Text-to-Image Generative Models: An Exploration of Their Potential in Transforming UX Design from Wireframes to High-Fidelity Interface Designs

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A Master of Science Thesis

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2123-S2

June 28, 2023

Abstract

The advent of Artificial Intelligence (AI) has raised concerns regarding its potential impact across various sectors, particularly in terms of potential job displacement resulting from automation (Thomas, 2022). These concerns have also permeated the field of User Experience (UX) Design (Akhmedov, 2022). The integration of AI in UX design is a multifaceted topic, owing to the diverse range of AI applications available. The incorporation of AI in professional UX design workflows is not yet commonplace. UX designers often face constraints in terms of budget and time for their projects (Choudhury, 2022), making it intriguing to explore how AI can enhance the design process and contribute to more efficient product delivery. The literature concerning the application of AI models such as text-to-image in the context of User Experience (UX) design is noticeably scarce.

This study aims to bridge this research gap and develop a comprehensive understanding of the effectiveness of AI implementation in UX, specifically by employing a text-to-image generation model to transform wireframes (Rees, 2023) into high-fidelity (hi-fi) interfaces. To achieve this aim, an initial phase involves conducting a thorough review of existing literature on the utilization of AI in UX design and its diverse applications. Subsequently, several pre-evaluation experiments are conducted to familiarize the researchers with the AI model and adequately prepare for subsequent evaluation experiments involving UX design professionals as study participants. Prior to starting the evaluation experimentation phase, the study participants are requested to complete a UTAUT-based questionnaire, which serves as a baseline assessment. The evaluation experimentation culminates in an interview process, designed not only to gather qualitative data regarding the efficacy of the technology in transforming wireframes into hi-fi interfaces, but also to elicit insights into potential enhancements for future systems. The ensuing analysis and synthesis of the obtained results are presented in the "Discussions and Conclusion" section, wherein the study's limitations are also addressed, and recommendations for future research are proposed.

Contents

1. Introduction

Computer technology has undergone remarkable advancements in the 21st century, revolutionizing society and transforming various aspects of human life. In comparison to the previous century, the integration of computer technology has become an indispensable part of our daily routines. The introduction of the original iPhone marked a significant milestone in this technological revolution (Mukherjee, 2022). With its groundbreaking large touchscreen interface, the original iPhone eliminated the need for a stylus and allowed users to interact directly with the device using their fingers. Notably, the advent of the original iPhone also brought the concept of mobile applications to the forefront. As technology continues to evolve, an increasing number of individuals have gained access to smartphones, emphasizing the importance of designing mobile applications that cater to user needs. This is where user experience (UX) designers play a crucial role.

UX designers are responsible for shaping the interaction between users and a product or service (Stevens, 2023). Their primary objective is to ensure that the product aligns with users' experiences by being relevant, efficient, and aesthetically pleasing. Through meticulous research into user needs, UX designers enable companies to gain a deeper understanding of their customers. One commonly employed method in this process is the creation of personas, which are fictional representations of the target user group. By using personas, designers can develop products that cater to user needs rather than relying solely on their own preferences (Babich, 2017).

To effectively design user-centric products, UX designers employ various methods throughout the development workflow. During the early stages of product development, mood boards are used to establish the visual direction of the project. These boards consist of visual elements such as images, features, and icons that effectively communicate the desired aesthetics and gather feedback from stakeholders (Ascanio, 2021). Once the desired direction is established, UX designers create initial iterations of the product, often in the form of wireframes. Wireframes serve as low-fidelity (lo-fi) representations of the product's interface and focus on its structural elements, preceding the application of visual design (Rees, 2023). They can be hand-drawn or created using specialized software design tools. By iterating upon wireframes, designers can ensure that the product meets the user experience requirements and plays a vital role in the overall design process. When designers believe that the wireframes adequately address user needs, they move on to designing a hi-fi interface, which is more visually appealing.

As technology continues to advance, the topic of AI has gained prominence, prompting concerns about its potential to displace jobs (Thomas, 2022). The field of UX design has also experienced the impact of AI with the introduction of Midjourney, a text-to-image generation AI system (Akhmedov, 2022). Midjourney, alongside other AI systems such as Stable Diffusion and OpenAI's DALL-E, utilizes textual prompts to generate realistic images and has found widespread use among artists (borji, 2022). While AI has been integrated into various domains, its application within UI and UX design remains relatively limited, according to existing literature. However, recent studies have explored the use of language models like ChatGPT, which can simulate human-like conversations and generate content across diverse topics, including essay writing, programming code, and emails (Ortiz, 2023). Although these studies have investigated the potential integration of language models within the UX design workflow, they have focused less on utilizing AI to aid in designing interfaces that align with the overall user experience of a product.

While some attempts have been made by UX designers to leverage text-to-image models like Midjourney to create interfaces, limited knowledge exists regarding how these models can transform existing wireframes into high-fidelity interfaces. Therefore, this study explores the

potential of text-to-image generative models in conjunction with wireframes that already adhere to user experience requirements. The research question that arises from this context is as follows: *Can text-to-image generative models assist UX designers in transforming wireframes into high-fidelity visualizations?*

2. Related work

This review comprehensively surveys a diverse range of studies and experiments conducted both within and beyond the scientific literature. The relevant investigations delve into the application of various forms of AI, including Machine Learning (ML), Generative Adversarial Networks (GANs), and text-to-image models, within the realm of UX design. Furthermore, the experiments conducted outside the scientific literature primarily concentrate on the utilization of text-to-image models, such as Midjourney, for the purpose of generating interfaces.

2.1 Literature review on existing literature

Ko et al (2022) evaluates the quality of content generated by a text-to-image generation model, specifically DALL-E, within the context of visual design. The study involved 28 participants, of which three were User Interface (UI)/UX designers who aimed to explore the potential of text-to-image generation within the context of mobile UI interfaces. While attempting to generate user interfaces, the UX designers reported concerns regarding the usability of the interfaces produced. However, the prompts used by these designers were found to be abstract and lacking specificity. In some cases, they also used words or phrases that can have different meanings to what the designers had in mind, leaving the system to generate something undesirable. For instance, Ko explains that one of the participants used the word 'Mohei', with the original meaning being an abbreviation of 'sunshine' on the corner'. According to Ko, the output generated by the system was a random image of a dumpling. Furthermore, a prompt like "Mobile UI screen of a social media" generated a UI with patterns associated with social media but without taking into account user needs or user-friendliness. While the paper provides limited insights for more specific use of Dall-E in UX design, the study offers intriguing insights into the attempts of UX designers to use a text-to-image AI for generating an interface. The study authors recommended using a prompt engineering tool to suggest ways of writing prompts for DALL-E to help the designer from getting exhausted from engineering a prompt that suit their wishes. Although the primary focus of the study was not on UX, the findings suggest the potential of text-to-image generation within the context of visual design and highlight the need for specificity in prompts to generate more user-friendly interfaces.

Houde et al (2022) examines the potential of AI-generation to improve the UX of a legacy interface. The code of an existing interface is translated into an editable version through the use of AI-generation. Regarding the modernization of design specifications through automation would prove more difficult. Because different products consist of different UI styles and layouts, it requires manual effort, by using design tools, to transform these legacy styles & layouts to modernized ones. The study proposes a methodology where generative AI would translate legacy UI code to "first cut" representation a designer can work with. Although the study offers a methodology on how AI-generation can facilitate the conversion of a legacy page to an editable one, it still requires the UX designer to manually design a new solution instead of assisting in the design process itself. Houde et al (2022) conclude that the current approach to UX modernization is insufficiently addressed and highlights the potential of generative AI technology in this area.

Yang (2017) examines the integration of ML into user experience (UX) design, with a focus on a clinical application aimed at assisting healthcare providers in diagnosing and treating patients with skin conditions. A machine learning model trained on a dataset of images and clinical data, helps to identify conditions and recommend treatment. The study explores how ML and UX design can be combined to present information to clinicians in a manner that is easy to understand and interpret. ML is used as a tool to enhance the UX for clinicians by prioritizing personalized and

relevant information. Examples of integration within the case study include the use of natural language processing (NLP) to extract relevant information from clinical notes and present it in a more comprehensible manner, as well as algorithms that predict whether patients are at high risk for certain medical conditions. This allows clinicians to take preventive measures early on. As, the study notes the AI in the form of ML is utilized for information management rather than proactively assisting UX designers in designing new interfaces.

