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## Usage of Artificial Intelligence in Today's Graphic Design

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### ABSTRACT

As technology advances and the process of graphic design continues on computers, artificial intelligence applications inevitably enter the design industry. Such applications appear in the field of graphic design as well. Today, graphic design activities are carried out in various fields, such as corporate identity design, web design and page design, using artificial intelligence codes without the need for a graphic designer. This paper discusses whether certain graphic design applications running on AI and machine learning algorithms are as creative as a graphic designer and the impact of artificial intelligence on graphic design business.

**Keywords:** graphic design, artificial intelligence, creativity, design applications

### 1. INTRODUCTION

One of the biggest issues of humanity is time. Human life is very brief compared to the existence of the universe. Therefore, humanity has been developing technologies to make its time more meaningful. People need more time in their short lifespan, and have created artificial intelligence, which can think and act like people.

Intelligence consists of the entirety of skills like comprehension, creativity, problem solving, emotional management, planning, and self-consciousness. In the article titled "Intelligence: Knowns and unknowns" it is stated that "Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought." (Neisser et al., 1996) Artificial intelligence is the ability to adapt human skills to machines, allowing machines to evolve, and use these skills outside the human body. According to Luger (2008) "Artificial intelligence (AI) may be defined as the branch of computer science that is concerned with the automation of intelligent behavior." (Luger, 2009) In time, machines have taken over physical jobs that do not require thinking or decision making mechanisms. However, people have needed

thinking and decision-making machines to reduce the workload further.

It has been debated for years whether or not machines can think like humans. In his article, Jefferson (1949) quotes Descartes who is known as the father of modern western philosophy "A parrot repeated only what it had been taught and only a fragment of that; it never used words to express its own thoughts. If, he goes on to say, on the one hand one had a machine that had the shape and appearance of a monkey or other animal without a reasoning soul there would be no means of knowing which was the counterfeit. On the other hand, if there was a machine that appeared to be a man, and imitated his actions so far as it would be possible to do so, we should always have two very certain means of recognizing the deceit. First, the machine could not use words as we do to declare our thoughts to others. Secondly, although like some animals they might show more industry than we do, and do some things better than we. Yet they would act without knowledge of what they were about simply by the arrangement of their organs, their mechanisms, each particularly designed for each particular action."(Jefferson, 1949) Turing quotes (1950) Geoffrey Jefferson's view of the machine's ability to think "Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain-that is, not only write it but know that it had written it. No mechanism could feel pleasure at its successes, grief when its valves fuse, be warmed by flattery, be made miserable by its mistakes, be charmed by sex, be angry or depressed when it cannot get what it wants."(Turing, 1950) Investigating the ability to think in machines, Turing has developed the "imitation game" test.

Today, the question is not whether machines have the ability to think but whether machines are as creative as people. In 2014, Mark O. Riedl proposed a test, named "Lovelace 2.0," which measures creativity of machines. Like in other fields, AI has entered business areas that require creativity. Employment declines in certain sectors as AI comes into play. Some argue that employment rate will go down in the field of design in the future. Others think there is not going to be much change in the employment rates of professions that require creativity, which a robot can ever have.

Undoubtedly, graphic design entails creativity and is under the influence of the automation process. As technology advances and the process of graphic design continues on computers, artificial intelligence applications inevitably enter the design industry. Such applications appear in the field of graphic design as well. Today, it is possible to design a logo on logo creation websites using artificial intelligence codes without the need for a graphic designer. Any person without design experience is able to



design a website on webpages developed for that purpose, again, without the "need" for a designer. In this case, creativity and originality of these works in terms of design is a matter of debate.

