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Direct Labor Market Effects of Artificial Intelligence Assisted Applications Based on the Opinions of Illustrators and Company Managers: Hungarian Case Study

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Abstract: In the creative industry, the last six months have seen a remarkable and rapid change with the widespread availability of certain AI-based applications for the average user, such as the various Stable Diffusion image generators, the ControlNet that goes with them, and ChatGPT. In particular, the world of illustration, corporate design/design planning, translation, film production, copywriting, virtual education is all undergoing significant and irreversible change. In this article, we summarize what can be known about the impact of AI-assisted digital applications on the labour market for the illustration professionals. Based on exploratory research used in-depth interviews, opinions are markedly divided. Some see AI-assisted applications as a new opportunity, a rapid development of a hybrid toolkit to gain a competitive advantage. Others argue that they represent a threat to daily livelihoods and devalue hand-made creative work. According to business leaders, they can deliver significant cost savings without compromising on the level of quality expected, and on the contrary, they can enhance the user experience.

Keywords: Artificial intelligence, Ai painting, Digital illustration, Labour market, Competitiveness

Introduction

This year, programs such as DALL-E, Midjourney, Craiyon and other web solutions based on the Stable Diffusion model have become widely available worldwide (Goring et al., 2023). These programs are causing a major headache for illustrators and significantly changing the outlook for the industry. The digital revolution is still ongoing in the SME sector in Hungary (Tick et al, 2022; Saáry et al, 2022), and one of its aspects is the rapid spread of artificial intelligence-based applications. The vast majority of graphic designers work in the SME sector, and their income depends to a large extent on the needs of the client side. Graphic designers have a weak bargaining position in terms of wages. This could make them particularly vulnerable to the emergence of AI-based programs, which could further weaken their competitiveness. This sector is highlighted in our research because the rate of technological adoption is astonishingly fast.

The changes that have rippled through the industry have mainly been brought about by the dramatic shift in the way that AI assistive software has been made available to a wider audience in a web-based environment at the end of 2022. Such (not in all cases anymore) free or paid-based solutions include Midjourney, Playgroundai, Mage.space, Lexica.art, etc. There are significant differences between the tools in terms of the hardware background they require and the level of user skills needed to produce valuable results. The best known and clearly the market leader is Midjourney, which operates on Discord and has the largest number of registered users. Currently running version 5.1. which produces professional paintings using explicitly simple text commands. It requires no expert knowledge and can be run quickly and easily from an android smartphone as well. Its potential drawbacks are that it is not well suited to creating more complex compositions, and that it works with a specific, instantly recognisable colour style (mixing and overemphasis of ocean blue and yellow). Its advantage is that it has a high level of human anatomy, specifically in terms of hands and fingers. There is no

official information about exactly what source code and AI architecture Midjourney uses (as it is private, with its own secured source code), but it is likely that it uses a different version of the latent diffusion model that powers Stable Diffusion, and adopts some elements of Stable Diffusion v2 (Ajaay, 2023).

The other groups of competing programs are those that are clearly based on Stable Diffusion versions 1.5 and/or 2.1, i.e. open source. Of course, these "brands" are also trying to develop their own modified source code (e.g. Playground V1), but mostly they try to differentiate their marketing by including different styles from CivitAi in their offerings (e.g. Duchaiten, RealisticVision v2, Deliberate, DreamShaper, LoRa). Probably the largest group of users running Midjourney, another larger group prefers the various web interfaces, while a third (presumably smallest) group uses the free SD versions available from GITHUB and installable on the computer. All styles are free to install from GITHUB, but web apps offer them as a part of a paid service.

The above ranking also shows the level of user intervention and the strong hardware background required to create a piece of art: Midjourney requires the lowest level of intervention and has low/average hardware requirements. Web-based services are more complex, more customisable and capable of creating more complex material, but require more user expertise and stronger hardware support. The installed version has the highest requirements in both respects (user skills and hardware environment).

Interestingly, the Web of Science database has about 6970 results (in 2023 at the end of July) for "AI + drawing", 3600 publications available by searching for the keyword "AI + HR", 538 for "AI + painting", 81 for "AI + Stable Diffusion", and 11 for "Midjourney". In contrast, for example, 1,035,801 results are found for the term marketing. I believe that our research is completely novel, because there are very few studies on this topic, and they focus mainly on the creative process and the end result, rather than on the market impact (Sun et al., 2022; Koziol, 2023; Lyu et al., 2022; Goring et al., 2023; Ragot et al., 2020; Gu & Li, 2022). The available scientific articles on AI mainly analyse the marketing, HR or generic managerial aspect (Palos-Sánchez et al, 2022; Jia et al., 2018), especially logistics, education, knowledge transfer, financial markets, otherwise such as the workplace environment adoption, policy, recruiting, employer resilience, and industry examples such as military, law, geopolitics, cyber security and technological solutions in healthcare (Bencsik, 2021, 2022; Hwang et al., 2020; Lari et al., 2023; Aydin & Turan, 2023; Chen et al., 2020; Machová & Zsigmond, 2019, Dobos, & Csiszárik-Kocsir, 2022). The revolution in the creative industries is an extremely fresh and vibrant field, where, without exaggeration, there is an innovation almost every week.

