. In other words, we claim that the adoption of digital technologies affects the incentives of a creator to DIY versus DIT by altering the respective advantages of both options.

Alteration of coordination costs. The first argument is that the adoption of digital technologies leads to a decrease of the coordination costs that would otherwise be incurred in collaboration, which unequivocally increases the incentive to collaborate. Among the factors that explain the recent trend towards increasing collaboration in knowledge production and the growing size of teams of creators (e.g. Adams et al., 2005; Wuchty et al., 2007; Haeussler and Sauerman, 2020), technology is stressed because of its impact on coordination costs: the adoption of digital technologies allows for the improvement of information processing, thus enabling adopters to transmit information more easily and at a lower cost (e.g. Malone et al., 1987; Brynjolfsson and Hitt, 2000) - hence reducing coordination costs between members of a team (e.g. Chen et al, 2017). This positive effect of digital technologies on the decrease in collaboration costs clearly contributes to increasing the ‘net benefit’ of collaboration for users. As stressed by Adams et al. (2005), facilitated communication resulting from technology adoption could explain the rising propensity to collaborate, even with no significant change in talent. For instance, in music, artists rely on digital technologies to record demos and easily share them with other artists, thus greatly facilitating the search for potential partners. As a comparison, without digital technologies, artists needed to identify potential partners by

posting ads (the story of how Elton John and Bernie Taupin met is in this regard striking¹⁰) or simply relying on chance. They would then need to meet physically to share their work and see if collaboration might be valuable. Also in contrast, artists today further rely on digital technologies to exchange and share files as they proceed with their collaboration.

Alteration of combination benefits. While the impact of digital technologies on coordination costs has been widely recognized, the way in which these technologies can alter patterns of knowledge combinations has been neglected. Our second argument is thus that the adoption of digital technologies greatly affects the ‘combination’ process of creative production in two ways. Firstly, by allowing easier access to others’ knowledge inputs, new technologies allow solo creators to more easily nourish their inspiration and enhance their own combination possibilities without the need to engage with others. For instance, musicians and songwriters often have a YouTube Channel or a SoundCloud page on which they post their personal creations, which others listen to. More generally, new technologies make it possible to aggregate, store and manipulate/modify modular creations published by others (Walzer, 2017). “Sampling” in music creation is an emblematic illustration of such use of technology. Sampling consists of exploiting previously recorded sounds in a new composition in which the original sample may be clearly recognizable (in this case, the intention is to pay tribute to the sample/artist) or not. While sampling has existed for a long time (e.g. it was the foundation of hip-hop in the 1980s), digital technologies have considerably popularized this practice. Computers now store libraries full of loops and sampled sounds, which anyone can place on a timeline and use to create her/his own “music” based on sounds previously created by other musicians.¹¹ Secondly, with technology doing things that were previously done by

¹⁰ The way Elton John and Bernie Taupin (whose songwriting partnership is one of the most famous in rock history) met in the 60’s illustrates this. In 1967, they both answered an ad placed by a music label calling for talent. Elton John failed the audition but was given a batch of poems written by Bernie Taupin. John immediately contacted Taupin and their collaboration began with the latter writing the lyrics and the former the music.

¹¹ <https://makingmusicmag.com/digital-sampling/>

human beings (e.g. Mokyr, 1990; Autor et al., 2002), it allows creators to substitute human skills with digital productions and generate inputs that they previously needed to draw from collaboration. For instance, the drum sequencer is probably one of the most widely used digital technologies that replaces skilled human labor (the drummer) in the recording industry (Arditi, 2014). These effects of digital technologies thus tend to alter the advantage of collaboration, with regard to combination possibilities and benefits, because they also enhance combination possibilities for solo creators.

An exclusive focus on how the adoption of digital technologies alters the incentive to collaborate in creative work by facilitating collaboration thus seems misleading as digital technologies also appear to increase opportunities for solo creators to create richer knowledge combinations on their own, thereby altering the incentive to DIY in creative work as well.

Disentangling the effects of different digital technologies on DIT versus DIY

We further argue that the extent to which digital technologies might be leveraged by creative individuals to DIY or DIT depends on whether their function allows enhancing knowledge combinations, or rather facilitates coordination (e.g. Yoo et al., 2010; Chen et al., 2021). In fact, digital technologies typically fall into two categories: those that have a substitution effect (human work substituted with machine work) and those that have an information effect (information is easier to access, store, use and share. Specifically, in the music creation process, which constitutes our empirical setting, relevant digital technologies can be thought of as falling into two main categories: (i) home studios and (ii) digital information tools, which range differently with respect to their substitution and information effects.

Home studios or DAWs (Digital Audio Workstations) refer to both hardware devices (e.g., computers) and software that can be used to create and produce original musical content. DAWs are thus digital technologies that have primarily a substitution effect; they substitute human inputs with digital inputs. Not only do DAWs replace labor for low value

tasks the creator used to do alone “manually”, with the aim of increasing work productivity, they can perform high value tasks such as writing music for an additional instrument. By doing so they help creators ‘augment’ the range of creative tasks they can perform alone – without asking others for help. For instance, while in the past a singer who could not write music needed to find a music composer to write the music for his/her songs, today he/she could rely on a DAW to compose music for his/her lyrics. Although DAWs may also have a Remote Music Collaboration Software (RMCS) function (Koszolko, 2015), their path-breaking effect is acknowledged as allowing artists to be more self-sufficient and autonomous in their creative work. This was stressed in a media interview by the founder of one of the leading home studio companies: “*Music is by nature a collaborative process, and what DAWs have been doing for 15 years now, maybe 20, is promoting an exception in music history – making music alone*” (Carson, 2014).

We therefore propose our first hypothesis:

Hypothesis 1: The use of digital technologies that have a substitution effect (i.e. DAWs) is more likely to be associated with DIY than with DIT

The second category of digital technologies used by artists is digital information tools. In this category falls applications such as YouTube¹², SoundCloud¹³ and BandLab¹⁴. These applications improve the codification, access to, and sharing of information, and thus have an undisputable information effect. One of their effects is to ease social networking, making it

¹² YouTube is a video-sharing platform launched in 2005 and bought one year later by Google. The platform allows users to upload, view, rate, share, add to favorites, report, comment on videos, and subscribe to other users. It offers a wide variety of user-generated and corporate media videos. Music is the most popular category of content on YouTube.

¹³ At its launch in 2008, SoundCloud’s primary function was to help musicians, producers, and other professionals in the music industry share and collaborate around music tracks. SoundCloud is now one of the world’s largest music and audio platforms. It lets people discover and enjoy a huge selection of music from the most diverse creator community on earth. <https://soundcloud.com/pages/contact>

¹⁴ “BandLab is a social music platform that enables creators to make music and share the creative process with musicians and fans. [...] BandLab’s mission is to break down the technical, geographic and creative barriers between creators, collaborators and community”. <https://www.bandlab.com/>

easier to identify collaboration partners. For instance, YouTube, SoundCloud and similar applications considerably facilitate the search for partners. This is epitomized by recurrent comments on a popular blog devoted to songwriting, portraying YouTube as a “*great place to meet someone. There are thousands, if not more, of people on YouTube that have the same interest in songwriting as you do. Find some of those channels and start commenting. Eventually, see if they would be interested in co-writing a song with you. You could even start a channel of your own. Get known as a songwriter looking for collaborators*”¹⁵. More striking is that famous collaborations have started by artists browsing other artists’ creations online. For instance, in 2010, ‘Example’, British rapper and songwriter, discovered Ed Sheeran, still a rather confidential artist through a video uploaded on online media. The connection they established boosted Ed Sheeran’s career¹⁶. Likewise, in December 2009, UK chart-topper ‘Plan B’ discovered Ria Ritchie through her YouTube video channel and began to co-write songs with her, which appeared in her debut album¹⁷. Another effect of these digital information tools is to facilitate coordination among collaborators. For instance, an artist might use an application such as BandLab to co-develop and share musical pieces with musicians on the other side of the planet. By providing musicians with tools for live sessions, video sharing and messaging, as well as the ability to record and exchange audio/MIDI files, applications such as BandLab facilitate the codification of creative production into information that can easily be shared.