A systematic review conducted by Hughes, Zhu and Bednarz (2021) examines the utilization of GANs in the creative and design industries. The scope of the paper encompasses how AI such as GANs are used as a tool to improve the creativity, productivity, and design horizons. The review includes an analysis of 26 papers that describe a variety of case studies. The review highlights that although Machine Learning has been active for some time, it is still relatively new to the creative and design space. There has been a significant emphasis on researching the capabilities of these systems in performing tasks, but not on the user experience when using these systems. As a result, the paper argues that UX design has remained relatively undeveloped when it comes to ML applications (Hughes et al., 2021).

Additionally, the paper explores the limitations of GANs in collaborative human-AI design. The researchers argue that there is a lack of knowledge sharing between UX designers and ML engineers concerning the capabilities and limitations of ML. Moreover, nearly half of the case studies presented in the review were not tested with users, with the users who were included being either expert or novice users.

Abbas et al (2022) presents a systematic review of the current literature on the utilization of ML in UX design, focusing on identifying the existing state of research and the effectiveness of ML techniques and the limitations of ML as a tool for UX design. Notably, the paper highlights that ML as a tool for assisting designers is being underutilized and is yet to be integrated into the education of UX design, design patterns, and prototyping tools. Furthermore, the paper stresses the importance of developing ML tools for UX design through an in-depth examination of existing design processes, rather than solely because the technology exists and is technically feasible.

The study also identifies several limitations related to the understanding of ML by designers, its practical use as a tool within UX design, and the absence of a design process or device to assist designers in utilizing ML effectively. Moreover, some studies exploring the use of ML in UX design are still in their conceptual stage and may produce inaccurate results. Additionally, there is a lack of investigation into implementing ML within UX design in a working environment in the existing studies. Therefore, the paper suggests that further research is necessary to address these limitations and enable designers to use ML effectively in UX design.

While the paper by Nural Choudhury (2022) offers interesting insights into the intersection of AI and UX design, it should be noted that the paper lacks peer review. Nonetheless, the paper provides valuable perspectives from a UX designer's scientific viewpoint. Choudhury's objective is to examine the potential applications of AI in UX design and to identify which phases of the design process could benefit from AI. The paper discusses several AI systems, including Deep Neural Networks (DNNs), Generative Adversarial Networks (GANs), and Long Short-term Memory models (LSTMs). DNNs are found to be useful in mining variables from datasets, while LSTMs are considered to generate design feedback and suggest design alternatives. Additionally, GANs can produce design variations based on user feedback. The paper concludes that AI has the potential to significantly

enhance the efficiency of UX design.

2.2 Review of Experiments outside the Scientific Literature

The above review examined scientific literature from a variety of areas concerning the integration of AI with UX. However, a plethora of internet articles beyond the scope of scientific literature offer relevant insights to this paper. These sources describe experiments conducted by UX designers, which provide a glimpse into how they have experimented with different AI systems and approaches to their integration into UX design. Nonetheless, the primary limitation of these articles is their lack of peer review. As a result, it is important to note that these articles serve only to provide insight and should not be regarded as definitive sources for drawing conclusions. It is worth noting that it is not common practice for UX designers to write peer-reviewed scientific papers. Instead, UX designers tend to publish articles on the internet or create YouTube videos related to their field. Accordingly, to investigate the use of text-to-image generation in UX design, this paper explored articles where UX designers experimented with generative AI in combination with UX design.

The article by Nick Lawrence (2023), a highly experienced UX designer, focuses on the use of Midjourney. Lawrence describes his use of Midjourney to improve the visual appeal of an existing website landing page asset. Specifically, he combined the image of a VR headset with the landing page and uploaded it to Midjourney to generate a more stylish output, as shown in Figure 1.

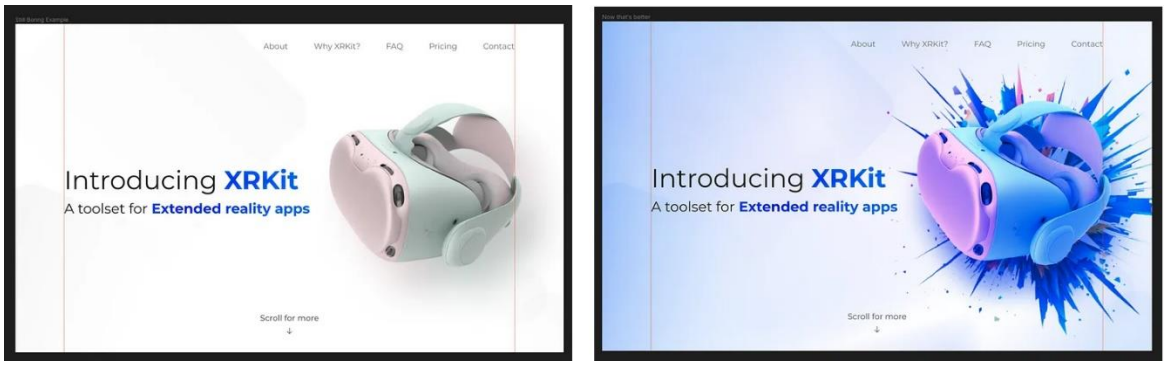


Figure 1: Improving existing assets with Midjourney. The interface on the left is a pre-existing asset not enhanced with Midjourney. The image on the right showcases the asset enhanced using Midjourney (Lawrence, 2023).

Although Midjourney is the focus, the principles discussed can be extended to other similar AI systems. According to Lawrence (2023), UX designers can leverage Midjourney to create design assets and combine them to produce desired products. While the article provides a brief exploration of Midjourney in the context of UX design, it has several limitations. Firstly, the article describes only one experiment with specific steps, limiting the generalizability of the findings. Secondly, the article focusses solely on UI design rather than UX design, as it evaluates only the aesthetic results of an asset and not user needs or system requirements. Therefore, the article does not fully explore how text-to-image generative AI systems like Midjourney can facilitate UX-friendly design practices.

Matthew Askari, a self-proclaimed "AI enthusiast" and UX designer, explored the potential of text-to-image models in UX/UI design (Askari, 2023). Although his article aims to compare DALL-E and Midjourney models to determine which one would be better, he argues that text-to-image models cannot produce UX-friendly designs due to their nature as image generation models.

According to Askari, the outputs might have good UX principles because the models are trained on existing images of interfaces, but using these models is still as rolling a dice (Askari, 2023). However, the author has not explored how text-to-image AI can assist in UX design beyond the use of prompts.

Julia Landgraf, another UX designer, wrote an article discussing the use of text-to-image generation for UX design purposes (Landgraf, 2023). In the article, Landgraf and her team used Midjourney and discussed how it could be used to create mood boards, as demonstrated in Figure 2. According to Landgraf et al. (2023), text-to-image generation can be useful in reducing the time it takes to create a mood board, especially as conveying a product's mood can be challenging. Landgraf explains that Midjourney can generate mood boards within seconds using specific prompts or by uploading a reference.

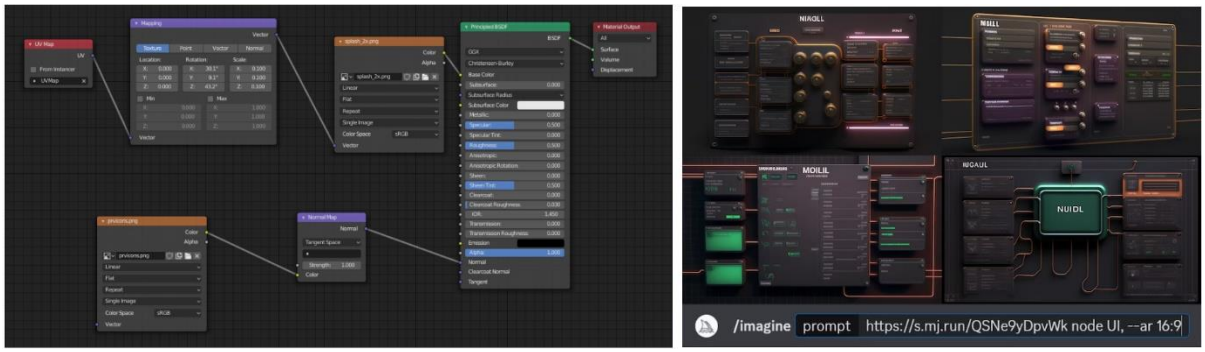


Figure 2: creating mood boards using the text-to-image generator called Midjourney. Landgraf uploaded a UI reference image left to Midjourney for the model to create a mood board right (Landgraf et al., 2023).