## **2. THE RELATIONSHIP OF AI, CREATIVITY AND GRAPHIC DESIGN**

Scientists have developed tests to measure the thinking skills and creativity of machines. "Analytical Engine," notes developed by Charles Babbage, contains the first algorithm written for a computer, (Menabrea, 1843) and Ada Lovelace, who is known as the world's first computer programmer, notes that "the Analytical Engine has no pretensions to originate anything. It can do whatever we know how to order it to perform" (note G). Turing (1950) refutes the charge that computing machines cannot originate concepts and reframes the question as whether a machine can never "take us by surprise." (Rield, 2014)

The "imitation game," developed by Alan Turing in 1950 to answer the question "Can machines think?", is played by a group of three people: a man (A), a woman (B) and an interrogator (C). In a separate room from the others, the interrogator tries to guess the genders of the others correctly. The interrogator bases guesses on typewritten questions and their answers. The challenging part of the game is one of the participants is constantly lying to the interrogator and the other is constantly telling the truth. For instance, one of them can say "I am a man" and the other can say "No, I am the man, don't listen to her!" Turing adapts the game, changing the trait in question from gender to human-machine. At the end of the game, if the interrogator is convinced the machine is human, the machine passes the Turing test. (Turing, 1950)

Finding the Turing test inadequate, Selmer Bringsjord, Paul Bello and David Ferrucci explain an alternative test they developed in the article titled "Creativity, the Turing Test, and the (Better) Lovelace Test" in 2001. They explain their opinion and the test they developed as follows: "The problem of the Turing Test's structure is such as to cultivate tricksters. A better test is one that insists on a certain restrictive epistemic relation between an artificial agent (or system) A, its output o, and the human architect H of A - a relation which, roughly speaking, obtains when H cannot account for how A produced o. We call this test the "Lovelace Test" in honor of Lady Lovelace, who believed that only when computers originate things should they be believed to have minds." (Bringsjord, Bello, & Ferrucci, 2001) They think it is very easy to convince the interrogator that the respondent is human and not a machine, and in the Lovelace Test, the machine passes the test and is declared creative when the person who created the machine cannot explain how the machine's work is created. Existing systems at the time

of the article were analyzed and no machine was able to surprise its creator and pass the test. Letter Spirit, a project designed by Douglas Hofstadter, was put through the Lovelace Test. The Letter Spirit project is intended to teach computers creative letter design. "The task of Letter Spirit is to accept as input a few grid letters from a human designer, with those seed letters intended to represent the same style. Using the seeds as a beginning, Letter Spirit creates versions of the remaining lowercase letters of the roman alphabet until it has produced an entire gridfont of 26 stylistically consistent gridletters." (Rehling & Hofstadter, 2004)

In 2014, Mark O. Riedl proposed a test as alternative to the Turing Test named "Lovelace 2.0," which was an updated version of the Lovelace Test and measures machine creativity. Riedl explain his opinion on the Lovelace test which was developed in 2001 as follows, "One critique of the original Lovelace Test is that it is unbeatable; any entity h with resources to build a in the first place and with sufficient time also has the ability to explain o. Even learning systems cannot beat the test because one can deduce the data necessary to produce o." Riedl explains the creativity measurement as follows: "The new Lovelace Test asks an artificial agent to create a wide range of types of creative artifacts (e.g., paintings, poetry, stories, etc.) that meet requirements given by a human evaluator. The Lovelace 2.0 Test is a test of the creative ability of a computational system, but the creation of certain types of artifacts, such as stories, require a wide repertoire of human-level intelligent capabilities." (Riedl, 2014) The Lovelace 2.0 Test is as follows: artificial agent a is challenged as follows:

- a must create an artifact o of type t;
- o must conform to a set of constraints C where  $c_i \in C$  is any criterion expressible in natural language;
- a human evaluator h, having chosen t and C, is satisfied that o is a valid instance of t and meets C; and
- a human referee r determines the combination of t and C to not be unrealistic for an average human.

Creativity is not a precisely identifiable phenomenon. Boden says (Boden, 2004) "Human creativity is something of a mystery... one new idea may be creative, while another is merely new." In their article Higgins and Morgan defines creativity as "the ability to repackaging or combine knowledge in a new way which is of some practical use or adds value." (Higgins & J., 2000) According to Runco and Jaeger (2012) the standard definition of creativity requires both originality and effectiveness and they argue if any one of them are really necessary. They come to the conclusion of originality is vital and effectiveness may take the form of value.