While these two information effects make it more likely that these digital technologies will be associated with DIT than with DIY, there is however another information effect that makes it more likely that they will be associated with DIY than DIT. Specifically, YouTube or SoundCloud can also be used to browse others’ creations with the aim of finding

¹⁵ <https://songpioneer.com/collaborators/>

¹⁶ <https://www.biography.com/musician/ed-sheeran>

¹⁷ http://news.bbc.co.uk/local/norfolk/hi/people_and_places/music/newsid_8946000/8946019.stm

inspiration and ‘borrowing’ pieces of creative work made by others to fuel one’s own creative work. Indeed, social media are widely used by artists to publish their work and, in this regard, have greatly democratized the access to large audiences for various types of artists, including artists not under contract with a music label, aggregators, and amateur musicians. As a result, digital information tools have greatly enhanced access to others’ creations not only for potential collaboration purposes but also for inspiration and sometimes imitation. As expressed by a musician: “*since as a creator of music you’re simply building on the ideas you’ve heard in other songs, you’re limiting your abilities to write if you aren’t listening.*”¹⁸ Hence, digital information technologies might also be used to enhance solitary creative work, and thus to favor DIY over DIT. Therefore, we propose the two conflicting hypotheses:

Hypothesis 2a: The use of digital technologies that have an information effect is more likely to be associated with DIT than with DIY

Hypothesis 2b: The use of digital technologies that have an information effect is more likely to be associated with DIY than with DIT

Creators’ agency in using digital technologies for DIT or DIY

The above developments suggest that digital technologies whose primary purpose is to substitute human inputs with digital inputs (i.e. home studios / DAWs) are associated with DIY (therefore negatively associated with DIT), independent of artists’ characteristics. Since we expect any artist using these digital technologies to use them for DIY, we expect these technologies to offer only opportunities for DIY.

In contrast, the above developments also suggest that digital technologies that primarily have information effects offer artists opportunities to both DIT and DIY. We are therefore unclear about their association with DIT or DIY a priori; there is no clear argument overall as to why one type of opportunity might systematically overwhelm the other for any

¹⁸ <https://www.secretsofsongwriting.com/2018/10/26/how-listening-makes-you-a-better-songwriter/>

artist. To further predict whether these digital technologies are more likely to be leveraged to DIY or to DIT, it is necessary to turn to creators' characteristics, as ultimately, it is up to the creators to decide whether to use these technologies for DIY or for DIT. As summarized by a musician: *"In the end, any fears that technology will isolate musicians [...] will either come to fruition or not depending on how those musicians [...] decide to use it."* (Carson, 2014). We thus argue that it is likely that, depending on an artist's characteristics, opportunities to use these digital information technologies to DIT or to DIY have different appeals, since incentives to DIT or to DIY differ across individuals at any moment in time in any population of heterogeneous artists, as illustrated below.

We surmise that there are at least three characteristics that affect whether creators - artists, more specifically in this paper - use digital information technologies to DIT versus DIY. First, we presume that the age of the artist is likely to help delineate the boundary conditions for which digital technologies might be associated with DIY or DIT. Our hypothesis is that age is a proxy for the size or quality of one's social network. Younger artists typically start with smaller social networks and fewer relationships on the creative scene (e.g. Dowd and Pinheiro, 2013). Digital information technologies can thus greatly help them build a larger network and thereby get in touch with potential future creative partners (e.g. Sargent, 2009). In other words, the 'main problem' of age lies in the lack of potential partners and thus digital information technology's specific appeal is in enlarging one's network of relationships and, as a result, in helping to reach out to potential collaborators. Therefore, in line with hypothesis 2a, we posit that younger creators should have a higher propensity to use digital information technologies for DIT.

Likewise, we presume that the reputation of the artist defines another boundary condition delineating whether digital information technologies might be associated with DIY or DIT. Our hypothesis is that reputation is a proxy for the collaboration opportunities

available to an artist.¹⁹ More reputed artists typically have far more collaboration opportunities than less reputed ones because a greater number of other artists attempt to reach out to them with the goal of increasing their own reputation (e.g. Jeong et al., 2011; Deichman and Jensen, 2018). Digital technologies therein greatly facilitate collaboration whenever the reputed creator decides to collaborate with others, as technology drastically decreases coordination costs. With regard to this issue, the main appeal of technology is to ease collaboration. In line with hypothesis 2a, we assert that the higher the reputation of an artist, the higher is the propensity to use digital information technologies for DIT.

Lastly, we surmise that the breadth of creative talent can also help delineate the boundary condition for which digital technologies might be associated with DIY or DIT. Our hypothesis is that a limited breadth of talent is a proxy for the need to find inspiration by looking at what others are doing (Kurtzberg and Amabile, 2001). Digital technologies can greatly facilitate access to others' creations, drastically reducing the cost at which one is able to imitate, copy, or adapt others' work. In the case of a limited talent breadth, the main appeal of digital information technologies is to ease the creative process by providing missing pieces, hence we predict the use of these technologies for DIY, in line with hypothesis 2b.

In order to test our hypotheses, we asked a sample of French artists about how their latest song was created – alone or collaboratively, as well as their adoption of different types of digital technologies. The advantage of this dataset is that we have first-hand information on whether the songwriting creative process was effectively conducted alone or collaboratively, rather than data from public sources on who was officially credited for a creative work, which

¹⁹ Note that while 'age' captures the size of an artist network, 'reputation' captures the extent to which it is easy to leverage one's network for collaborating. Thus, an older artist may have a larger network than a younger artist (and thus potentially or in theory more partners with whom to collaborate), yet if her/his reputation is low s/he would not have much demand for collaboration. In this case, this artist would be less likely to be appealed by the functionalities of digital technologies than younger and/or more reputed artists. Thus, 'age' and 'reputation' capture quite different aspects of an artist's network and allow for different predictions regarding how these network aspects shall affect the use of information tools for DIT versus DIY.

we believe does not make it possible to assign authorship as accurately²⁰. Additionally, our data contains information on various types of digital technologies rather than a single measure, allowing us to study potentially conflicting effects of digital technologies on forms of creative production.

3. Methodology

Data collection

The data used in this study come from a survey conducted, in the fall of 2014, on French professional musicians belonging to Adami²¹, a collective management organization that collects and distributes the rights of performers (from radio airplays, TV broadcasts, live performances, etc). To belong to Adami, a musician has to have sold at least one album in mainstream retail channels. Moreover, to collect revenue from public broadcasting (radio, TV and so on), a musician must be registered at Adami. Thus Adami's 9,000 musician members are exclusively professionals or aspire to become so. The survey aimed at understanding musicians' behaviors, practices and opinions on the digitization of the music industry, and consisted of a set of questions on the creative process.

The questionnaire was sent by postal mail to 4,000 randomly selected musicians, while the remaining musicians received an email to access an online version²². We eventually received around 1,230 valid questionnaires and verified that this sample was representative of

²⁰ For instance, the famous song "Yesterday" was written by Paul McCartney alone but is credited as a Lennon/McCartney song. "No other Beatle was involved in the songwriting or production. This led to the question of whether it should be released as a Paul McCartney song, but this had hints of splitting the band up." (Clydesdale, 2006). Conversely, many contemporary artists actually use backroom co-writers who are not credited because the former want to ensure their credibility as 'songwriters' (Bennett, 2011).