Landgraf et al (2023) also noted that text-to-image generation could be used to create icons using prompts, as shown in Figure 3. Depending on the generated results, the UX designer would need to use other tools to separate the icons from the background and edit the generated image accordingly.

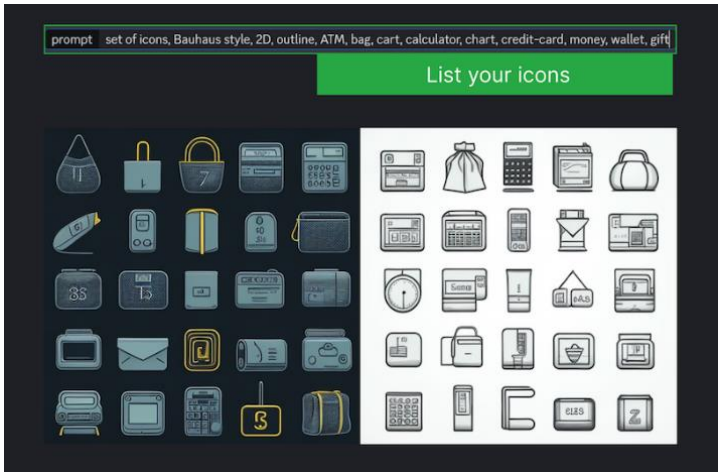


Figure 3: creating icons using the text-to-image generator called Midjourney. The image shows icons generated using Midjourney using specific design instructions (Landgraf et al., 2023).

A further advancement in text-to-image generation for user experience (UX) design was demonstrated by Monika Buchelt (2023) through the creation of a plant care website and application. In addition to using text-to-image generation to create the interface from scratch, Buchelt utilized the language model ChatGPT to generate the name, content outline, and textual

content. Buchelt employed Midjourney for interface generation, conducting 17 prompts to achieve the desired visualization. However, as Midjourney outputs results in images, further processing was required to implement the generated interface. Additionally, text-to-image generation models are not semantically trained, which may result in nonsensical outputs, as depicted in Figure 4. To utilize the generated output, Buchelt had to manually reconstruct the interfaces produced by Midjourney in alternative software while copying the content provided by ChatGPT. Despite the need for manual intervention and the requirement of several attempts, Buchelt acknowledged that utilizing these two artificial intelligence systems facilitated her work efficiency and speed.

Figure 4: Creating a website and application using text-to-image generation. On the **(left)** is the mobile version of the plant care application selected by the author. On the **(right)** is the website variant. Both variants are seen as having letters but do not make sense semantically (Buchelt, 2023).

The article's limitations the experiment's lack of user needs to guide it. The website or application was not created with a target group, or their user needs in mind, indicating a crucial omission in the UX design process. Although Buchelt suggests utilizing AI to improve existing templates, this was not attempted in the article. Similarly, Paul DelSignore (2022), used Midjourney to design mobile applications and website interfaces and concluded that text-to-image generation like Midjourney could be useful to inspire designers in the early stages of working with clients and prototyping.

Landgraf et al. (2023) present an article that explores various types of AI and their potential usefulness within UX design. It offers valuable insights into different AI models, including ChatGPT, a natural language processing (NLP) model developed by OpenAI. Landgraf et al. (2023) suggest that ChatGPT could be particularly helpful in creating UX personas for specific industries. The authors propose that ChatGPT is best used in the early stages of product development and with proto personas, which are ad-hoc versions of personas based on the designers' existing knowledge of users (Laubheimer, 2020).

NLP models such as ChatGPT have limitations that users should be aware of. OpenAI has acknowledged that ChatGPT can produce plausible sounding but incorrect or nonsensical responses (OpenAI, 2022), which could potentially mislead UX designers when integrated into the design process.

2.3 Summary

The review of related work has incorporated a range of literature sources, including peer-reviewed and non-peer-reviewed articles, to gain a comprehensive understanding of the application of artificial intelligence (AI) within the field of user experience (UX). The study has revealed that the process of manually building a product, particularly when modernizing an existing product, is often time-consuming. The current research focus in this area has been on exploring AI's potential to assist in the design of products, but less attention has been given to the user experience of using AI in this context. Machine learning (ML) has been identified as a means to process data and provide relevant information to the user in a user-friendly way.

The review highlights the important role that UX designers play in bridging the gap between the needs of the users and the use of an AI system. While concerns have been expressed about the usability of products designed by an AI system, the review suggests that the use of an AI system should not be based solely on the fact that it exists as a tool. Rather, there is a need to investigate how AI systems, such as ML, can be effectively integrated into existing design processes used by UX designers. Currently, there is a general lack of understanding among UX designers about how to use AI systems effectively as a tool, and no dedicated design process available for using AI in UX design. Although some UX designers believe that AI can be useful in the UX design process, particularly through the use of text-to-image models, there is a lack of attempts to use these models with actual user needs and target groups in mind. The experiment surveyed in this study show that designers generated interfaces and styles without a clear list of user needs or requirements to guide them in creating these interfaces. Despite AI's potential to improve UX design efficiency, there is currently no investigation into how to use AI for UX design in a working environment.

3. Methods & materials

In order to explore how a text-to-image model can aid UX designers in their design process, it is essential to define the tools and techniques being utilized. This section will examine wireframes, the specific text-to-image model employed for the experiments, and the parameters within which the experiments will be conducted.

3.1 Prompts

Midjourney utilizes prompts to generate images. However, there is no single approach to prompt setup, as it heavily relies on the intended image output. For instance, instructing the AI to create a portrait of a car vastly differs from requesting it to produce an application interface.

Documentation from Midjourney (n.d.) states that two prompt types exist, namely basic and advanced prompts. A basic prompt may consist of a single word, phrase, or even an emoji, as depicted in Figure 5. On the other hand, an advanced prompt can contain an image to be edited, a description similar to that of a basic prompt, and technical parameters to direct the AI on a more granular level. The parameters may specify the aspect ratio or version model the AI will employ to generate the image.

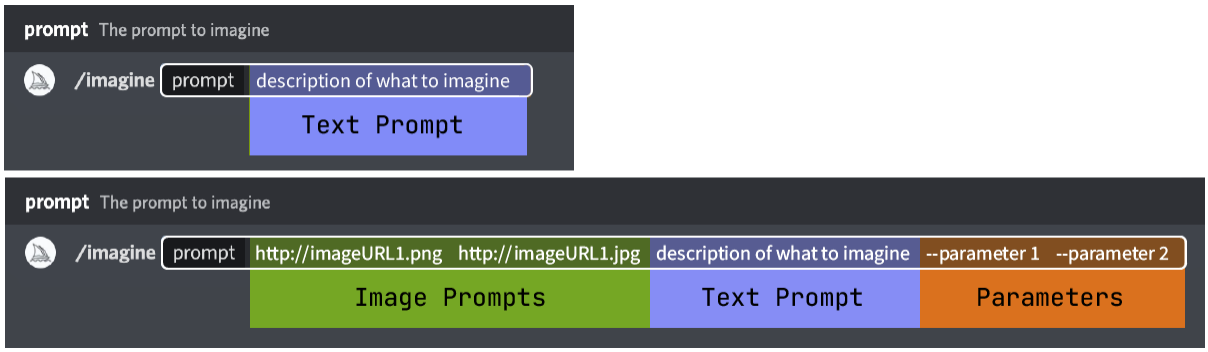


Figure 5. The use of different prompts. This figure shows a basic prompt setup **(top)** and a more advanced prompt setup **(bottom)** (Midjourney, n.d.).

Midjourney offers a range of parameters that aid in configuring the desired outcome. Notably, several noteworthy parameters are available, including the 'chaos' parameter, the 'version' parameter, and the 'image weight' parameter. The default value for this parameter is 1.