Method

We used two internationally recognised methods of marketing research, the secondary and the primary methods. Secondary market research is the systematic collection, processing and analysis of existing social and economic statistical data according to the specific objectives and criteria of the researcher. Its importance lies in the fact that it provides a suitable starting point for the delineation of the area to be investigated and the definition of the decision problem. Primary market research is "original" data collection, as it collects information directly, through primary research, on the behaviour and opinions of market participants (Hair et al., 2009). Our ecoscopic studies have focused on understanding user behaviour in relation to the use of AI, and on mapping the domains in which it is used, focusing exclusively on creative industry applications. For the analyses, data were extracted from source works through targeted keyword searches on WOS, Scopus, Researchgate and Google Scholar. In the Hungarian context, we searched the results of mtmt.hu database and the Budapest Business Review for the last 5 years.

Primary market research can be divided into two broad categories, quantitative and qualitative qualitative research, according to the modern understanding of marketing. The basic aim of quantitative research is to be able to provide quantified answers to research questions with the highest possible reliability. Qualitative research, on the other hand, is "exploratory" in nature, seeking to understand the "whys" behind the actions of the user/user (Hair et al., 2009). Among the qualitative market research methods, the so-called semi-structured in-depth expert interview was used as the basis for this research. It was essential to get the views of stakeholders and industry decision-makers on the state of the domestic market.

The essence of in-depth interviews with experts via an online interface (combined with a semi-structured questionnaire and Facebook Messenger call) is that the researcher, based on his/her own experience and knowledge of the research objectives, determines the points and topics of the dialogue with the respondent that he/she wants to explore in more depth or that he/she wants to ignore. The interviews were conducted to get the opinion of recognised experts on the market conditions experienced in the industry.

We focused on the following issues and asked questions about them:
Which A.I.-based graphics software/tools do participants use in their graphics/illustration work?
How their work is influenced by the emergence of AI-based "text-to-image" applications?
What are the positive and negative impacts of these programs on the workplace?

A separate block of questions covered topics that target entrepreneurial competitiveness, such as:

- the impact on service quality,
- changes in the frequency of orders,
- the amount paid for illustration,
- copyrights,
- the workflow design phase,
- the role of product development,
- the issue of time savings,
- the area of comparison with traditional techniques.

The questions for company managers differed from the questions for illustrators, but the topics were the same, with the addition of the following two topics: cost efficiency and possibility to broaden the product range. In the pilot research, we asked illustrators and creative industry executives what they think about AI-assisted programs. The research was conducted via an online interface using semi-structured interviews with Google Forms and Messenger calls. 11 illustrators and 5 business leaders responded. The interview questions were composed after reviewing relevant literatures and also based on the author's own experience.

Three quarters of the respondents have been working as illustrators for more than 15 years (Figure 1). Half of the illustrators are full-time professional artists, a third are hobby artists, and two are part-time freelancers who supplement their income with drawing. Three quarters of respondents make digital paintings. They were the authors who contributed to the publication of their names: Gabor Szikszai, Gyula Pozsgay, Gergely Buttinger, Péter Tikos, Gergely Nagy, Norbert Birgány, Norbert Vakulya.

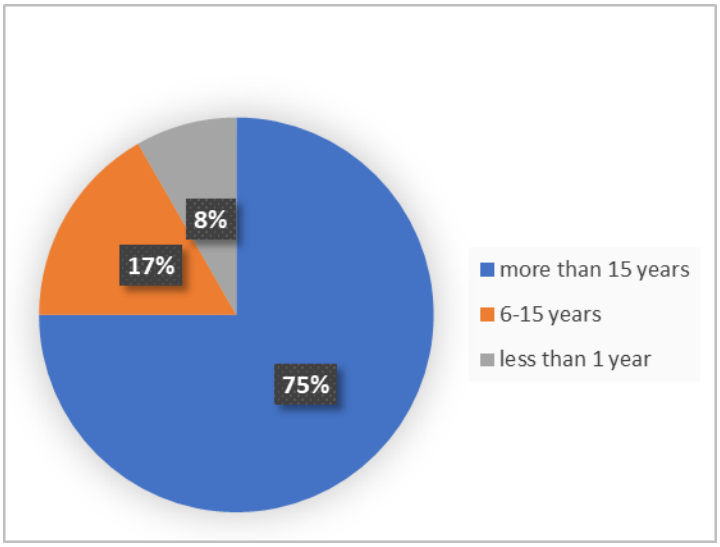

Figure 1. Working time in the industry in years (n=11)