²¹ Adami also manages the performing rights of other kinds of artists (actors, dancers, ...). Of the approximately 30,000 artists associated with Adami at the time the survey was conducted, around 9,000 were musicians. <https://www.adami.fr/en/>

²² Since among these 5,000 remaining musicians, 1,500 did not have a valid email address, only 3,500 Adami members had the opportunity to answer the online questionnaire.

the entire population of musicians belonging to Adami²³. In the survey, which contained over one hundred questions, the musicians were asked if they had written at least one song (lyrics and/or music) during the past 12 months and, if the answer was positive, if this song had already been recorded²⁴. Our sample was limited to the musicians who answered positively to these two questions, and comprised 706 musicians. We first note that songwriting is not the only domain where creativity is at work in the music industry; orchestral work, and mixing or performing (by DJs for instance) are also important forms of artistic creation. Songwriting is, however, the domain where it is easiest to delineate the role of collaboration versus solo production²⁵. Secondly, one might comment that the trade-off between DIY and DIT is not always so clear-cut and that the frontier between the two strategies can be blurred. In effect, between pure DIT and pure DIY, there may be some forms of very punctual collaboration (outsourcing the short inclusion of an additional instrument, relying on an audio engineer to add some loops or sample sounds from a digital sound library, etc.). Yet, it is likely that a soloist songwriter would not consider this punctual work as collaborative work. Additionally, in songwriting, the strong pecuniary incentives that exist in being credited for a song make it unlikely that a significant contribution to the writing of a song would not be recognized. In summary, we are confident that the answers of the survey respondents regarding their last song being a solo or rather collaborative work are accurate and effectively reflect DIY and DIT practices among songwriters.

To ensure data reliability, all the questions about the creative process referred to the latest song the musicians had written and recorded during the past 12 months at the time of

²³ We checked that there was not a systematic bias in the respondent vs. non-respondent populations according to several features: gender, location, income paid by Adami.

²⁴ We consider a new musical creation complete when it is recorded instead of released. Indeed, it can take a long time between the recording and the release of a new song. Of the artists in our sample who had recorded a new song, only 36.3% had already released it as a CD, on iTunes or on streaming platforms such as Deezer or Spotify.

²⁵ In orchestral work, mixing and performing, processes of creation are more inherently collaborative as multiple types of professionals tend to be involved.

the survey. This approach follows common practice in survey design and is aimed at reducing the risks of ‘recall bias’ and approximations that would arise should one ask about multiple past events or events too far back in time²⁶ (e.g. Tourangeau et al., 2000; Iarossi, 2006; Bradburn et al., 1987; Strube, 1987; Mathiowetz and Duncan, 1988). Given that our purpose was to gather data on occurrences of DIY and DIT (in order to link them to digital technology usages) rather than on individuals per se, the standard methodological recommendation of asking about the last occurrence of the event or phenomenon of interest presented itself as the best option to maximize data accuracy, knowing that research has shown that asking about multiple similar events or occurrences in the past rather diluted data quality (e.g. Schwarz and Oyserman, 2001).

Variables

Our dependent variable measures the choice between DIY and DIT in the creative process. Artists were asked about the latest song they had written and recorded in the past year. We learned whether: (a) this song did not rely on collaboration (neither for music nor lyrics), (b) the musician collaborated on this song for either music or lyrics, or (c) the musician wrote this new song in collaboration for both music and lyrics. Table 1 below indicates that the absence of collaboration is the most frequent situation while full collaboration (for both lyrics and music) is the least frequent configuration. The first situation corresponds to the DIY case; the second and the third correspond to the DIT case with a difference in the intensity of collaboration. We thus use two alternative dependent variables. The first one

²⁶ Asking about the ‘last event’ or last occurrence, instead of asking about all the occurrences that happened in a given time frame, avoids a number of issues such as: (i) forward telescoping (e.g. Neter and Waksberg, 1994) implying incorrect dating and reporting events outside the referenced period; (ii) overlapping of memory implying confused information relating to the different events or occurrences (Bradburn et al., 1987; Schwarz and Oyserman, 2001). Thus, the deeper the ‘cognitive processing’ required from a respondent the higher the risk of false reporting and inaccurate data (e.g. Iarossi, 2006). Moreover, the further back the occurrence (if asking about the last five songs for instance), the higher the number of ‘recall errors’ (Fowler, 1995). Finally, it has been demonstrated that the larger the number of recall events or occurrences, the larger the risk of inaccuracy in data reporting (Burton and Blair, 1991; Bradburn et al., 1987). For all these reasons, common practice is to ask only about the last event or occurrence of the phenomenon of interest rather than about multiple similar events that individuals had encountered in the past (e.g. Schwarz and Oyserman, 2001).

DIT_DIY_BINARY is a dichotomous variable that merely distinguishes DIY from DIT, whatever the intensity of collaboration in the latter case. Hence, *DIT_DIY_BINARY* takes value 1 if the musician collaborated in the creation for music and/or lyrics (i.e. DIT), and 0 otherwise (i.e. DIY). The second dependent variable, *DIT_DIY*, takes into account the intensity of collaboration. Thus *DIT_DIY* equals 0 if the song has been written without any collaboration (i.e. DIY), 1 if the musician collaborated either for music OR for lyrics (i.e. partial DIT), and equals 2 if the musician collaborated for both music AND lyrics (i.e. full DIT).

Table 1 – DIY versus DIT in songwriting

The latest written and recorded song generated with:	Frequency
No collaboration, either for music or lyrics	64.3%
Collaboration for either music OR lyrics	22.1%
Collaboration for both music AND lyrics ^a	13.6%

^a in the case of instrumental songs, when collaboration occurred for the composition of the music, it is considered a “full collaboration”.

Several variables allow us to test our hypotheses concerning the impact of digitization on collaboration in the creative process. For instance, we built the variable *HOMESTUDIO*. This variable can take three values: 0 if the artist does not own a home studio, 1 if the artist owns a home studio that costs less than 10,000 euros, and 2 if it costs more than this amount. The more expensive a home studio, the higher the technical quality and complexity of the musical project that can be undertaken²⁷. In line with hypothesis 1, we expect the coefficient of *HOMESTUDIO* to be negative (null hypothesis being $\beta = 0$); we expect this type of digital technology to be negatively associated with DIT.

We also built the variable *INFORMATION*, which allows us to account for the role of information tools the artist may use to DIY as well as to DIT. This role is undoubtedly harder

²⁷ We also test our hypothesis with a dichotomous variable for *HOMESTUDIO* (does not own/owns). Our results remain unchanged.

to capture because digital information tools cover two different dimensions: making one's music known to potential collaborators, and exploring other musicians' productions - either to search for new collaborators or to find some inspiration for a solo creation. To have one's music known by other musicians and to generate collaboration, the best strategy is to make one's music available on the most famous platforms (as mentioned earlier, YouTube and SoundCloud are among the most important). To explore what other musicians are doing, listening frequently to others' music is common practice. This could be done on SoundCloud, on YouTube, or directly by visiting the websites of other musicians. To account for these multiple dimensions, we have built the *INFORMATION* variable, which aggregates the following aspects: whether the artist has made her/his music available on YouTube, whether s/he frequently listens to music on YouTube, whether s/he has a SoundCloud page. Hence, *INFORMATION*, which can take values from 0 to 3, measures the intensity of the use of digital information tools. We acknowledge that the role of information tools is less clear-cut, therefore harder to measure than the role of a home studio, and thus that the underlying variable is also more elusive. We consequently tested the robustness of the variable *INFORMATION*. First, we consider only those artists who spontaneously make their music available on YouTube; this allows us to eliminate situations where the decision to adopt YouTube is made by the music label or producer. Second, since listening to music on YouTube may also be a purely leisure activity, we test a configuration where listening to music on YouTube is substituted with listening to music on the websites of other artists. This practice is clearly more complicated and time-consuming than listening to music on YouTube. Actually, only 38.4% of our sample listen to music on websites of other artists whereas 73.2% listen to music on YouTube. However, this alternative measure ensures that the goal is precisely to discover the music of a specific artist, whatever the reason. Our results remain unchanged in the two specifications of the *INFORMATION* variable

We expect the effect of *INFORMATION* on DIT / DIY to be undetermined given the conflicting benefits that these digital technologies might offer to artists. We thus further consider the role of *INFORMATION* in interaction with three specific features of each musician: age, writing/composing talent, and reputation (see previous section). *BIRTHYEAR* is a discrete variable that reflects the actual year of birth of the artist. The writing/composing talent is of course hardly measurable. To address this issue, we use a dummy variable built from a question where the musicians were asked to consider whether they saw themselves as performers or rather as songwriters; answering ‘performer’ suggests that their writing/composing skills are limited. *TALENTBREADTH* takes the value 1 if the artist considers him/herself also as a writer/composer and not only as a performer, and 0 otherwise²⁸. *REPUTATION* is a dummy variable which indicates whether the artist holds a contract from a record label which is the case for only a quarter of our sample.