The 'chaos' parameter (--c) serves to direct the AI in generating unexpected outcomes at a specified level, with levels ranging between 0 and 100. Increasing the parameter value results in more unconventional and unreliable outputs (Midjourney, n.d.). The default value for this parameter is 0.

When using a reference image, the 'image weight' parameter (--iw) can be utilized to adjust the image's relevance to the text prompt. Acceptable values for this parameter range between 0.5 and 2, with higher values indicating greater emphasis on the image in the generated result.

The 'version' parameter (--v or --version) facilitates selection of the desired version of Midjourney, with the latest version serving as the default option. However, if desired, an earlier version of the AI can be selected using this parameter. Presently, version 5 of Midjourney is the latest version available for users.

3.2 Wireframes variations

Wireframes can come in various designs, either hand-drawn or created using software tools. Hand-drawn wireframes are sketches that can be regarded as low-fidelity, while software wireframes can be mid or high-fidelity. Certain software, such as Figma, allows wireframing to be designed manually with consistent and clean lines and shapes, as illustrated in Figure 6. Conversely, other software, such as Balsamiq, utilizes electronic patterns that still have a hand-drawn shape style, as demonstrated in Figure 7.

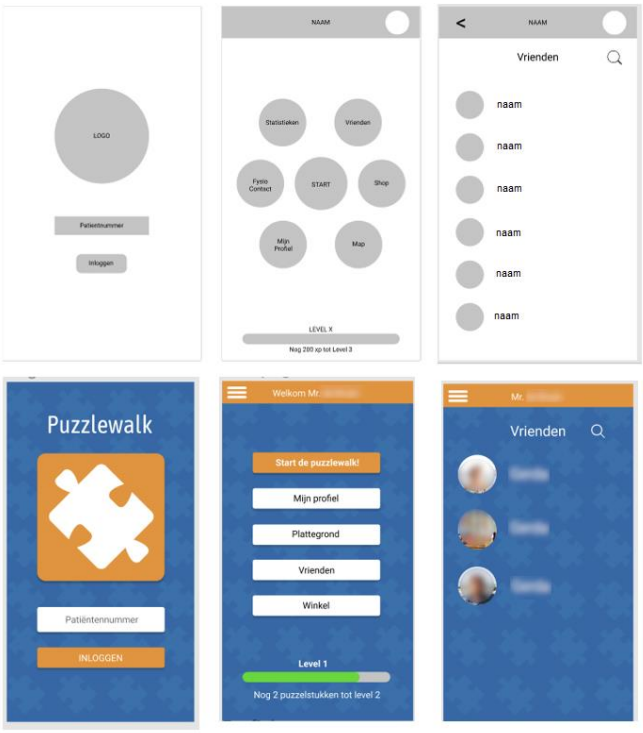


Figure 6: Wireframes of a mobile application created in Figma. Here we see the wireframes at the top and at the bottom is the final design for a mobile application depicted.

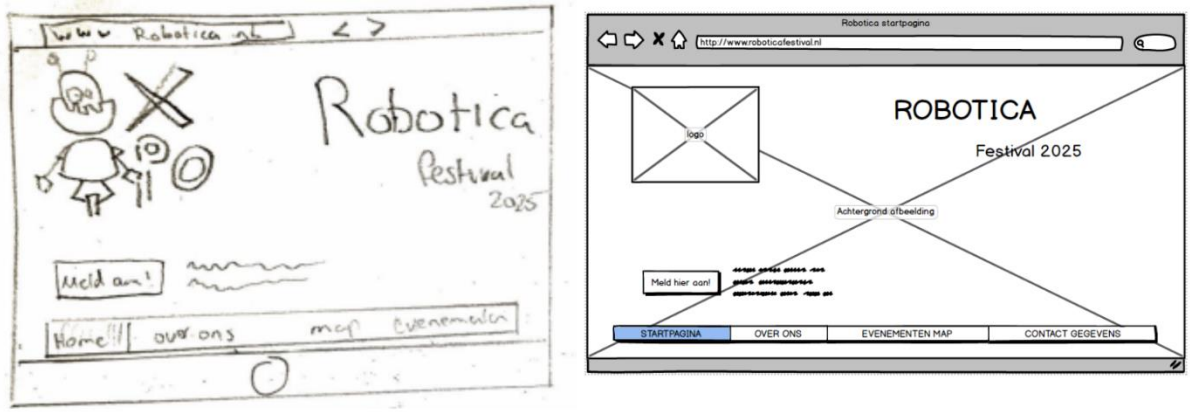


Figure 7: Wireframes of a website interface hand-drawn (low-fidelity) and re-created in Balsamiq (mid-fidelity). An interface of a landing page is both drawn by hand **(left)** and in the Balsamiq tool **(right)**.

In the realm of UX/UI design, wireframes exhibit diverse designs, as each designer or design agency applies its own style in creating them. While some designers craft their own wireframes, others rely

on tools to aid them. Although there exist numerous examples of wireframe designs, this research demonstrates two examples of different wireframe designs of the same interface, as depicted in Figure 8. However, what all wireframes share in common is that they represent the initial phases of interface design and are not intended to be final products.

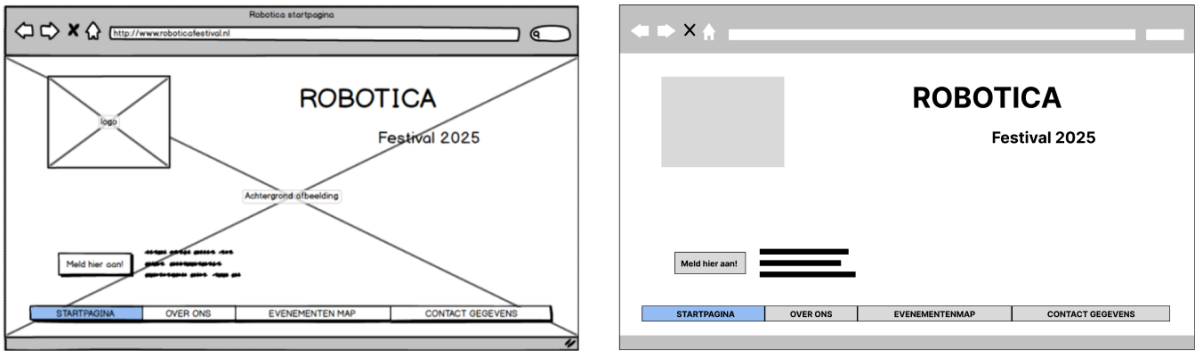


Figure 8: Two mid-fidelity wireframe variations. Here we see two different variants of the same website interface. They are near pixel-perfect copies when it comes to pattern sizes. The left is made using a design tool named Balsamiq and the one on the right with a tool named Figma.

3.3 Pre-evaluation Experimentations

Given the diversity in wireframe design approaches, it is essential to examine the types of wireframes that the AI system can process. In this study, mid-fidelity wireframes that are not hand-drawn have been selected as they tend to be more consistent in their patterns. Unlike hand-drawn wireframes, which rely heavily on the designer's drawing abilities, employing software tools that facilitate the creation of "universally known" wireframe designs would be the most appropriate approach.

3.3.1 Experiment 1: Testing wireframe design variations

The initial experiment entails an A/B test aimed at assessing the efficacy of the AI system in generating two distinct designs, illustrated in Figure 8. Specifically, both designs pertain to a wireframe interface serving as a website landing page, albeit portrayed in two different fashions.

The test procedure involves uploading each wireframe to Midjourney and prompting the AI system to generate a corresponding design using an identical prompt, as described in section '3.4.4 Prompt setup for experiments'. The ultimate objective of this first experiment is to identify the wireframe variation deemed most suitable for conducting subsequent experiments.

3.3.2 Experiment 2: Testing wireframe element variations and prompt formulas

The subsequent experiment serves three distinct purposes. The foremost objective entails examining the performance of a text-to-image model concerning mobile-based design. This implies that the experiment will incorporate wireframes adhering to the style selected in experiment 1 but tailored to a mobile interface, as opposed to a desktop interface. Given that UX designers frequently devise mobile applications, this experiment seeks to scrutinize the capabilities of a text-to-image model concerning mobile-based design. Figure 9 depicts the mobile wireframes utilized in this experiment, which are based on the style created with Figma but subject to certain modifications. A

rationale for selecting this wireframe style is outlined in section '3.4.2 Experiment 1: Wireframe comparison results'.