Results and Discussion

Analysis of Illustrators' Opinions

The first question was "Which A.I.-based graphics software/tools do participants use in their illustration work?" Those who use these solutions mentioned SD installed from Github, PS Firefly, Ps Neural Filters, PS Upscaler (Lightroom), Devaiart Dreamup, PS Beta AI, other web interfaces. Users mentioned that, e.g.:

- Midjourney never generated what the designer wanted to see as the end result

- one said, “At the moment, I only do illustrations for US clients who have asked me not to use AI-generated images, bases or references.”
- and another said, “I don't use it, on the one hand I think it takes away the joy of the creative process to get something so ready-made (it's like cooking a bag of soup or heating a pizza), and on the other hand it's stealing and exploiting artists.”

To “What extent does the emergence of AI-based “text-to-image” applications (e.g. Midjourney, Stable Diffusion - installed or web app) influence your personal work as an illustrator?” we received these answers, summarized in Figure 2.

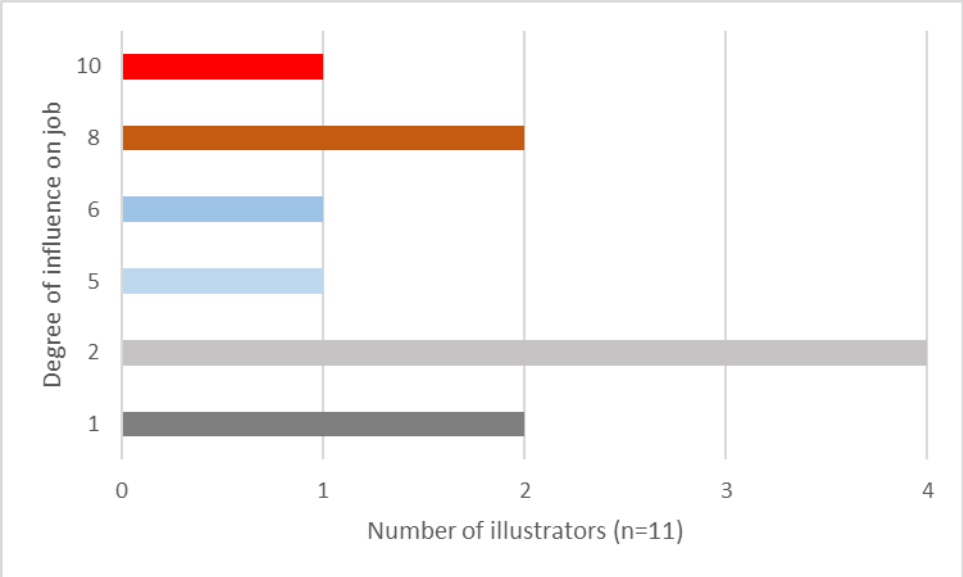

Figure 2. What extent does the emergence of AI-based "text-to-image" applications influence your personal work as an illustrator? (n=11)

More than half of the respondents do not use any of the programs, but they are also following changes in the industry. The same proportion say that their work is minimally or not at all influenced by the revolution in the creative industry - they are all senior illustrators. Among the younger generation, there is a palpable fear and resistance, a rejection of AI-based text-to-image solutions. One of them said, “I don't use it because I think it's the death of art”. There is a lot of misunderstanding and miscommunication, as some of the participants involved point out (VerevolfGD, 2023; Rajnerowicz, 2022).

In the following we ask, what are the positive and negative impacts of these programs on the workplace? Six or seven out of 11 artists said that using these solutions is a good idea at the initial stage: in the design, in pre-concepts, in sketches, or just as inspiration, to test the use of colour, or to develop different versions. Opponents say that it has no positive impact, that it is a “thieving technology”, market-distorting, harmful, and that it is killing the industry.

These were mentioned among the positive impacts in details:

- in retouching
- in idea-generation
- “Helps with reference, sketching, brainstorming, experimenting with variations. Can be useful for generating background behind certain content where precise details are not important. E.g. for a presentation.” Or as another of them put it:
- “They greatly help the workflow and can be used to create creative works of art by people who have only dreamed about it before.” And one who also works as an editor:
- “I've used it to complete 1-1 pictures when there wasn't enough runway for the picture.”