In accordance with hypothesis 2a, we expect both the coefficients of *INFORMATION*BIRTHYEAR* and of *INFORMATION*REPUTATION* to be positive. Likewise, in accordance with hypothesis 2b, we expect the coefficient of *INFORMATION*TALENTBREADTH* to be positive.

The extensive survey used in this study enables us to include numerous control variables in our quantitative analysis. Hence, we control for the artist’s tendency to use digital tools; the variable *MOBILE* is a dummy that takes value 1 if the artist owns a cell phone with 3G or more for Internet access²⁹. We also include variables that could have an impact on collaborative behavior in the creative process. We control for the artist’s intensity of creation; *INTENSITY* is a count variable that measures the number of songs created by an artist within the past 12 months (fewer than five, from five to nine, ten or more). When an artist has a

²⁸ Artists were asked whether they consider themselves more a songwriter than a performer, more a performer than a songwriter or both a songwriter and a performer. An artist who answers that s/he sees herself more as a performer than a songwriter will be considered to have less talent in songwriting.

²⁹ According to Arcep (the French Telecommunication regulator), about 53% of French cell phone subscribers had 3G mobile internet access in 2014.

manager, the latter could be helpful to find new collaborators; *MANAGER* is a dummy that equals 1 if the artist has a manager. Likewise, some musical genres could be more favorable to collaboration in creation than others. We therefore include eight dummies to take into account the main musical genre declared by the artist (*CLASSICAL*, *JAZZ*, *POP-ROCK*, *POPULAR*, *WORLD*, *URBAN*, *ELECTRO*, *SOUND_EFFECT*, *OTHER*). We also tried to control for the artist’s usual sociability that can partly explain the person’s collaborative behavior in creation. In the survey, the artists were asked “How many times did you have dinner or a party with friends/relatives?” From the answers “none”, “once”, “several times in the month”, or “several times a week”, we built the variable *SOCIABILITY* that takes a value from 0 to 3. This is, of course, an approximation to account for individual sociability but this variable provides at least a partial control for this phenomenon. Lastly, we also include the usual socio-demographic variables. *FEMALE* is a dummy variable that equals 1 if the artist is a woman. *INCOME* is treated as a continuous variable that accounts for the artist’s personal income³⁰. *HIGH_EDUCATION* is a dummy variable that equals 1 if the artist holds at least a Master’s degree. *PARIS* is a dummy variable which equals 1 if the artist lives in the Paris region; all these variables are presented in Table 2. We checked for possible multicollinearity issues. Although, of course, there exists some correlation between these variables (see Table A1 in appendix, which exhibits pairwise correlation between the main variables of our model), VIFs never exceed 2 for the main variables, and never exceed 3 for any of the variables. We thus consider that we can rule out any multicollinearity issue. Table 3 lists the characteristics of the main independent variables and their expected impact on DIT behavior.

Table 2 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>DIT_DIY_BINARY</i>	706	.357	.479	0	1
<i>DIT_DIY</i>	706	.493	.723	0	2
<i>HOMESTUDIO</i>	706	.895	.738	0	2

³⁰ Five answers were proposed for the question about personal income: less than €9,000 a year, from €9,000 to €15,000, from €15,000 to €30,000, €30,000 to €60,000, or more than €60,000.

<i>INFORMATION</i>	706	1.824	.935	0	3
<i>TALENTBREADTH</i>	706	.912	.283	0	1
<i>BIRTHYEAR</i>	706	1963.9	10.82	1914	1989
<i>REPUTATION</i>	706	.262	.440	0	1
<i>MANAGER</i>	706	.204	.403	0	1
<i>SOCIABILITY</i>	706	1.963	.658	1	4
<i>CREATIVITY</i>	706	2.340	.772	1	3
<i>PARIS</i>	706	.500	.500	0	1
<i>INCOME</i>	706	23.58	17.05	4.5	60
<i>FEMALE</i>	706	0.147	.355	0	1
<i>HIGHEDUCATION</i>	706	.330	.471	0	1
<i>MOBILE</i>	706	.812	.391	0	1
<i>CLASSICAL</i>	706	.0425	.202	0	1
<i>JAZZ</i>	706	.123	.329	0	1
<i>POP-ROCK</i>	706	.190	.392	0	1
<i>POPULAR</i>	706	.256	.437	0	1
<i>WORLD</i>	706	.129	.335	0	1
<i>URBAN</i>	706	.037	.188	0	1
<i>ELECTRO</i>	706	.051	.220	0	1
<i>SOUND_EFFECT</i>	706	.082	.275	0	1
<i>OTHER</i>	706	.089	.285	0	1

Table 3 – Expected impact of the main independent variables on collaboration

Variable	Description	Expected sign
<i>HOMESTUDIO</i>	Three categories: no home studio, cheap home studio (less than €10,000), or expensive home studio (€10,000 or more). <i>HOMESTUDIO</i> takes a value from 0 to 2.	-
<i>INFORMATION</i>	Count variable built upon the addition of three characteristics: making his/her music available on YouTube, listening frequently to music on YouTube, or having a SoundCloud page. <i>INFORMATION</i> takes a value from 0 to 3.	?
<i>TALENTBREADTH</i>	Dummy variable that equals 1 if the artist considers him/herself a writer/composer, not only a performer.	-
<i>BIRTHYEAR</i>		?
<i>REPUTATION</i>	Dummy variable that equals 1 if the artist holds a contract from a record label	+
<i>INFORMATION*TALENTBREADTH</i>	How <i>INFORMATION</i> acts when artists have more creative talent	+
<i>INFORMATION*BIRTHYEAR</i>	How <i>INFORMATION</i> acts when artists are younger	+
<i>INFORMATION*REPUTATION</i>	How <i>INFORMATION</i> acts when artists have a high reputation	+

Analysis techniques

Since our dependent variable is either a dichotomous variable, or an ordinal variable that can take three values, we use alternatively a simple probit model and an ordered probit model. A model such as this aims to estimate the probability of an observation with given specific characteristics belonging to one of the two (probit) or three (ordered probit) categories. The model we use to test our hypotheses, the results of which are presented in the next section, is the following:

$$DIT_DIY_BINARY \text{ or } DIT_DIY = f(HOMESTUDIO, INFORMATION, INFORMATION*BIRTHYEAR, INFORMATION*REPUTATION, INFORMATION*TALENTBREADTH + \text{Control variables})$$

4. Findings

Main results

The first observation that can be made from Table 4 is that the results obtained with both models (simple probit or ordered probit) are very similar. The same variables are systemically significant. We merely observe that significance is usually higher with the ordered probit. Moreover, the analysis of the values “cut1” and “cut2” in columns (3) and (4) of Table 4 allow us to assess the relevance of relying on three categories for our dependent variable (ordered probit) rather than on only two (simple probit). The values of cut1 and cut2 are significantly different (p-value<0.000), which means that it is not relevant to merge two of the three categories of the dependent variable and that using an ordered probit is thus preferable. Hereafter we will therefore focus on regressions (3) and (4) of Table 4.

Regression (3) displays the results of our model without the interaction terms. It shows that the coefficient of *HOMESTUDIO* is negative and significant, thus supporting hypothesis 1. Digital tools that we assume to have a primary substitution effect are indeed less likely to be associated with DIT than with DIY. Regression (3) also highlights that the role of digital information tools (*INFORMATION*) on the DIT/DIY trade-off is undetermined, as expected. However, regression (4) allows us to disentangle the conflicting effects of digital information tools on DIT versus DIY and to test hypotheses 2a and 2b. Let us now report how individuals' characteristics enable us to disentangle whether digital information tools tend to make DIT or DIY more likely.