While attempts are made to define the concept of creativity, the concept of "computer creativity" emerges. Computational creativity is the art, science, philosophy, and engineering of computational systems that, by taking on particular responsibilities, exhibit behaviors that unbiased observers would deem to be creative. (Riedl, 2014) In the article called "Creativity, the Turing Test, and the (Better) Lovelace Test" an opinion of Ada Lovelace on computational creativity is mentioned as follows: "Computers can't create anything. For creation requires, minimally, originating something. But computers originate nothing; they merely do that which we order them, via programs, to do." (Bringsjord, Bello, & Ferrucci, 2001) According to Boden (2004), "computers and creativity make interesting partners with respect to two different projects. One is understanding human creativity and the other is trying to produce machine creativity in which the computer at least appears to be creative, to some degree."

Although we are unable to define creativity precisely, the concept is very important in graphic design. Various processes have been developed in graphic design in order to trigger creativity and find unique solutions to problems. Each designer has a distinctive process. Today, artificial intelligence applications design by using preprogrammed algorithms and repeating most of user actions through machine learning. In this case, the designer artificial intelligence works without any design process and does not require any power or inspiration to trigger creativity. Can AI really be creative and pass these tests? Even though AI does not have the creativity necessary for a new design, it can easily do what a graphic design operator does. For instance, a graphic design operator takes a layout designed by a graphic designer or art director, and places it on other pages according to the system. The important part of this job is not creativity but proficiency in software and doing the placements fast and without errors, depending on the urgency of the work. Artificial intelligence would be excellent at this job compared to a human because it is much less likely to make mistakes.

### **3. EXAMPLES OF GRAPHIC DESIGN PROGRAMS WORKING WITH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING METHOD**

There are many pieces of design software that work with artificial intelligence and the machine learning method. In this section, four graphic design programs using these methods are examined. These are logo design, image processing, page design and web design programs.

#### **3.1 Logojoy - AI Powered Logo Maker**

Logojoy is a website founded in 2016. It uses learning artificial intelligence to create and sell a variation of logos without a real graphic designer. Logojoy's process involves four

stages. The user writes in the brand name, and chooses various logos and colors offered by the website. Optionally, slogans and icons relevant to the brand are added to the options. In a few seconds, the website's algorithm creates different logo designs based on the input and the user chooses a design. (Figure 1) Mockup templates, a part of the logo design process in graphic design, are also generated by the AI. In the last stage, the user immediately sees the logo of choice on mockup templates. Thanks to the website's user-friendly, simple and easily understood interface, the entire process takes very little time. (2016) Dawson Whitfield, founder of the website, is a logo design specialist. Advocating for minimal design, Whitfield bothered by how long it takes to design a simple logo for small companies that do not need to be assertive, decided to create a website where an AI designs logos. He intended for the website to provide easy access to simple and good-looking logos for new businesses, blogs, clubs and nonprofit organizations.