To pick out a few typical negative comments and dilemmas arose at the mention of negative impacts:

- “A lot of graphic design work can be outsourced to AI-based programs by clients, so many illustrators could lose orders.” Or:

- "It kills the joy of playing with compositions and sketching, the end result is soulless."
- "It is unsuitable for individual illustrations and its legal background is questionable."
- "It is easy for lay people to believe - as many did before the rise of AI - that the computer will produce the graphics on its own and therefore undervalue the work of the graphic designer."
- "It's a net thief technology. It institutionalises it and allows it and even relies on it."
- "It has only negative effects, and anyone who is even tangentially informed on the subject can list them all. It has taken me 10 years in this profession (illustrator) to get to this point, and I can already feel that this is as far as it has come. In 2-3, maybe 5 years at the most, there will be maybe a dozen illustrators working in Hungary, those who have already managed to "break into" the industry (game development, film studios, matte painting, etc.), the rest will disappear into the background, along with me. For me, it is inconceivable that there are people in the industry who are happy with these tools."
- "It is unsuitable for individual illustrations, in my opinion, and its legal basis is questionable."
- "It can be frustrating, it can make you more inclined to build on AI foundations instead of your own solutions."
- "Copyright infringement. Competing the AI generated image as a full-fledged work with other hand-made digital works."
- "A lot of graphic design work can be replaced by AI-based programs by clients, so many illustrators could lose orders."
- "It kills the joy of playing with compositions and sketching, the end result is soulless. These programs take away the work of illustrators because there is less and less demand for "expensive artists" when there is "cheap AI". Which is understandable, obviously, but "paints" a very sad picture of the future."
- "It's already clear that publishers have taken the plunge, they will save money on artists, they don't need to hire as many if they're going to have AI doing a lot of the work. But in the same way, individuals will also use the services of artists less, which is typical in role-playing circles, for example, where people who might have had their character drawn by a graphic artist might now be happy with a machine solution."
- There were also some less strident comments: "Copyright needs to be clarified as soon as possible. Nevertheless, I think such programs are similar to, for example, the SPSS statistical program. Without the human factor, they cannot create independent works."
- "My fear is that it will take away a lot of work from the skilled artists who have been making a living from it. I can reconcile myself to this if graphic designers can use them as a supplement and their work is made easier, rather than the AI working for the graphic designer."

Looking deeper into the industry and self-competitiveness, the following main findings can be made: overall, there is no deep fear of receiving fewer orders because of the emergence of low-cost "competitors" trying to use AI in the market. Only three people agree with the statement "Since Midjourney and SD, clients want to pay less for my work".

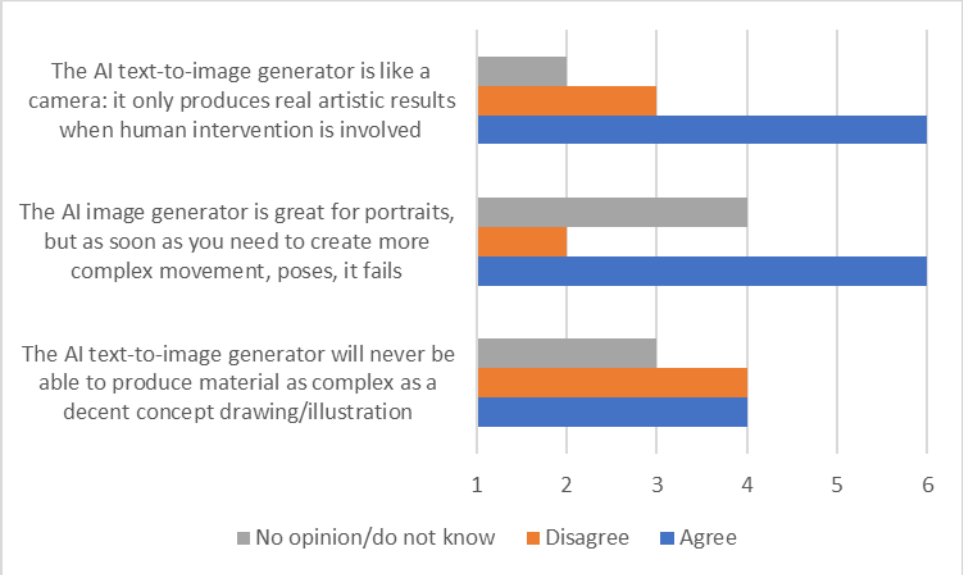

Figure 3. Capabilities and quality of AI-based "text-to-image" applications as judged by the illustrators (n=11)

One half of the respondents to the survey said that the AI text-to-image generator will never be able to produce complex material such as a good concept drawing/illustration. The other half of the group is not sure about this at the same time, because they see a potential in AI. This is reinforced by the fact that AI is great for portraits, but as soon as you need to do more complex movement and poses, it fails, said the vast majority. Many shared the view that "AI text-to-image generator is like a camera: it only produces real artistic results when human intervention is involved." On the negative side, it has been mentioned that such work is often soulless, in the category of visual kitsch. The Figure 3 summarizes the main findings about the capabilities.