The interaction term in regression (4) between *INFORMATION* and *BIRTHYEAR* is positive and significant. This means that, besides being more prone to use digital information tools (see pairwise correlations on table A1 in appendix), younger artists, when they use them, are more prone to collaborate than older ones who use digital information tools. This supports hypothesis 2a and suggests that younger artists may consider information tools as a means to develop their social network, which has a positive impact on collaboration in creative tasks. It is worth noticing that, as shown in regression (3), an artist's year of birth does not play any direct role in her/his collaborative behavior in creative tasks. It is possible that two opposing forces are at work. Younger artists are more prone to DIT because they lack the creative skills required to create a new song alone – skills that come with experience and thereby age! Conversely, younger artists may also be more likely to adopt DIY because they lack the social network that favors collaboration. This social network also comes with age.

We argue that a highly reputed artist uses digital information tools to collaborate more because they facilitate remote coordination and thus allow the artist to respond more frequently to the demands of collaboration s/he receives. In regression (4), the interaction term between *INFORMATION* and *REPUTATION* is indeed positive and significant. This

means that highly reputed artists using digital information tools collaborate even more in creative tasks than reputed artists who are not using such tools³¹. This is additional support for hypothesis 2a.

We argue that a musician with limited breadth of talent in writing/composing draws no benefit from either being more easily spotted by potential co-creators, or a reduction in coordination costs. Conversely, such an artist benefits from a reduction in the cost of imitating and copying, prompting her/him to find inspiration on the Internet and thus ease combination (i.e. DIY). In this case, the ‘combination effect’ prevails over the ‘coordination effect’. This is how we interpret the positive and significant sign of the coefficient of the interaction between *INFORMATION* and *TALENTBREADTH* in regression (4). This supports hypothesis 2b.

Table 4 – Results

Dependent variable:	Probit		Ordered Probit	
	DIT_DIY_ BINARY		DIT_DIY	
	(1)	(2)	(3)	(4)
<i>HOMESTUDIO</i>	-0.165** (0.0770)	-0.157** (0.0775)	-0.145** (0.0722)	-0.140** (0.0725)
<i>INFORMATION</i>	-0.0409 (0.0596)	0.3921 (0.2839)	-0.0401 (0.0560)	0.462* (0.263)
<i>TALENTBREADTH</i>	-0.4367** (0.1845)	-1.0352*** (0.341)	-0.371** (0.167)	-0.875*** (0.304)
<i>BIRTHYEAR</i>	0.0072 (0.0055)	-0.0084 (0.0110)	0.0064 (0.0052)	-0.0117 (0.0102)
<i>REPUTATION</i>	0.2748** (0.1187)	-0.1606 (0.255)	0.292*** (0.1102)	-0.176 (0.238)
<i>INFORMATION*REPUTATION</i>		0.214* (0.1207)		0.230** (0.112)
<i>INFORMATION*BIRTHYEAR</i>		0.0088* (0.0053)		0.0104** (0.00498)
<i>INFORMATION*TALENTBREADTH</i>		0.366** (0.174)		0.319** (0.158)
<i>MANAGER</i>	-0.0641 (0.129)	-0.0864 (0.130)	-0.0369 (0.120)	-0.0584 (0.121)
<i>SOCIABILITY</i>	-0.0231	-0.0360	0.0049	-0.0154

³¹ We indeed observe in regression (3) that artists with a high reputation are more prone to collaborate in creative tasks, possibly because they have more collaboration opportunities (the coefficient of *REPUTATION* is positive and significant).

	(0.0794)	(0.0806)	(0.0747)	(0.0757)
<i>CREATIVITY</i>	0.0992	0.1121	0.0946	0.1055
	(0.0696)	(0.0706)	(0.0654)	(0.0661)
<i>PARIS</i>	-0.0448	-0.0615	-0.0456	-0.0653
	(0.105)	(0.106)	(0.0987)	(0.0989)
<i>INCOME</i>	0.0009	0.0005	0.0011	0.0017
	(0.0033)	(0.0034)	(0.0031)	(0.0032)
<i>FEMALE</i>	0.0412	0.0765	-0.0643	-0.0393
	(0.149)	(0.151)	(0.140)	(0.141)
<i>HIGHEDUCATION</i>	-0.1983*	-0.210*	-0.1913*	-0.2015*
	(0.113)	(0.114)	(0.106)	(0.1064)
<i>MOBILE</i>	0.2944**	0.343**	0.2075	0.254*
	(0.138)	(0.140)	(0.131)	(0.132)
Control for musical genres	Yes	Yes	Yes	Yes
_cons	-0.0576	-0.938		
	(0.510)	(0.741)		
cut1			-0.0962	0.881
			(0.482)	(0.689)
cut2			0.676	1.665**
			(0.482)	(0.691)
Observations	706	706	706	706
Log Likelihood	-430.18	-424.65	-600.83	-594.10
LR chi2	59.75	70.80	53.37	66.83
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R-squared	0.065	0.077	0.042	0.053

Robustness checks

We ran a number of robustness checks. First, although we argue that home studios have primarily a ‘substitution effect’, we mentioned that they may have secondary functions that could be used for collaborating with others. We thus checked how *HOMESTUDIO* interacts with the three individual characteristics, which have been shown to affect how artists with different attributes engage with the other type of digital technologies, i.e. digital information tools. The goal is to check whether a finer grained analysis might reveal that, depending on their individual attributes, some artists might be more likely to use home studios to DIT than to DIY. Our results show that all the interaction terms are non-significant, thus confirming the unequivocal usage of home studios to DIY (see Table A2 in the appendix).

In order to further test the robustness of the support received for the first hypothesis, we looked at the specific situation of Electronic-music songwriters. One may indeed argue that developments in computer technology should have a stronger substitution effect in this musical genre, where digitization is at the heart of the creation process. As stressed by Neill (2004, p.390): “*Electronic-music composers can work in a way very similar to that of painters and sculptors; being self-contained and not relying on others to perform one’s art speeds up the process greatly.*” This conjecture is indeed confirmed by our data. When added to regression (4), an interaction term *HOMESTUDIO*ELECTRO* is negative and significant at the 5% level (see Table A3 in the appendix). This suggests that electronic-music composers who own a home studio are far more likely to create alone than other types of artists.³² Conversely, the interaction term between *INFORMATION* and *ELECTRO* is not significant suggesting that for those musicians, digital information tools have no impact on their collaborative behavior.

The most important potential limitation³³ of our study stems from the possible endogeneity of our variables *INFORMATION* and *HOMESTUDIO*. We might imagine that an omitted variable could explain both the collaborative behavior of an artist in creative tasks, and the adoption of digital tools. We could also imagine a reverse causality: artists use digital tools because they create in a collaborative way. Likewise, we might imagine that an inclination towards solo creation explains the purchase of a home studio. To test for this possible limitation, we use the instrumental variable method. An instrumental variable (IV) must satisfy both exclusion and inclusion restrictions. The exclusion restriction stipulates that

³² In the regression reported on Table A3 the reference category is constituted of the eight musical genres other than Electronic-music. However, running the same regression with the nine musical genres separately leads to the same result: the specificity of electronic-music composers still holds.