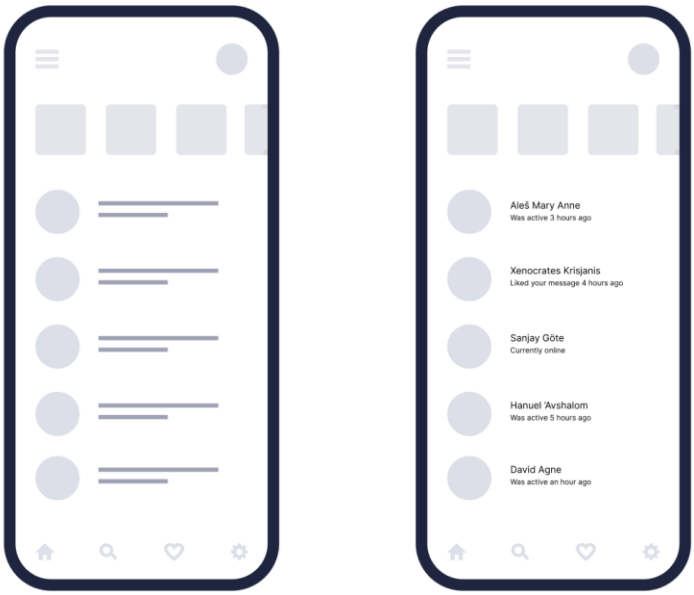


Figure 9: Mobile wireframe variants of the same social media interface. Variant A on the left has lines representing the text while variant B on the right has text included.

The wireframes depicted in Figure 9 employ distinct shapes to represent different design patterns. The ellipses serve as placeholders for profile picture icons, while the three smaller lines on the top left depict a 'hamburger icon' used for navigating to the application's menu. The four icons displayed at the bottom are intended to facilitate navigation through the application. Additionally, the squares present on the upper half of the interface serve as placeholders for images.

As illustrated in Figure 9, the wireframes are nearly identical, except for the way text is represented. Variant A uses lines to represent text, whereas variant B includes actual text. The second objective of this experiment is to examine the impact of using lines versus actual text in wireframes for representing text.

The third objective of this experiment is to evaluate the effectiveness of two different prompt formulas, which are described in section '3.3.4 Prompt setup for experiments'. Both variant A and variant B are tested using two different formulas to assess the differences in the generated results. The aim is to determine not only which wireframe variant yields superior results for the same style, but also which wireframe formula produces better outcomes.

Each wireframe from Figure 9 is subjected to individual testing within the AI model using both prompt formulas, and the variations of the formulas presented in table 4. To account for the stochastic nature of text-to-image models, each variation is regenerated four times.

3.3.3 Experiment 3: Exploring the effect of additional parameters

The third experiment is aimed at investigating the effectiveness of additional parameters included within prompts when utilizing a wireframe as a reference. This experiment seeks to determine whether including additional parameters in the generation process is beneficial when working with wireframes as references, as well as what differences can be observed in the

generated output. As detailed in section 3.1.2, there are three types of parameters that can be included in prompts: version, image weight, and chaos. During the first two experiments, the version parameter was utilized, enabling the selection of the AI model's latest version. The third experiment focuses on the image weight (--iw) and chaos (--c) parameters. These parameters afford the user more control over the AI model's image generation by adjusting the reference image's level of importance or requesting more or less unusual results. Because the default image weight (--iw) value is 1, this experiment will explore the effects when the value is reduced to 0.5 and increased to 2.

The default value of the chaos (--c) parameter is set to 0. Despite this parameter's minimal initial value, even a slight increase can significantly impact the generated result. However, pushing its value to the extreme (i.e., 100) could render the results useless. This experiment aimed to assess the effects of modifying the chaos parameter on the generated interface when values of 10 and 20 were applied. These values are considered to be relatively low. Additionally, the experiment explored the impact of using even lower values of 0.5 and 2 to determine whether the use of the parameter at lower values could yield better results. The primary objective of experimenting with the chaos parameter was to evaluate its potential as a valuable tool in UX design.

The image weight and chaos parameters will initially be tested individually to gauge their individual effects before being combined to evaluate their combined effect. Table 3 in section 3.4.4 outlines the sequence in which the parameters will be tested. Both prompt formulas presented in Table 2 will be employed in this experiment, each containing the same variant. Thus, both formulas will be tested twice to determine the impact of the parameters on each formula and to assess whether the use of a different formula could affect parameter results.

3.3.4 Prompt setup for experiments.

Text-to-image models rely heavily on the prompt used to instruct the AI model on what to generate. The prompt serves as the model's contextual guide. In section 3.1.2 Prompts, a differentiation between basic text prompts and advanced prompts was expounded. For the purpose of the experiments, the utilization of an advanced prompt setup is deemed most appropriate. The concept behind this approach was inspired by UX designer Christie C. (2023) who provided a compilation of forty examples of prompts designed to assist in UI design. A subset of prompts recommended by Christie C. (2023) is presented in Table 1.

Table 1: Five examples of different text prompts using the same formula suggested by Christie C. (2023).

1	UI design of a Forest Exploration Game, Landing Page --ar 4:3 --v 5
2	UI design of a Forest Exploration Game, Landing Page on a Tablet --ar 4:3 --v 5
3	UI design of a Motorbike with 3D illustration, Landing page, Modern, Classy, Minimalistic, High Resolution ---ar 4:3 --v 5
4	UI Design of a Real Estate Agency, Landing page, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --ar 4:3 --v 5
5	UI Design of a Headphone with 3D Illustration, Landing page, Sci-fi, High-tech, Futuristic, Trending UI color on Dribble, High Resolution --ar 4:3 --v 5

It is apparent that the construction of prompts plays a crucial role in facilitating the text-to-image model in generating appropriate visualizations. The implementation of an advanced prompt setup is deemed most appropriate for the experimentation, as discussed in the section '4.1.2 Prompts'.

Christie C. (2023) provided a comprehensive set of forty prompts specifically catered to UI design, examples of which are provided in Table 1. Notably, each prompt begins with “UI Design” to ensure that the AI model is aware of the desired outcome. The author has also implemented certain parameters in the prompt such as an aspect ratio of 4:3 and version 5 of the AI model, separated by dashes in accordance with Midjourney's (n.d.) documentation. The keywords between “UI Design” and the parameters provide specific instructions to the AI model regarding the desired visualization. Although the aspect ratio used is based on preference, it has been included in the first experiment, which focuses on the landing page of a website.

The paper has opted for a limit of two prompt formulas, given the vast number of ways to construct prompts for text-to-image models like Midjourney. The formulas used in each pre-evaluation experiment are shown in Table 2. The first formula, beginning with “UI design” followed by a context description, is suggested by Christie C. (2023), while the second formula, starting with a context description followed by “UI design”, is a reconstruction of the first formula that provides the exact same instructions.

Table 2. Formulas used within each experiment. The text highlighted in bold is static.

Experiment 1	/imagine **URL to an image, UI design** context description, optional design instructions **--ar 4:3 --v 5**
Experiment 1 - 3	/imagine **URL to an image, UI design** context description, optional design instructions **--v 5**
Experiment 1 - 3	/imagine **URL to an image,** context description **UI design,** optional design instructions **--v 5**
Experiment 3	**--iw** <value number> **--c** <value number> **--v 5**

In Table 3, the specific prompts utilized in each of the three experiments are presented. As the prompt formulas provide users with the freedom to set up their own prompt and AI instructions to achieve their desired result, a maximum of two prompt variations were selected for each experiment to avoid the potential for a combinatory explosion of possible variations.

Table 3. Exact formulas and parameters and the order they are being used within each experiment.