The use of the AI text-to-image generator is a violation of copyright, according to the overwhelming majority of illustrators involved (Figure 4). It's not a very creative idea to exclude traditional (hand-drawn) and digital illustrations from the learning phase of AI. Some people would think that if we ban them, they should no longer be thought of as a competitor, because their capabilities are dramatically reduced. This is not the case according to illustrators, the situation is more complex, the "genie is out of the bottle". Illustrators uniformly feel that it is a bad idea to feed their work into the learning phase of AI, as they did in the first phase of development (see the case of Greg Rutkowski, Mayor, 2023). They do not believe that they can get royalties for their work because it is used by the image generator. They believe that this situation is unresolved, and that there is a violation of the rights of creators whose work is unauthorizedly exploited by deep learning systems.

On the question of whether the author of illustrations created with an AI text-to-image generator should also be entitled to copyright, there was no consensus: some said yes, he/she should, others said no, he/she should not. What will happen is similar to what happened with music or movie sharing sites: they will find a way to make illustrators get royalties if someone uses their work in such applications, some say, but just as many believe the opposite, that is, the situation will escalate.

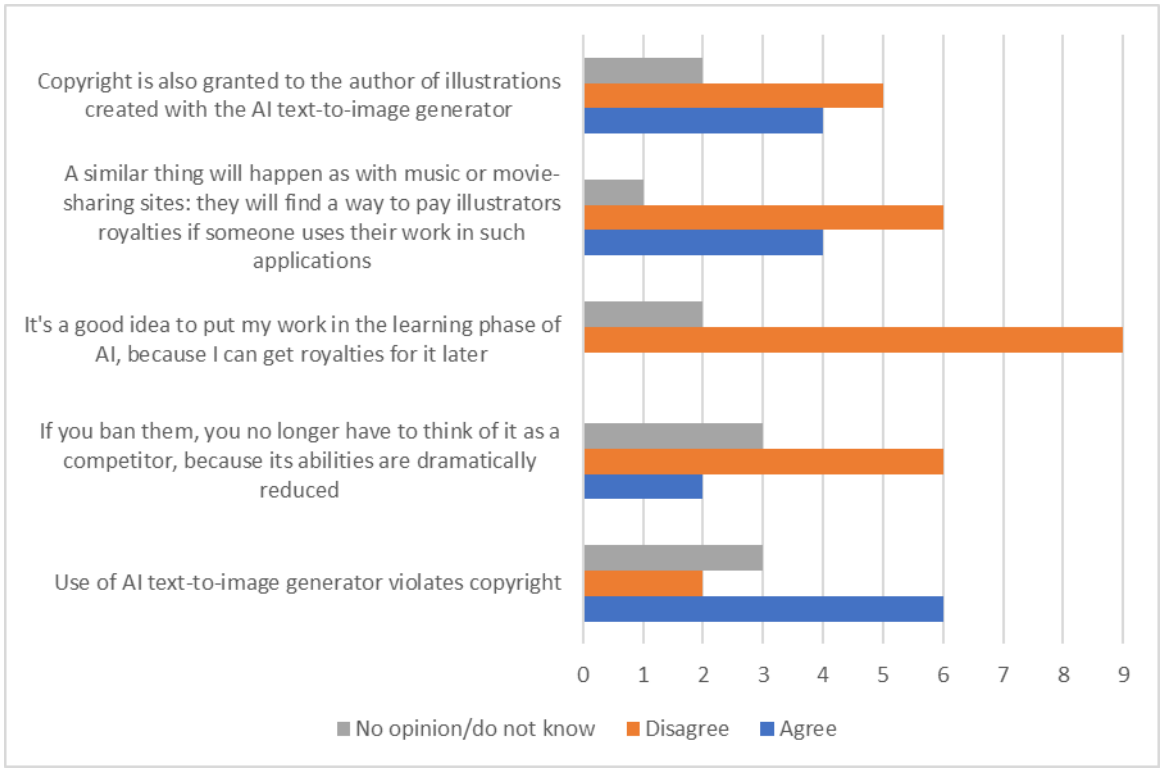

Figure 4. The treatment of copyright as perceived by illustrators (n=11)

On the positive side, the use of AI-based graphics solutions can increase the competitiveness of illustrators, mainly by saving them time. "My job is easier because AI helps me with certain parts of the process," we asked, and the responses showed that the vast majority agreed with this statement. Turning to the potential benefits respondents were divided on the question "my work has become more valuable because hand-drawn illustrations are now considered more unique" (Figure 5). Some agreed, just as many disagreed. Surprisingly, it seems that professionals are still open to the future of using such applications. They said that although they see value in traditional things, and many people only paint traditionally, by hand, they may still give technology a chance in time. Everyone agreed without exception that the launch of the AI text-to-image generator is a milestone for the industry.