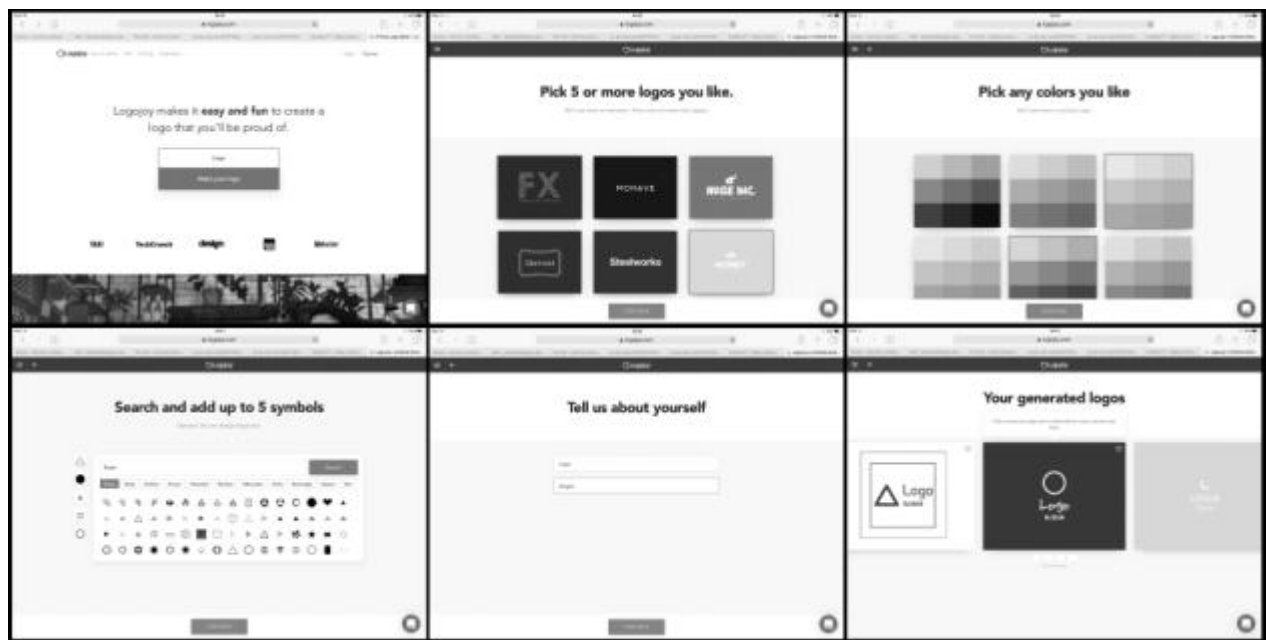


Figure 1: The design process of Logojoy

The logos in Logojoy are a blend of various types of fonts, colors, symbols and compositions. Through machine learning, Logojoy builds on the blends that result well. Colton, Charnley and Pease (2011) state that "machine learning is a very well established research area and has possibly had the greatest impact of all AI subfields, with successful applications to classification and prediction tasks in hundreds of areas of discourse."(Colton, Charnley, & Pease, 2011)The AI continues to learn by monitoring user choices, changes users make on the logos like different fonts, and the logos they purchase. The algorithm follows 80 types of behavior, scans how many times a day

these behaviors are seen, and acknowledges the most frequent behaviors as rules. An assumed type of behavior, "user increases font weight from 100 (light) to 600 (bold)," contains how many times this action takes place, the previous actions and all logo components. Each time this behavior is seen, for instance, when the logo is on a lighter color scale, the algorithm develops the rule "If the logo is in a light color, do not use this font in light weight."

A logo is a simple design of the symbol of a company or organization: it could consist of an emblem or a logotype alone, or both an emblem and a logotype. In order to be successful, a logo must be simple, timeless, usable, legible, original and easily remembered according to the general opinion. Logos designed at Logojoy, which stands out by not requiring a designer to design logos and does very fast designs, generally do not possess the qualities needed in a logo. It appears that the best aspect of the designed logo is that it is easily fitted on various surfaces like business cards or signboards without wasting time on a computer. As the emblems are limited to frequently used icon alternatives offered by the website, the generated logo has no distinctive feature. Fonts used for logotype are chosen by the user, which means designs do not comply with logo design principles if the user does not know the psychological meanings of fonts. The ability to design good-looking logos fast, which was the founding purpose of Logojoy, does not mean designing the correct logo. Logos created with this program by people who do not have graphic design training may not reflect corporate identity and lead to visual pollution. It looks like the designs here are not actually logos but beautifully written names of company names. With these limitations, Logojoy logos do not have the chance of being creative. Although Logojoy has the possibility of implementing different configurations by artificial intelligence or machine learning skills, the logos it creates are very unlikely to attain the creativity level of a trained graphic designer.