³³ Among other limitations, some of the control variables we used are ordinal (*CREATIVITY*, *SOCIABILITY*), thus implicitly assuming that each step, from one level of the variable to another, has the same impact on the collaborative behavior of creators. To check that this does not affect our results, we transformed all these ordinal variables in several dummies, allowing each level of the ordinal variables to have a specific impact on the dependent variable. Our results remain qualitatively unchanged.

the IV must not directly impact the dependent variable (*DIT_DIY*). Conversely, the inclusion restriction means that the IV must correlate with the possible endogenous variable. For *INFORMATION* we use the frequency of Internet use (*INTERNET*) and having a Facebook page (*FB*) as instrumental variables. There is no reason to believe that the frequency of Internet use, or having a Facebook page, directly affects collaborative behavior in creative tasks beyond the ease of DIT associated with digital information tools (exclusion restriction is thus satisfied). Moreover, a simple ordered probit model with *INTERNET* and *FB* as independent variables and *INFORMATION* as the dependent variable shows that both variables are highly correlated with *INFORMATION* (p-value < 0.000). The inclusion restriction is therefore also satisfied. Likewise, we use *COMPUTER* and *ABANDON* as instrumental variables to test for the endogeneity of *HOMESTUDIO*. *COMPUTER* is a binary variable that equals 1 if the artist owns a computer specifically devoted to her musical activity. As above, there is no reason to believe that owning a computer has an impact on collaboration in creative tasks beyond its use as a home studio, and owning a computer is highly correlated to owning a home studio (p-value<0.000 in an ordered probit with *HOMESTUDIO* as the dependent variable and *COMPUTER* as the independent one). If both variables are highly correlated (correlation coefficient equals 0.52), they do not simply capture the same latent variable. In fact, over a quarter of the artists in our sample (27%) have either a home studio but not a computer dedicated to music, or own such a computer but not a home studio. However, to enhance the robustness of our analysis we add a second IV for *HOMESTUDIO*. *ABANDON* is a variable built from the following question: “Do you intend to abandon the physical medium for the distribution of your recorded music in the near future?”. Three answers were possible: {no}, {yes}, {I already abandoned it} which are coded respectively 0, 1 and 2 in the ordinal variable *ABANDON*. We argue that *ABANDON* is highly correlated to *HOMESTUDIO* as both indicate an inclination to digital production (an ordered

probit with *HOMESTUDIO* as the dependent variable and *ABANDON* as the independent variable confirms this assertion with a p.value=0.000). However, this does not explain why planning to abandon the physical medium might have a direct impact on cooperation during the music creation process.

We then conduct for each case a bivariate ordered probit with our structural ordered probit (with *DIT_DIY* as the dependent variable), and a second ordered probit using *INFORMATION* and *HOMESTUDIO* respectively as the dependent variables, including our instrumental variables in the covariates. Under the exogeneity assumption, the error terms of both equations included in the bivariate regression must not be correlated; the null hypothesis $\rho = 0$ may not be rejected. Regressions provided in Tables A4 and A5 of the appendix show that, for both *INFORMATION* and *HOMESTUDIO*, the null hypothesis of exogeneity of the variable cannot be rejected. It seems thus appropriate to use our univariate ordered probit model provided in Table 4. However, this conclusion is conditioned to the quality of our instrumental variables. The fact that our instruments all have, in both first stage regressions on Tables A4 and A5, the expected positive sign, and that they are all highly correlated with the suspected endogenous variables, is comforting. To more robustly test for that we first run a simple 2SLS regression, which allows us to include both endogenous variables simultaneously as well as our four instruments. This regression confirms that the exogeneity of *HOMESTUDIO* and *INFORMATION* cannot be rejected. In a Wu-Hausman test, the null hypothesis of exogeneity is not rejected: $F(2,682) = 1.20475$ ($p = 0.3004$). Furthermore we have tested that the instruments are not weak, in the sense that they are indeed correlated with the endogenous regressors, and that they satisfy the overidentification restrictions, which means that they are not correlated with the error terms of the main regression.³⁴

³⁴ Firstly, we use the Cragg and Donald minimum eigenvalue statistic and compare it with Stock and Yogo's critical values for tests of weak instruments. We can reject the null hypothesis that the instruments are weak, because the statistic of 20.39 exceeds the critical value (16.87) corresponding to an acceptance of at most a rejection rate of 10% of a nominal 5% Wald test. Secondly, since our model is overidentified (four instruments

However, we would like to acknowledge that our instrumental variables cannot fully exclude any risk of reverse causality in the cross-sectional dataset. This is why we remain cautious on the causality between the use or choice of digital technologies, and their choice of working alone or with others. This, however, does not prevent us from discussing the association between the use of digital technologies and collaboration in creative practices.

5. Discussion and conclusion

While the literature emphasizes the role of digital technologies as favoring collaboration in creative work (e.g. Forman and Van Zeebroeck, 2012), it also provides evidence that these technologies enable individuals to work more autonomously than what was previously possible (e.g. Tanenbaum et al., 2013). Our framework proposes to address whether, when artists (and creators in general) have agency in how they perform their creative work, their use of digital technologies tends towards creating with others (DIT) or creating alone (DIY) – by focusing on the opportunities that new technologies offer to support working with others or, in contrast, working alone. In this regard, the originality of our framework is in distinguishing digital technologies according to whether their primary effect is a ‘substitution effect’ – where digital inputs can substitute for human inputs – or rather an ‘information effect’ – which enhances how information may be accessed and used.³⁵ Our findings support our main hypotheses that the digital technologies that primarily have a substitution effect are significantly associated with DIY, while those that primarily have an information effect have an undetermined relation to creative work practices as they offer opportunities both to DIT

for two potential endogenous regressors) we can test whether the excluded instruments are appropriately independent of the error process. We run a Sargan test that shows that we cannot reject the null hypothesis that all the instruments are valid, i.e. not correlated to the error term (p.value = 0.257).

³⁵ Interestingly, unreported calculus show that the interaction term *HOMESTUDIO*INFORMATION* is not significant, which indicates that artists tend to behave quite independently when it comes to home studio and information technologies. For instance, artists using a home studio are not systematically found to use information technologies intensively. In fact some do use them intensively and others much less intensively.

and to DIY. We show that further insight into whether artists tend to leverage these digital technologies to DIT versus DIY may be gained by reflecting on artists' characteristics that might make these alternative opportunities differently attractive. For instance, we find that younger artists who use these technologies are more likely to DIT than to DIY, supporting our theorizing that younger artists, because they typically suffer from a narrow social network, tend to use these digital information technologies to find partners. Note that this behavior may be independent of whether younger artists typically tend to create alone or with others; as shown by the data, there is no significant relation between age and the probability to DIT versus DIY. More generally, we find support for our hypotheses that digital technologies are used for different purposes, and that these different purposes are differently attractive to individuals, depending on specific characteristics. Here, we focus on characteristics that relate to where artists are in their artistic career and how they differ in their breadth of talent, and show that, as a result, different issues or problematics might be salient for different types of artists, or at different moments in their career, thus inducing them to leverage the potentialities of digital technologies differently at any moment in time.

These findings make several contributions to the literature. To begin with, disentangling the effects of different digital technologies allows us to emphasize that the digital technologies available to any community of interest might in fact facilitate both DIT and DIY. Thus, while most studies of collaboration take place in the context of networks of organizations or individuals who are used to collaborating (e.g. Ding et al., 2010; Walsh et al., 2000), or in contexts where collaboration is forced upon individuals by organizations (e.g. Forman and Van Zeebroeck, 2019; Verstegen et al., 2019) – typically finding a reinforcement of collaboration caused by digital technologies – our findings suggest that even in such contexts, digital technologies might offer opportunities to both DIT and DIY at any moment in time. It may be neglected that, while agents might on average use digital technologies to

collaborate more over time, there may be a deeper reality wherein some agents use it to predominantly work alone, and others to work more collaboratively. Agents may also use digital technologies to complete alone some parts of their work that they used to make with others in the past, even if on average they tend to engage more often in collaborations. In fact, given the complexity of creative work, it is possible that, simultaneously, individuals use digital technologies to be more autonomous in some aspects of their work yet collaborate more in others, which is typically overlooked if the researcher only focuses on collaboration as the outcome under investigation. Similarly, while most studies of DIY are embedded in descriptions of the maker culture (e.g. Tanenbaum et al., 2013), emphasizing the current trend of the democratization of creative work, our findings suggest that it is possible that independent creators, while motivated by completing work on their own, may also collaborate with others on some modules of their creations. Our framework and findings suggest that, in order to get an accurate understanding of the role of digital technologies on patterns of creative work, researchers should also pay attention to the diverse benefits that these technologies can bring to individuals and to the resulting cross-sectional variance in technology use that this might cause. This allows us to uncover more complex evolutions in other communities, such as, for instance, more autonomy in certain tasks and more collaboration on others, or, in some creative domains, a democratization of creative work – with the entry of new types of actors – and simultaneously, a reinforcement of existing teams, illustrating both “destabilization and consolidation” (Chen et al., 2021).