Prompts used during Experiment 1	Prompts used during Experiment 2	Parameters used during Experiment 3
UI design of a robot festival, Landing page, Modern, Classy, High end, High Resolution --ar 4:3 --v 5	UI design of a social media app, Modern, Classy, High end, High Resolution --v 5	--iw 0.5 --v 5
UI Design of a robot festival, Landing page, Modern, Classy, Minimalistic, Trending Blue Color	Social media app UI, Modern, Classy, High end, High Resolution --v 5	--iw 2 --v 5

Palette on Dribble, High Resolution --ar 4:3 --v 5		
	UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	--iw 0.5 --v5
	Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	--c 10 --v 5
		--c 20 –v 5
		--c 0.5 --v 5
		--c 2 –v 5
		--iw 2 --c 2 --v 5
		--iw 0.5 --c 2 --v 5
		--iw 2 --c 0.5 --v 5
		--iw 0.5 --c 0.5 --v 5

3.4 Experimentation Results

This section presents the outcomes of the wireframes, prompts, and parameter experiments, followed by an analysis based on an evaluation criteria that is elaborated upon in this section. Additionally, the key findings and insights derived from the pre-evaluation experiments are discussed, along with the limitations associated with them.

3.4.1 Evaluation criteria

In this study, the evaluation of the generated results is based on specific criteria. Namely, the AI model's ability to adhere to the elements presented within the wireframes. To aid in the evaluation process, a wireframe is presented in Figure 10, with highlighted areas indicating the elements and their respective positions that a generated result is expected to have. The evaluation criteria not only consider the presence of the elements within the highlighted areas, but also their correct placement and shape.

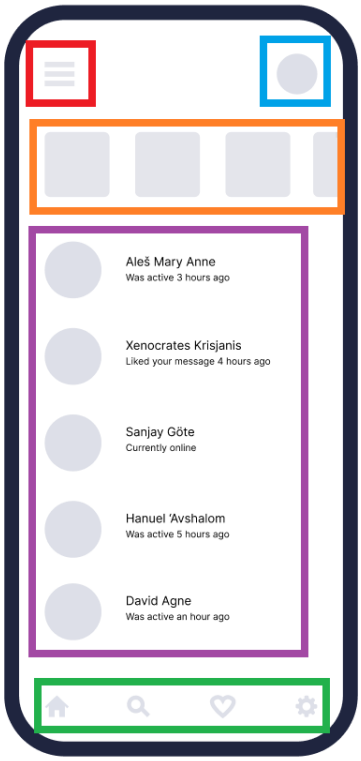


Figure 10: Areas of evaluation. Five areas with different elements and positions are highlighted that will lead the evaluation of the interfaces generated by the text-to-image model.

The aim of utilizing a wireframe as a point of reference is to generate a result that closely resembles the corresponding wireframe used as a reference, rather than a result that deviates significantly from the wireframe. Although it is not anticipated that the AI model will produce results that precisely match the wireframes, the arrangement of the elements, even if mirrored, is a critical evaluation criterion. The AI model can reflect the elements concerning the position depicted in the wireframe. It is vital that the same components illustrated in the wireframe, such as images, buttons, and text, are not only present in the generated outcome but are also organized closely to the wireframe.

3.4.2 Experiment 1: Wireframe comparison results

The evaluation of the text-to-image generation model indicated that although the generated results varied with each new prompt, the interface generated did not fully reflect the wireframe when it came to placing elements such as text, images, and buttons. The AI model used the wireframe as a reference but did not directly replace the elements of the wireframe with the correct visual elements without distorting the presented structure. The visual elements were spread across with little regard to the structure presented by the wireframe. Although some generated results came close to the wireframe's structure, the elements were not entirely replaced as expected.

The text-to-image model included the title; however, it was not always placed in the correct position, and it was unclear what caused the text under the title. It was either caused by the lines next to the button as shown in Figure 8, or by the sub-title.

The wireframe made in Figma, as depicted in Figure 8, was the more suitable variation to conduct experiments on. This is because the Balsamiq wireframe, also shown in Figure 8, caused the AI to generate a more "hand-drawn-styled" interface due to the hand-drawn style that the Balsamiq variation is built on. As the wireframe is a reference being used, the AI took the hand-drawn style into consideration when generating a result, causing the elements and images to also have a hand-drawn style. Figure 11 illustrates that the Balsamiq wireframe led to a more hand-drawn design on the left, while the Figma variant resulted in a more modern design on the right.

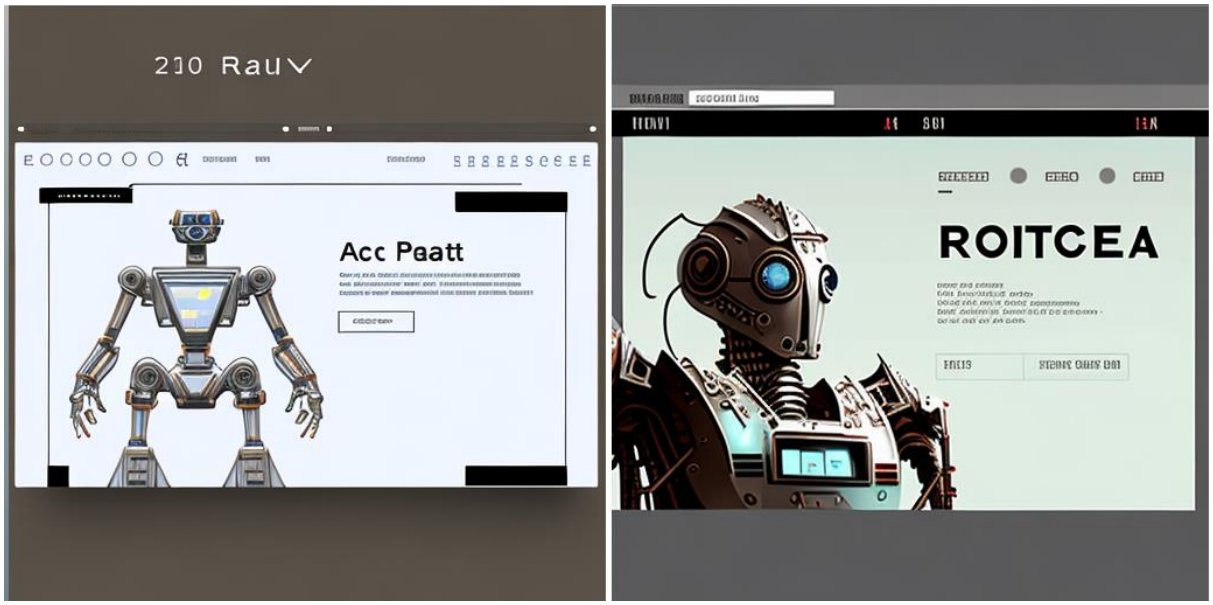


Figure 11: Two generated results using both Balsamiq and Figma wireframes. The interface based on the Balsamiq-styled wireframe on the left resulted in a hand-drawn styled interface. Whereas the interface using the Figma wireframe on the right resulted in a modern design.

The Balsamiq version of the wireframe was deemed unsuitable due to a particular feature incorporated in the design. Specifically, crosses within the image placeholders were used to denote the position of the image. The Balsamiq version employs crosses within rectangles and squares to represent a placeholder for an image. Nonetheless, the AI model takes the lines of these crosses into consideration, and they only create disorder within the generation process. This effect is clearly demonstrated in Figure 12. Conversely, no such issue arose in the generated results utilizing the Figma version.