Analysis of CEOs`, decision makers' opinions

Turning to the views of the other target group, most of the senior managers and CEOs` (80%) surveyed have been working in the creative industry for more than 15 years, typically in publishing, game development and games publishing (with board games, card games, role-playing games, internet games portfolio). Some of them hire freelancers and are self-employed, others are senior managers in companies employing 2-25 people. The company managers replied that their company has the following A.I.-based programs: graphics programs, translator, educational program, marketing decision support analysis program.

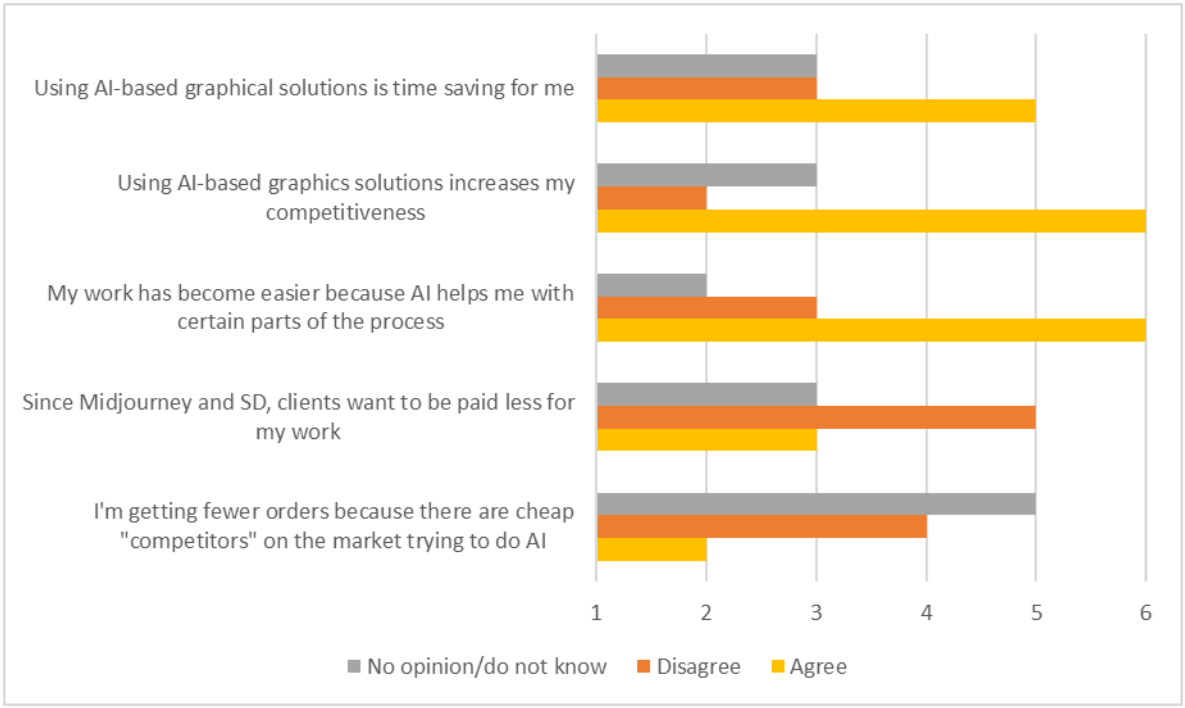

Figure 5. What extent does the emergence of AI-based "text-to-image" applications influence your personal work as an illustrator? (n=11)

When we asked about the positive benefits of A.I. based programs, the following answers were given by them:

- "Cheaper than using a human graphic designer, generates versions faster",
- "Much faster in time",
- "Illustrations are much more detailed and grants more variability",
- "The advantage is that it is faster and cheaper to draw good or at least acceptable images",
- "It expands creativity, it makes art accessible to everyone",
- "It is affordable".

In the context of negative effects, it has been claimed that:

- "There are ethical concerns about AI sourcing, unclear copyright, potential for fraud, visual kitsch",
- "I think that the only negative impact is on graphic designers, but even there it is more likely to be on those with poorer abilities in drawing",
- "Personally I like AI images less because they lack uniqueness",
- "Human creativity is not 100% stimulated",
- "Soulless".

Their comments suggest that the emergence and diffusion of AI-based text-to-image generators save money because they will pay less for products made using this process. Overall, they believe that the final quality of the illustration paid for will be improved by such programs. There are significant time savings in choosing this solution because orders are completed more quickly. It also helps them to get a more varied content because they can choose from a wider range of pro-versions.

For many, their openness to these solutions is due to necessity: they need somewhere to save money in today's difficult market situation. Most executives believe that AI-based solutions could eventually drive some creative professions out of the market altogether. They said that it is a good thing that such a program exists, because it allows them to support more people, to commission more work.

However, they were divided on how impressive these programs are. Some think they are a must if you want to keep up with the times, others disagree. There was a statement that "this process will not be sustainable: the copyright problems will drive this phenomenon out of the market". However, the vast majority of the business leaders interviewed believed that they would be a persistent feature among users.