Further, concurring with recent research that calls for greater attention to the ways individuals engage with external enablers (Ding et al., 2010; Chalmers et al., 2019; Nasiri et al., 2020; Davidsson et al., 2020), our findings suggest that research on the role or impact of digital technologies should pay more attention to individual characteristics, as creators’ talent or stage of career development make different work problematics differently salient, driving

them to leverage digital technologies' potentials differently. In fact, most studies assume that individuals in the community or group they study are homogeneous and aligned, whereas in fact they tend to be heterogeneous in their preferences, skills, or career stage (Markus and Silver, 2008; Yoo et al., 2010; Leonardi, 2013; Nambisan et al., 2017; Chalmers et al., 2019). Therefore, findings reported in the literature, in particular that digital technologies enhance collaboration, may be biased by individuals' characteristics in the samples under study, namely by the fact that individuals tend to be viewed as homogeneous in the characteristics that are relevant in the work context under investigation. As shown by our findings, samples in which individuals are heterogeneous reveal a different picture, where some individuals find appeal in digital technologies' facilitation of collaboration while others are attracted by their ability to facilitate completing work alone. Our findings suggest that research should pay more attention to individual-level problematics at work to provide finer-grained and more accurate reflections of how digital technologies affect patterns of creative work, – in a general context, individuals, particularly those engaged in creative work, will more and more frequently be independent workers rather than members of institutions or organizations constraining their behaviors or biasing their use of technology (Brown, 2009; Cappelli and Keller, 2013).

Finally, our framework and findings contribute to the literature on creative work practices by portraying digital technologies as operant resources, serving as an active ingredient, fueling creative endeavors (Lusch and Nambisan, 2015). Operant resources may be physical, social or cultural. They designate various resources, in the form of skills, abilities, personality traits, or else various applied processes, that produce an effect on operand resources, i.e. inputs. Operant resources affect task performance since they affect how tasks are performed (Arnould et al., 2006). In this line of thought, individuals play an active role when leveraging operant resources because they need to learn about their

properties and potentialities, and may thus attempt to activate them (von Briel et al., 2018; Chalmers et al., 2019). Our study therefore contributes to the literature on creative work practices by conceiving of digital technologies as operant resources constitutive of creators' creative capabilities. Rather than focusing on creative skills, and how they may be augmented over time, or complemented by working with others (e.g. Sternberg and Lubart, 1999), research could gain by focusing on the creative capabilities that individual creators (and not only organizations or teams) might build over time as they, for instance, access and learn to master digital technologies offering multiple functionalities and opportunities. In this respect, creative capability designates the individual's ability to perform a creative activity by using specific processes, tools, knowledge, and behaviors in a coordinated way (e.g. Napier and Nilsson, 2006). Interestingly, while talent may be unevenly distributed, individuals can, however, potentially rely on various strategies and mechanisms to enhance their creativity, and possibly reduce talent inequality, by building a creative capability. Although the literature has acknowledged the role of digital technologies in opening up new ways of being creative (e.g. Loveless, 2002), it has generally been evasive about whether and to what extent technology affects creative skills and/or creative capabilities (e.g. Napier and Nilsson, 2006). Our framework and findings suggest that individuals may seek to build creative capabilities enhancing their independence in the creative process (i.e. DIY orientation) or, in contrast, enhancing their co-creating with others (i.e. DIT orientation). Thus, in similar contexts, where for instance similar technologies are available, it is likely that individuals adopt different strategies to enhance creativity, some more focused on supporting an individualistic creative mode, and others more inclined to build capabilities supporting a more collaborative mode.

Like most studies, ours is not without limitations. One limitation stems from the fact that we did not ask artists why they chose DIY or DIT per se but instead asked them about how they performed their creative work – by DIY or by DIT. Hence, we do not know whether

the artists really compared the merits of the two alternatives – DIY or DIT – when writing their latest song. Routines in the creative process, previous commitments and/or formal contracts may also explain their choice of one mode versus its alternative. The creation process does not always stem from a rational analysis. Collaboration also depends on chance, and opportunities generated by encounters with other professionals during festivals, recording sessions, etc. However, these determinants have no reason to be affected by digitization and thus should not disqualify our results. In addition, as mentioned previously, one could question the causality of the relationship between using digital technologies and choosing to DIY or DIT in one’s creative work; it may be argued that artists first choose whether to DIY or to DIT and subsequently acquire or decide to use the digital technologies accordingly. Because our survey has no longitudinal dimension, we cannot address this limitation straightforwardly. However, identifying a sense of causality is not the main concern of this paper. Instead, we aim to highlight that digital technologies may be associated with both DIY and DIT depending on the specificities of digital tools – whether they impact productivity or networking – and on the characteristics of users (age, reputation and breadth of talent).

Our findings suggest several avenues for future research as they highlight a need to learn more about how creators engage with digital technologies, and specifically, how and why this engagement may differ.

First, future research could study the extent to which DIY and DIT are exclusive choices or may, to some extent, be complementary in the long run. For example, it is possible that creators using digital tools to improve their creative outputs i.e. DIY, at some point in time will increase their chance of attracting partners in the future, thus deciding to create with others later on. This suggests a more complex role and impact of digital technologies on creative work practices, as well as thinking of individual creators’ creative capabilities as dynamic capabilities supported by an evolving engagement with a range of digital

technologies. Also, the study of creative contexts in which creative work may be decomposed into creative modules could reveal a simultaneous use of digital technologies for DIT and DIY, with technology used to complete some modules alone and others collaboratively. Overall, future research could study how DIT and DIY might substitute or complement one another, and the different dynamics of DIY and/or DIT that unfold over time.

Second, if digital technologies tend to create different opportunities for creative workers depending on their personal attributes, we need to further our study of the personal attributes that affect how creators engage with digital technologies. For instance, how does self-efficacy interact with other personal attributes to affect engagement with digital technologies? In addition, we need to uncover the contextual elements that lead creative individuals to act upon those opportunities. For instance, to what extent do work context and social interactions matter? In particular, how do they affect the availability of specific technologies and the way they are enacted upon? For instance, do creators working in collective spaces, such as co-working spaces, makerspaces, or any other collective space, engage with digital technologies differently from those who have home offices? More generally, future research could rely on interviews to uncover the different types of factors, including individual-level and contextual, that may explain when individual creators choose to engage with digital technologies to work alone versus collaboratively, and more generally, how they conceive of choosing between DIT and DIY.

Third, future research might subsequently investigate how creative people acting upon the DIY and DIT opportunities offered by digital technologies relates to their creative outcome in the long run. For instance, Ding et al. (2010) found that, in the sample of academic researchers they study, the use of digital technologies has enabled researchers in less reputed universities to increase their collaborations and quality of their publications, potentially leading to a decrease in the quality gap across researchers. In the arts, where

criteria of success are more subjective, findings may be more nuanced because enhancing DIY could also lead to improved outcomes (Tingen, 2012). It would thus be worth studying how choices of DIY versus DIT affect creators' performances and whether adopting digital tools allows creators creating alone to overcome, to some extent, the disadvantages that the literature associates with relying solely on individual creativity.

Overall, this paper contributes to a better understanding of the factors affecting forms of creative production and, more specifically, of the role of digital technologies in creative work. Digital technologies are crucial because they affect the opportunities available to creators to complete their work alone or to collaborate with others. This research suggests why individual creators may leverage these opportunities differently and hopes to spark interest in further studying the complex impact of digital technologies on creative work practices.