### **3.2 Adobe Sensei – AI-Powered Photo Editor**

Adobe Sensei is a series of intelligent services in Adobe Cloud Platform of developing design and digital experiences. Adobe benefits from trillions of pieces of content and data, from high-resolution images as part of combined artificial intelligence and machine learning to customer clicks, by using the information it has accumulated over the years about creativity, document and marketing. Adobe Sensei is intended for image matching, understanding and sensing documents and important mass segments amidst all this information. With machine learning, it predicts the designer's next move and recreates fonts for the designer by recognizing font types. It also reduces the amount of time a designer spends to edit faces by automatically defining facial features like eyes,



mouth and nose in a photo with Adobe Photoshop's "Liquify" filter. Adobe has integrated image processing programs with AI, such as Photoshop Fix, Photoshop Mix and PS Express, which have similar features to desktop Adobe Photoshop like adding color effects, creating collages, cutting, trimming and color correction. Photoshop Fix automatically recognizes faces and can rescale facial elements. (Figure 2)

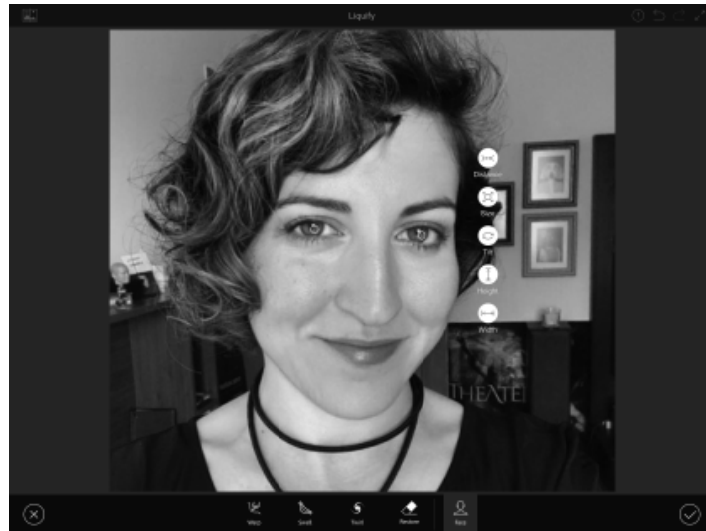


Figure 2. Photoshop Fix - Liquify filter

With the deep learning technique, Adobe Sensei automatically tags images, does searches and makes intelligent recommendations. It can even recognize a font or handwriting in a design and suggests similar fonts. DeepFont (2015), an AI system exclusively developed for Adobe, spares designers from using programs other than Adobe and saves time by finding the font of writings. As a font source for DeepFont, an expansive font database called Adobe VFR (visual font recognition) was created. (Figure 3) Writings on images are matched to the fonts in the database with an 80% success rate. (Wang et al., 2015)

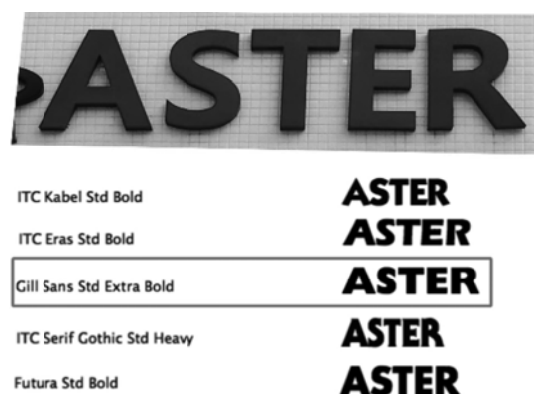


Figure 3. Adobe VFR – Visual font recognition

Adobe's research team developed the application Deep Photo Style Transfer (2017) to adapt a series of effects on an image to another image. Deep Photo Style Transfer was created with the deep learning technology. LeCun, Bengio and Hinton state that (2015) "Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. These methods have dramatically improved the state-of-the-art in speech recognition, visual object recognition, object detection and many other domains such as drug discovery and genomics." (LeCun, Bengio, & Hinton, 2015) What sets this application from previously developed similar applications is that it yields more realistic results after transfers. (Luan, Paris, & Bala, 2017) (Figure 4)