To the question "To what extent does the emergence of AI-based "text-to-image" applications (Midjourney, Stable Diffusion) influence the performance of your business?" The answers were very different, a typical attitude was:

- "It doesn't make us more successful primarily in a financial sense, it just saves a lot of time and energy and avoids a lot of annoyance and compromise."
- "We don't have many graphic designers working with them at the moment, and we don't want to go all the way, because the images lose their uniqueness."
- "Graphic designers are not reliable, so it can be easier to work with them".

In the Table 1 below, we have summarised which factors are the positive benefits of AI-based technology and which are the concerns about its use, based on the opinions of illustrators and business decision-makers.

Positive benefits of the AI-based "text-to-image" technology	Negative benefits of the AI-based "text-to-image" technology
Illustrators` opinions	
accelerates processes	killing art and the profession
supports brainstorming, planning and the development of different variations	takes the joy out of the creative process and the end result is soulless
allows you to quickly generate backgrounds, whether for presentations or illustrations	it's all about theft and exploitation of artists - thieving technology
excellent for inspiration	thieving technology and infringes copyright
useful for developing pre-concepts and sketches	has a market distorting effect
base-mesh (3D) modelling	no positive impact at all
non-artists can create with it	undervalues graphic design work (the computer does everything)
enhancing bad photos	unsuitable for creating a unique illustration
retouching	its legal background is unclear
colour grading	cheap, takes work away from graphic designers
Senior managers` opinions	
cheap, more work can be offered to more creators	raises ethical concerns about AI sourcing
get results much faster	copyright is unclear
more variability, more customisation	its use also opens the door to fraud
art becomes accessible to all	visual kitsch
saves a lot of time and energy	the end result is soulless
avoids a lot of frustration and compromise	human creativity is not fully exploited
	there is no uniqueness in such illustrations

It confirmed that the creative industry, and in particular the world of illustrators, is undergoing major, revolutionary changes. The perception of such programs is very divided, with stakeholders seeing them as both a source of danger and a new opportunity. The perception is varied among different generations, with young people more critical and fearful. For businesses, they provide significant cost savings. They are very useful at the design phase and can also achieve a higher level of customization, which is the basis and main objective of marketing orientation. The drawback is that these illustrations are basically soulless and not so unique, which may be due to the rudimentary level of facial mimicry or to the obstacles to the realisation of a unique drawing style (lack of clarity of copyright or difficulty in creating a good prototype).

In sum, all company managers agreed that using an AI-assisted program is cheaper than using only a "human graphic designer", generates versions faster and provides more variability, thus allowing for more customisation.

It is likely that the situation will not be resolved soon, especially as uniform legislation will be a long time coming. An interesting market observation is that in Hungary, some clients request that the final illustration should differ by at least 15% from what the program generates based on the promt. If this is met, the illustration is considered to be legally the product of the graphic designer. It is likely that the situation will not be resolved soon, especially as uniform legislation will be a long time coming. An interesting market observation is that in Hungary, some clients request that the final illustration should differ by at least 15% from what the program generates based on the promt. If this is met, the illustration is considered to be legally the product of the graphic designer. Our expectation is that this technology will quickly spread among graphic designers, with initial pushback based on the theory of innovation adoption. And there will be other creators on the market who are not professional artists but who could be serious competitors. They will be a kind of "hybrid" of prompt engineer and digital illustrator. Overall, opinions suggest that some graphic designers may indeed be squeezed out of the labour market, as the customer side is clearly positive about the technology because of its low cost and diverse capabilities. At the same time, the technology offers an opportunity for a new group of "aintrepreneurs" to generate revenue and compete with professional artists. However, it is a fact that brush-drawing artist robots are already being developed, perhaps as a next step in the innovation process (Karimov et al, 2023). Following the pilot research, the next step will be to launch a large-scale national survey to explore attitudes and the potential advantages and disadvantages of the application through a quantitative process.

Scientific Ethics Declaration

The author declares that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the author.

Acknowledgements or Notes

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References

Ajaay (2023). Does midjourney use stable diffusion? https://nerdschalk.com/author/ajaay/

Aydin, E., & Turan, M. (2023). An AI-based shortlisting model for sustainability of human resource management. *Sustainability, 15*, 2737. https://doi.org/10.3390/su15032737

Bencsik A. (2021). The sixth generation of knowledge management – the headway of artificial intelligence. *Journal of International Studies, 14* (2), 84-101. https://doi.org/10.14254/2071-8330.2021/14-2/6

Bencsik A. (2022.) Artificial intelligence in the middle east European countries, in: Munoz, J. Mark; Maurya, Alka (szerk.) *International Perspectives on Artificial Intelligence.* London, Anthem Press, 138 p. pp. 52-62., https://doi.org/10.2307/j.ctv270kv9x