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Appendix

Table A1 - Pairwise correlation between the main variables of the model

	<i>HOMESTUDIO</i>	<i>INFORMATION</i>	<i>TALENT BREADTH</i>	<i>BIRTHYEAR</i>	<i>REPUTATION</i>	<i>INCOME</i>	<i>EDUCATION</i>
<i>HOMESTUDIO</i>	1.0000						
<i>INFORMATION</i>	0.1207	1.0000					
<i>TALENTBREADTH</i>	0.3767	0.2058	1.0000				
<i>BIRTHYEAR</i>	0.0971	0.3733	0.0638	1.0000			
<i>REPUTATION</i>	0.0211	0.0575	+0.0761	0.0930	1.0000		
<i>INCOME</i>	0.0957	-0.1182	-0.0563	-0.0387	0.1275	1.0000	
<i>EDUCATION</i>	-0.1292	-0.0125	-0.1359	0.0378	0.0799	0.1257	1.0000

Note: VIFs never exceed 2 for the main variables of our model, and never exceed 3 for any of all the variables

Table A2 - Main regression (ordered probit) including interactions between owning a home studio and artist's characteristics (age, reputation, talent breadth)

Dependent variable :	<i>DIT_DIY</i>	
	B	Se
<i>HOMESTUDIO</i>	-.43614211	.32140299
<i>INFORMATION</i>	-.04441258	.05609868
<i>TALENTBREADTH</i>	-.45212272**	.19996065
<i>BIRTHYEAR</i>	.01082002	.00735312
<i>REPUTATION</i>	.1644982	.17022953
<i>MANAGER</i>	-.03572272	.12036116
<i>PARIS</i>	-.04469886	.09875952
<i>FEMALE</i>	-.07108912	.14023015
<i>SOCIABILITY</i>	-.0045807	.07466775
<i>INTERNET</i>	.20259886	.13057287
<i>CREATIVITY</i>	.09076285	.06554982
<i>EDUCATION</i>	-.1891437*	.10606394
<i>INCOME</i>	.00082269	.00315952
<i>HOMESTUDIO_BIRTHYEAR</i>	-.00522537	.00600555
<i>HOMESTUDIO_REPUTATION</i>	.15456917	.14671568
<i>HOMESTUDIO_TALENTBREADTH</i>	.21494905	.25093816
cut1	-.37325154	.56856889
cut2	.4014768	.56856967
Control for musical genres	Yes	
N	706	
Log Likelihood	-599.66	
LR chi2	55.72	
Prob>chi2	0.000	
Pseudo R-squared	0.044	

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Note: results remain unchanged if interactions between *INFORMATION* and *BIRTHYEAR/REPUTATION/TALENTBREADTH* are also included.

Table A3 - Main regression (ordered probit) including an interaction between owning a home studio and being an electronic music songwriter

Dependent variable:	<i>DIT DIY</i>	
	B	se
<i>HOMESTUDIO</i>	-.100763	.0742109
<i>INFORMATION</i>	-.0461534	.0573751
<i>TALENTBREADTH</i>	-.3853342**	.1675308
<i>BIRTHYEAR</i>	.007246	.0051848
<i>REPUTATION</i>	.2789067**	.1105442
<i>MANAGER</i>	-.007139	.1210734
<i>SOCIABILITY</i>	-.0004689	.0750203
<i>CREATIVITY</i>	.0970212	.0656536
<i>MOBILE</i>	.1850679	.1308156
<i>PARIS</i>	-.0412864	.0990087
<i>INCOME</i>	.001122	.0031656
<i>FEMALE</i>	-.0500305	.1397628
<i>EDUCATION</i>	-.1767696*	.1063334
<i>HOMESTUDIO ELECTRO</i>	-.8645071**	.3461846
<i>INFORMATION ELECTRO</i>	.133435	.2794101
cut1	-.0398392	.4470434
cut2	.737873	.447852
Control for musical genres	Yes	
N	706	
Log Likelihood	-597.42	
LR chi2	60.19	
Prob>chi2	0.000	
Pseudo R-squared	0.048	

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Note: results remain unchanged if interactions between *INFORMATION* and *BIRTHYEAR/REPUTATION/TALENTBREADTH* are also included.

Table A4 - Seemingly unrelated bivariate ordered probit regression to test for the endogeneity of *HOMESTUDIO*

Dependent variable	<i>DIT_DIY</i>		<i>HOMESTUDIO</i>	
	b	Se	b	se
<i>HOMESTUDIO</i>	.011312	.1861151		
<i>INFORMATION</i>	-.0410871	.0558957	.0188697	.052932
<i>TALENTBREADTH</i>	-.4176904**	.1740739	.3605321**	.1792813
<i>BIRTHYEAR</i>	.0061756	.005166	.0018037	.0048115
<i>REPUTATION</i>	.2916819***	.1100767	-.041099	.1071314
<i>MANAGER</i>	-.0194178	.1215103	-.1691605	.1156858
<i>SOCIABILITY</i>	-.0020052	.0745897	-.0303613	.0715274
<i>CREATIVITY</i>	.0798411	.0673753	.1460787**	.0617531
<i>MOBILE</i>	.1947909	.1310405	-.0850735	.1216926
<i>PARIS</i>	-.0221771	.1017749	-.2207648**	.0937974
<i>INCOME</i>	.0005392	.0032028	.0062044**	.0029434
<i>FEMALE</i>	-.0192941	.1479521	-.5067945***	.1392074
<i>EDUCATION</i>	-.1720027	.1080908	-.1085843	.1005804
<i>COMPUTER</i>			.9848894***	.1033763
<i>ABANDON</i>			.1855125***	.0688345
Rho	-.1291113	.1407321		
cut1	.1053215	.4690448		
cut12	.8736321	.4668638		
cut21	.1455554	.4152924		
cut22	1.705542	.4203796		
N	706			
Log Likelihood	-1208.33			
Wald chi2	46.70			
Prob>chi2	0.001			

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Both regressions include control for musical genres

LR test of independence of equations : $\chi^2(1) = 0.83$; $\text{Prob}>\chi^2 = 0.3633$

Table A5 - Seemingly unrelated bivariate ordered probit regression to test for the endogeneity of *INFORMATION*

Dependent variable	<i>DIT_DIY</i>		<i>INFORMATION</i>	
	b	Se	B	se
<i>HOMESTUDIO</i>	-.1413145**	.07201499	-.03177395	.06354651
<i>INFORMATION</i>	-.22106274	.16699662		
<i>TALENTBREADTH</i>	-.3209222*	.17369774	.31130507**	.15537823
<i>BIRTHYEAR</i>	.01120548*	.00657735	.02667762***	.00442887
<i>REPUTATION</i>	.28471436***	.11027291	-.10124988	.10073849
<i>MANAGER</i>	-.07440822	.12392317	-.36470614***	.10934277
<i>SOCIABILITY</i>	-.00624161	.07438568	-.03184081	.06607639
<i>CREATIVITY</i>	.10523514	.06563401	.07186453	.05749469
<i>MOBILE</i>	.2420081*	.13299097	.12468544	.11262639
<i>PARIS</i>	-.03360208	.09881681	.06821782	.0877084
<i>INCOME</i>	-.00010444	.00330802	-.00869045***	.00272948
<i>FEMALE</i>	-.06393	.13914456	-.03950726	.125413
<i>EDUCATION</i>	-.18412369*	.10575156	.01063045	.09363374
<i>INTERNET</i>			.60265027***	.12887855
<i>FB</i>			.73241986***	.10131855
Rho	.18035466	.16044269		
cut11	-.6530526	.68132709		
cut12	.11087324	.69331025		
cut21	-3.2079078***	.43829061		
cut22	-2.1567459***	.43025962		
cut23	-.90656102**	.42702355		
N	706			
Log Likelihood	-1402.55			
Wald chi2	54.00			
Prob>chi2	0.000			

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Both regressions include control for musical genres

LR test of independence of equations : $\chi^2(1) = 1.25$; Prob>chi2 = 0.2631