Figure 4. Deep Photo Style Transfer

Innovations offered by Adobe save time for trained designers who know what they are doing. Designers can let artificial intelligence speed up their work and they can be more productive in research, sketching and design improvements. The level of creativity in works designed in Adobe's design programs completely depends on the skills and knowledge of the designer. Adobe's AI-assisted programs help designers to choose fonts or colors or transferring photos but correct design impossible without getting graphic design training, knowing what design elements do and doing the correct work for a brief. The result would be projects that are incompatible with graphic design principles, cannot convey the message and cause visual pollution.

### 3.3 Designscape – AI-Powered Layout Designer

Supported by Adobe, Microsoft and NSERC, Design Scape is a system which aids the design process by making interactive layout suggestions, i.e., changes in the position, scale, and alignment of elements. It is the first work provides interactive suggestions for single-page designs like posters/advertisements. In general terms, it was developed for new and inexperienced graphic designers who do not have a command of design principles. The system uses two distinct but complementary types of suggestions: refinement suggestions, which improve the current layout, and brainstorming suggestions, which change the style. On the interface of the suggestive interface mode, design objects are positioned in the middle with three refinement suggestions under the heading of "Tweak your design" on the left and three brainstorming suggestions under the heading of "Brainstorm new ideas" on the right. (Figure 5) Refinement suggestions order design objects in the middle of the screen according to design principles and the user clicks on one of these three refinement suggestions. Optionally, the user can reorder objects by dragging them, after which refinement suggestions automatically change based on the new design. The user can click on one of the brainstorming suggestions to see the design objects in a completely different page order. (O'Donovan, Agarwala, & Hertzmann, 2015)



Figure 5: Designscape – Refinement suggestions

In the adaptive interface mode, the program automatically orders the design with no suggestions when the user changes an object. Brainstorming suggestions appear on the right of the screen on this interface as well. (Figure 6)



Figure 6: Designscape – Adaptive interface mode

The feature of retargeting layout changes the page size. After entering the page size to the interface, the page is resized and design objects are automatically rearranged according to the previous design. (Figure 7) Brainstorming suggestions also appear here and show different design options in various sizes.



Figure 7: Designscape – Retargeting layout

Explaining the Designscape program, Designscape worked with novice graphic designers at the website "Mechanical Turk" to evaluate the program in an article titled "DesignScape: Design with Interactive Layout Suggestions." Users were asked to create different designs on the program's Adaptive and Suggestive interfaces. Ultimately, designs created on the new interfaces were generally preferred to baseline designs.

Although the purpose of Designscape is to assist beginner graphic designers in their experience, the program may be more appropriate for people who are not designers but



want their pages to look better. Designscape can let people who use PowerPoint but cannot use Adobe Illustrator to think outside the templates offered by programs like PowerPoint but also create files or presentations with some compliance with design principles. It may be possible to adapt Designscape's Suggestive and Adaptive interfaces to a popular program with designers, such as Adobe Illustrator. An experienced designer is aware of the importance of starting designs with free-hand sketches; after the sketching stage, these new interfaces may offer new ideas with Brainstorming options or speed up the process by aligning the design on the Adaptive interface. Automatic resizing process of the Adaptive interface may be vexing for the designer. Designscape is convenient for serially produced works that require fast solutions but not a different design solution. This program would be beneficial for websites or applications that require the highest number of screen sizes when the same design must be implemented on mobile phones, tablets and different computer screen resolutions.

### **3.4 Firedrop – AI-Powered Web Designer**

Firedrop is a website that offers web design services with AI assistance like The Grid(2016), which was a pioneer in the field. Contrary to The Grid - services provided are unknown before becoming a paid member of the website - it offers free web design services. An AI chatbot named Sacha, which will create the design, welcomes the users to the page. The chatbot asks questions and based on the answers determines what kind of website is to be designed, and submits the design to the user for approval. Later, the user has the option to change color palette, fonts or page design templates, provide a link for or upload an image; however, the design is still limited to options offered by the artificial intelligence. (Figure 8) It does not support drag-and-drop like other websites that offer the service: the user writes the necessary content and places images and waits for the AI to create the design.