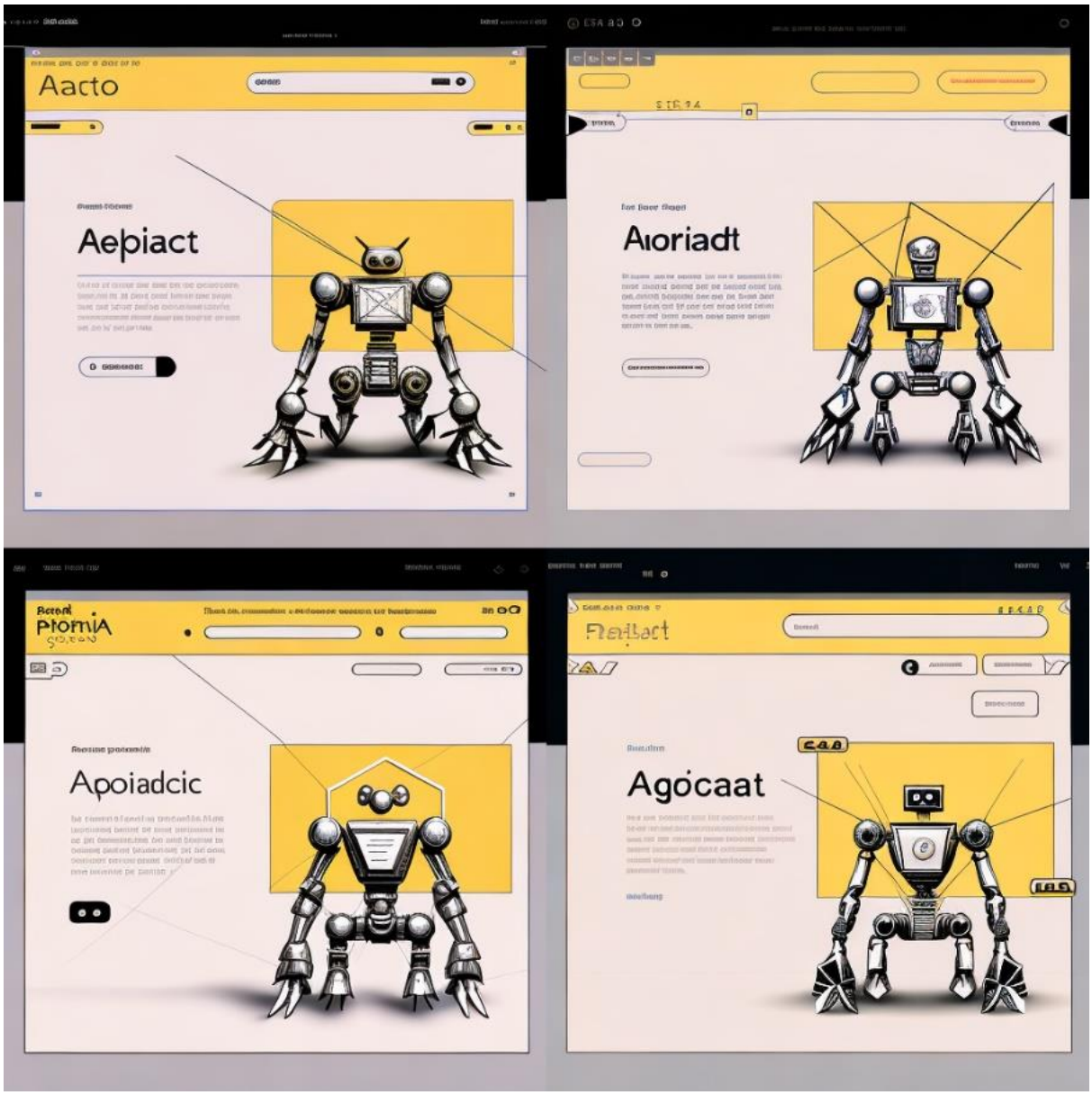


Figure 12: The image placeholder of the Balsamiq wireframe causing clutter in the interface. Here are four examples of generated interfaces where the AI model has not replaced the rectangular placeholder but is rather incorporating the placeholder in the generated result.

The findings of the experiment reveal that the Figma wireframe version yielded outcomes which are diametrically opposed to its Balsamiq counterpart. The simplistic nature of the elements within the Figma version resulted in a greater reliance on the prompt by the AI model to generate results. This factor rendered the Figma version as the more suitable wireframe configuration to gene rate results. An intriguing discovery is that the Figma wireframe contains both text and rectangular lines, which serve as placeholders for text. The AI model was able to interpret the thick lines as text and, as a result, transform these lines into text, showcasing the model's ability to identify and interpret such nuances in the wireframe.

3.4.3 Experiment 2: Wireframe element variations and prompt formulas results

In the second experiment, both wireframe variations demonstrated similar results as in the first experiment in terms of the structure of elements. While the text-to-image model employed the wireframes as a reference, it generated new elements stochastically, thereby distorting the

structure. The majority of the generated interfaces differed significantly from the wireframes, with several missing or improperly structured elements. As shown in Figure 13, four interfaces that are inconsistent with the wireframes are presented as examples. The AI model did consider the ellipses, squares, icons, and text within these examples. However, several of these elements are either not in the appropriate shape or are not placed correctly. In certain interfaces, the square elements are converted into rectangles and even placed beyond the interface itself.

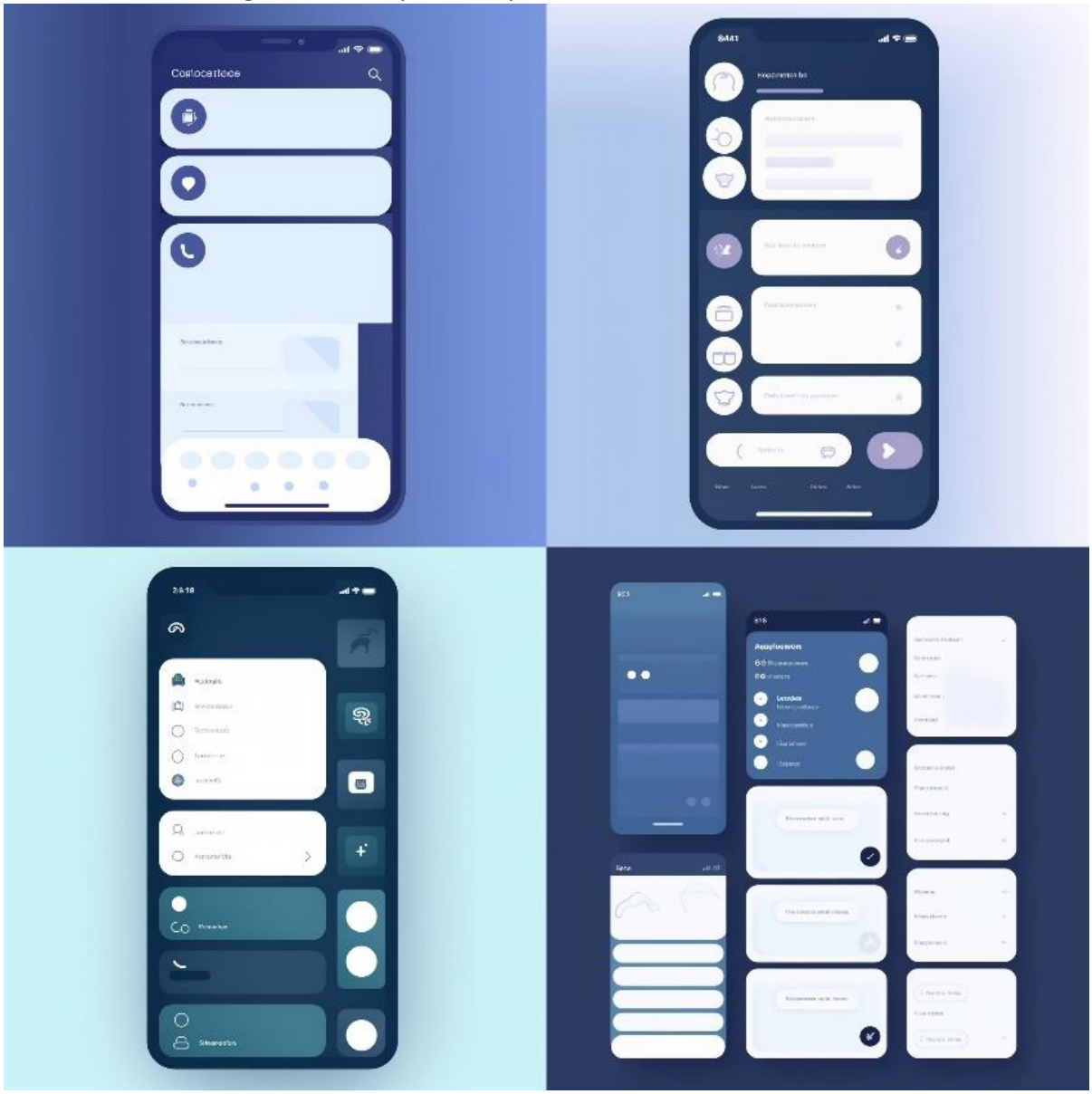


Figure 13: Unstructured Interfaces. Four different generation results show interfaces that make use of certain elements from the wireframe like icons and ellipses but are not structured properly.