Chen L., Chen P., & Lin Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 2020*(8),75264-75278, https://doi.org/10.1109/ACCESS.2020.2988510

Dobos, O.,& Csiszárik-Kocsir, A. (2022). The role of project management in cyber warfare with the support of artificial intelligence. *The Eurasia Proceedings of Science Technology Engineering and Mathematics, 17*, pp. 26-37., https://doi.org/10.55549/epstem.1175898

Goring, S., Rao, RRR., Merten, R., & Raake, A. (2023). Analysis of appeal for realistic AI-generated photos. *IEEE Access, 11*, 38999-39012, https://doi.org/10.1109/ACCESS.2023.3267968

Gu, L.,& Li, Y. (2022) Who made the paintings: Artists or artificial intelligence? The effects of identity on liking and purchase intention. *Frontiers in Psychology, 13*: 941163, https://doi.org/10.3389/fpsyg.2022.941163

Hair, J.F., Bush, R.P. & Ortinau, D.J. (2009). *Marketing research: In a digital information environment*. 4th Edition, McGraw-Hill Higher Education, Cape Town, 690.

Hwang, G-J., Xie, H., Wah, B.W., & Gašević, D. (2020). Vision, challenges, roles and research issues of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1,* 100001, https://doi.org/10.1016/j.caeai.2020.100001

Jia Q., Guo Y., Li R., Li Y.R., & Chen Y.W. (2018). A conceptual artificial intelligence application framework in human resource management. In Proceedings of *The 18th International Conference on Electronic Business* (pp. 106-114). ICEB, Guilin, China, December 2-6.

Karimov, A., Kopets, E., Leonov, S., Scalera, L.,& Butusov, D. (2023). A robot for artistic painting in authentic colors. *Journal of Intelligent & Robotic Systems, 107*(3), 34, https://doi.org/10.1007/s10846-023-01831-4

Koziol, M. (2023). 5 questions for Anton Troynikov: His company's creation identifies the art behind AI-generated images. *IEEE Spectrum, 60*(5), 23, https://doi.org/10.1109/MSPEC.2023.10120687

Lari, H.A., Vaishnava, K., Manu K.S., (2022). Artifical intelligence in E-commerce: Applications, implications and challenges. *Asian Journal of Management,13*(3), https://doi.org/10.52711/2321-5763.2022.00041

Lyu, YR., Wang, XX., Lin, RT., & Wu, J. (2022). Communication in human-AI co-creation: Perceptual analysis of paintings generated by text-to-image system. *Applied Sciences, 12*(22), 11312, https://doi.org/10.3390/app122211312

Machová, R., & Zsigmond, T. (2019). The connection between knowledge organization and artificial intelligence. In: *Helena, Majdúchová Aktuálne problémy podnikovej sféry: Zborník vedeckých prác z medzinárodnej vedeckej konferencie*, Bratislava, Ekonóm, 452 p. pp. 297-303.

Mayor, L. (2023) AI: *Digital artist's work copied more times than Picasso*. BBC News, 2023.07.20., https://www.bbc.com/news/uk-wales-66099850

Palos-Sánchez, P. R., Baena-Luna, P., Badicu, A., & Infante-Moro, J. C. (2022). Artificial intelligence and human resources management: A bibliometric analysis. *Applied Artificial Intelligence, 36*(1), 2145631.

Ragot, M., Martin, N., Cojean, S. (2020). AI-generated vs. human artworks. *A Perception Bias Towards Artificial Intelligence? CHI* 2020, April 25–30, 2020, Honolulu, HI, USA, pp 1-10., https://doi.org/10.1145/3334480.3382892

Rajnerowicz K. (2022). Will AI Take Your Job? *Fear of AI and AI Trends for 2023.* https://www.tidio.com/blog/ai-trends/

Saáry, R., Tick, A., Judit, Kárpáti-Daróczi, J. (2022). Digitalisation in hungarian SMEs technology or culture? In: Milan, Trumić (szerk.) *Possibilities and barriers for Industry 4.0 implementation in SMEs in V4 countries and Serbia.* Bor, Szerbia: University of Belgrade, Technical Faculty in Bor (2022), 510 p. pp. 207-230.

Sun Y., Yang, C-H., Lyu, Y., Lin, R. (2022). From Pigments to Pixels: A Comparison of Human and AI Painting. *Applied Sciences, 12*, 3724. https://doi.org/10.3390/app12083724

Tick, A., Saáry, R.,& Kárpáti-Daróczi, J. (2022). Conscious or indifferent - concerns on digitalisation and sustainability among SMEs in Industry 4.0. *Serbian Journal of Management 17*(1), 145-160.

VerevolfGD (2023). *The misunderstanding of AI art.* https://www.deviantart.com/verevolfgd/journal/The-Misunderstanding-of-AI-Art-948728694

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