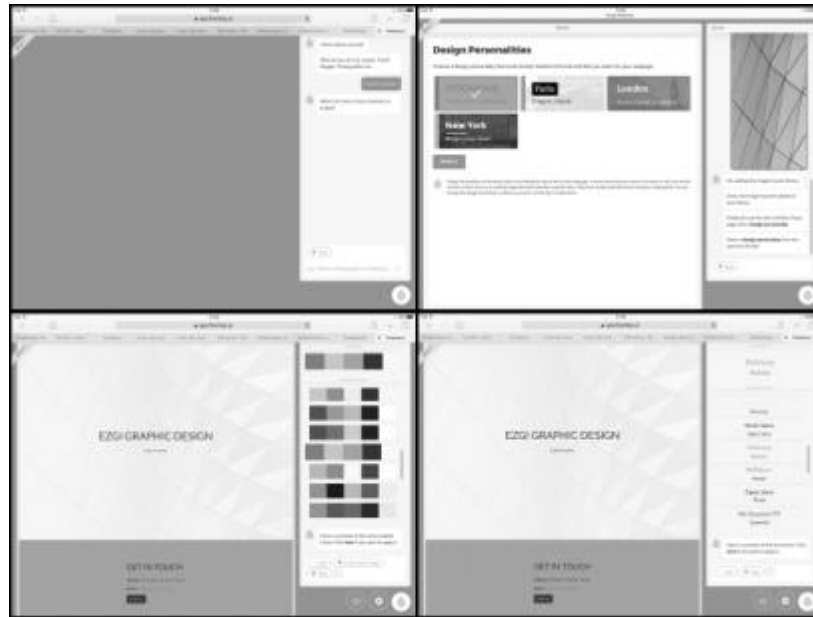


Figure 8: The design process of Firedrop

Automatically generated designs by Firedrop are based on flat design, which has recently become popular in the field of web design. There are no multiple pages; the website consists of a single page that scrolls down. (Figure 9)

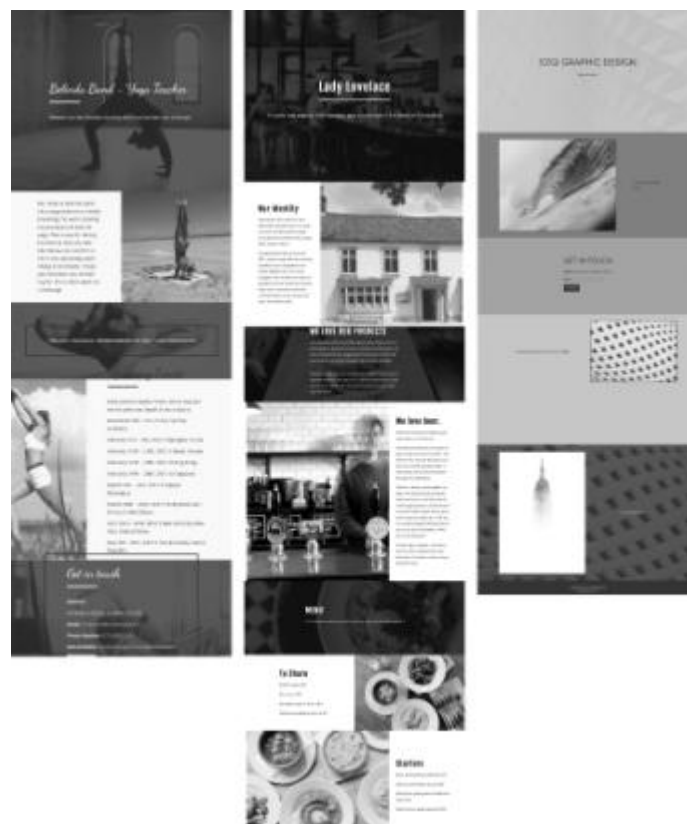


Figure 9: Three different websites that are generated by Firedrop



Firedrop takes only a few minutes to design the necessary website according to design principles and the operating logic of contemporary websites with a modern interface. Website founders do not have to beat their brains or have to learn how to use any of the program's tools and they can create their website only by answering the questions asked by the chatbot or asking the chatbot questions themselves. The user chooses a color scheme and page design from alternatives and does not get involved in the designing process. The user cannot drag and drop design objects and or get out of the templates offered by the program. These limitations are appropriate for beginner graphic designers to a certain extent but these designers without complete design training will not be able to figure out why Sacha, the AI designer positions objects in a certain way or why it offers certain color palettes. Naturally, a professional designer will not prefer to work with these limitations. Firedrop is more appropriate for people who are not designers but want to build a website by themselves. Generally, examples indicate that the same design templates are used, which means websites designed by Firedrop will look very similar. Obviously, this is not something companies that want to set themselves apart will prefer.

#### **4. DISCUSSION AND CONCLUSION**

The graphic design process is sure to gain speed along with the advancement of artificial design. Like the time spent on printing press letters and painting for a poster design at one time takes no time at all now with design programs. The time graphic designers spend today for the most time consuming things will become shorter with this technology. As graphic design process requires knowledge, it naturally involves aesthetic and artistic concerns. The designer creates his designs based on his knowledge and experience and definitely adds his creative awareness. Here, what artificial intelligence does not have is creative awareness, which may be a temporary problem that may be overcome in time with methods like creative learning or adapting neural networks of the human brain to artificial intelligence.

As artificial intelligence is used more and more in graphic design, more creative designs beyond the capabilities of artificial intelligence may be needed. Graphic design training may need to be reconfigured. As the usage area of artificial intelligence grows, the need for instructors of design programs that work on artificial intelligence and machine learning may grow in graphic design training. In addition to design theory, basics of typography, and creative thinking techniques, AI-running programs, which are designed on the foundations of graphic design problem solving techniques of the past, need designers with a command of basic design principles. User group of the existing AI-running logo design programs is customers. The user group of programs that target





designers, such as Adobe, is designers. Today, designers that use these programs must have knowledge of design principles and rules of typography; otherwise, these programs will only lead to pollution in design. With the integration of artificial intelligence and machine learning, these programs become easier to use and accelerate the design process. Thanks to AI-running page web design and page design programs, graphic designers will leave time-consuming business, such as working on grid or adapting user interface to all mobile device screens, to machines, and have more time for content improvements. After completing template design for works with predetermined templates, the rest of the time-draining work may be concluded with artificial intelligence with no designer or implementer by putting in the necessary information. For instance, on periodicals with specific grid systems like magazines or newspapers, daily, weekly or monthly information can be uploaded to the program, which uses artificial intelligence to create the publication in a much faster way than a real person according to the predetermined design template. Packaging design may be another example. A designer can create a dieline and the superimposed typographic and visual elements of the package of a chocolate brand with six flavors and packages of the five remaining flavors may be quickly prepared for printing by artificial intelligence. Programs that create logos with artificial intelligence, which generally does not accomplish anything beyond of a beautifully written brand name, can minimize the time spend in the time-consuming stage of presentation of the logo to the customer on various surfaces like business cards, signboards, pencils, etc.

The main reason technology exists and continues to advance is that it allows people to work less and have more time for themselves. Therefore, people create machines and systems that will help them with everything. In graphic design, artificial intelligence will reduce the amount of time-consuming work and leave designers more time for the creative process. In this case, designers most try to be more creative and follow technological advancements. AI-running graphic design programs of our time are devoid of creativity. Therefore, the graphic design profession does not appear to be under threat; on the contrary, designers have more time than ever to be creative.

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