In regard to wireframe variant A, certain generated outcomes exhibit some degree of similarity with the wireframe, as depicted in Figure 14. While the majority of the structure remains consistent in relation to the wireframe, some elements are misplaced or of an incorrect shape. Figure 14 displays three interfaces generated by the AI model using the wireframe with lines representing text, as illustrated on the left side (variant A) in Figure 9.

The left-most interface has managed to integrate user profile pictures in an ellipse shape, with corresponding names displayed alongside. It has also incorporated the primary user's profile, albeit incorrectly positioned. The wireframe depicts only five ellipses of users on the screen, while the AI

model exhibits seven. Additionally, the absence of square elements for the stories represents a clear flaw in the generated result. The AI model only produces one rectangular story element, spanning the entire width of the screen. The 'hamburger menu' icon, which should be placed in the top left corner, as well as the navigation icons at the bottom of the screen, are also missing.

The middle interface maintains the same number of ellipses for other users as in the wireframe, that is, five. It has also included four story icons, albeit with shapes differing from rectangles. In this interface, the ellipses for the main user's profile, intended to be placed on the top right, are missing, as are the 'hamburger menu' icon and navigation icons.

The right-most interface bears little resemblance to the other interfaces or the wireframe. Here, the AI model has placed greater emphasis on icons, replacing all profile pictures with icons. Notably, this interface exhibits navigation icons at the bottom of the screen, which are absent in the other two interfaces. However, even this interface has its flaws. The wireframe contains four navigation icons, while the generated interface exhibits five. The icons displayed differ substantially from the navigation icons presented in the wireframe. Another noteworthy observation is that the AI model has replaced the lines, which serve as placeholders, with text.

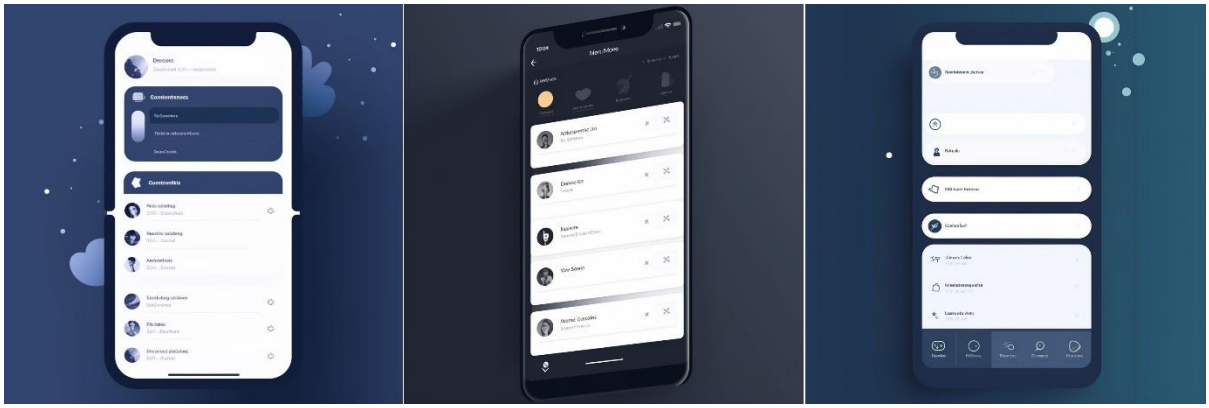


Figure 14: Generated interfaces using wireframe variant A having some resemblance to the wireframe. The first interface on the far left shows the profile pictures of users and the main user. The second interface in the center shows the user profiles, names, and stories. The third interface on the far right shows the navigation icons at the bottom of the interface.

Wireframe variant B utilizing actual text in lieu of a placeholder has demonstrated superior outcomes. Despite the stochastic addition of new elements, omission of elements, and reorganization of the layout in relation to the wireframe, the AI model exhibits greater consistency in accurately placing the user profiles and names in the designated areas, as highlighted in purple in Figure 10.

In Figure 15, three images resembling the wireframe in specific areas are depicted. The image on the far-left features navigation icons at the bottom of the screen, user profiles with names, a rectangle and squares representing the stories, and a hamburger menu on the top left. However, the main user's profile is not included in the top right corner; instead, the AI model utilized a placeholder element. Additionally, the square elements vertically distributed across the screen were improvised by the AI model and are not present in the wireframe.

The second image at the center displays two interfaces. Both interfaces include navigation icons and user profile icons with names, with the prominent interface positioned on the right. However, there is an inconsistency relative to the wireframe in which the sub-text appears below the user profile icons, whereas the wireframe depicts it situated directly under the name adjacent to the user profile

icons. The main user's profile picture and the hamburger menu icon are absent from this generated interface. Instead, a dark rectangle in the upper part of the interface displays icons with accompanying text, which replaced the rectangular story icons in the wireframe.

The third interface on the far right also contains two distinct interfaces, with the prominent one located on the left. In contrast to the other generated interfaces discussed thus far, the only similarity this interface shares with the wireframe lies in the user profile icons and names. Interestingly, a significant number of user profile icons and names are integrated into a rectangular form, which does not correspond to the wireframe.

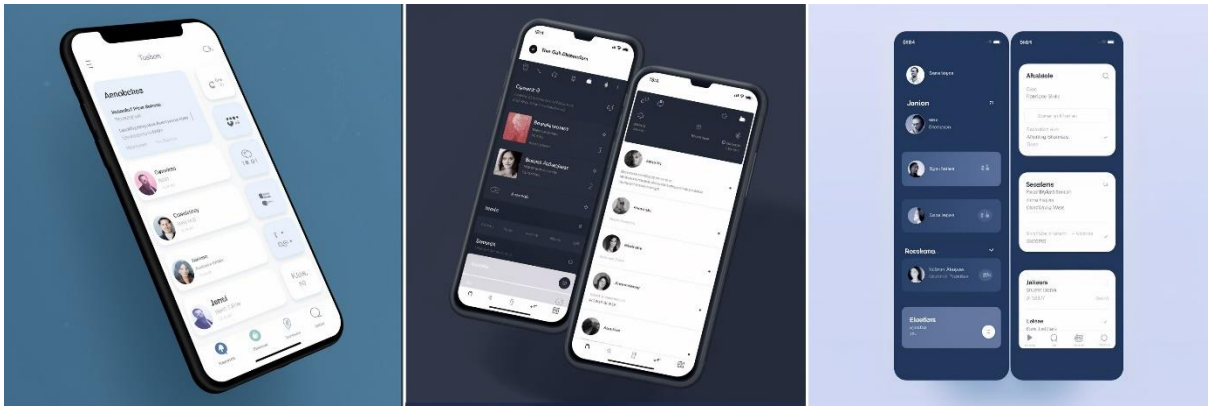


Figure 15. Generated interfaces using wireframe variant B.

Regarding the utilization of various formulas and their corresponding variants, the text-to-image model generates results in a stochastic manner. Although both formulas produce analogous outcomes, most of the generated results do not bear a resemblance to the wireframe except for a few interfaces. Altering the instructions' descriptions has an impact on the generated outcomes, as exemplified by the prompt containing the instruction 'Blue Color Palette on Dribbble'. This instruction resulted in interfaces with a blue color scheme in contrast to the prompt variation lacking this instruction. Achieving a generation that imitates the wireframe is largely dependent on chance and may necessitate several attempts to accomplish.

3.4.4 Experiment 3: Prompt parameters results.

3.4.4.1 Image weight parameter results

By increasing the image weight (--iw) parameter to 2, the text-to-image model produced more interfaces with white and light grey colors. This is because the wireframe, which consists of a white background and light grey-colored elements, was given more importance in the model's decision-making process than the instructions provided in the prompt. On the other hand, decreasing the image weight (--iw) to 0.5 caused the model to prioritize the prompt instructions, resulting in interfaces with a blue color palette and darker backgrounds and elements. However, as shown in Figure 16, an image weight of 2 also produced some darker interfaces.

Increasing the image weight (--iw) to 2 allowed the model to successfully generate elements such as user profile icons, names, sub-text, and rectangular shapes. However, the generated interfaces still lacked consistent structure. Figure 16 shows that this was the first time the model successfully generated story icons within rectangles and placed them horizontally side by side, but this was not enough to improve the structure of most generated interfaces.

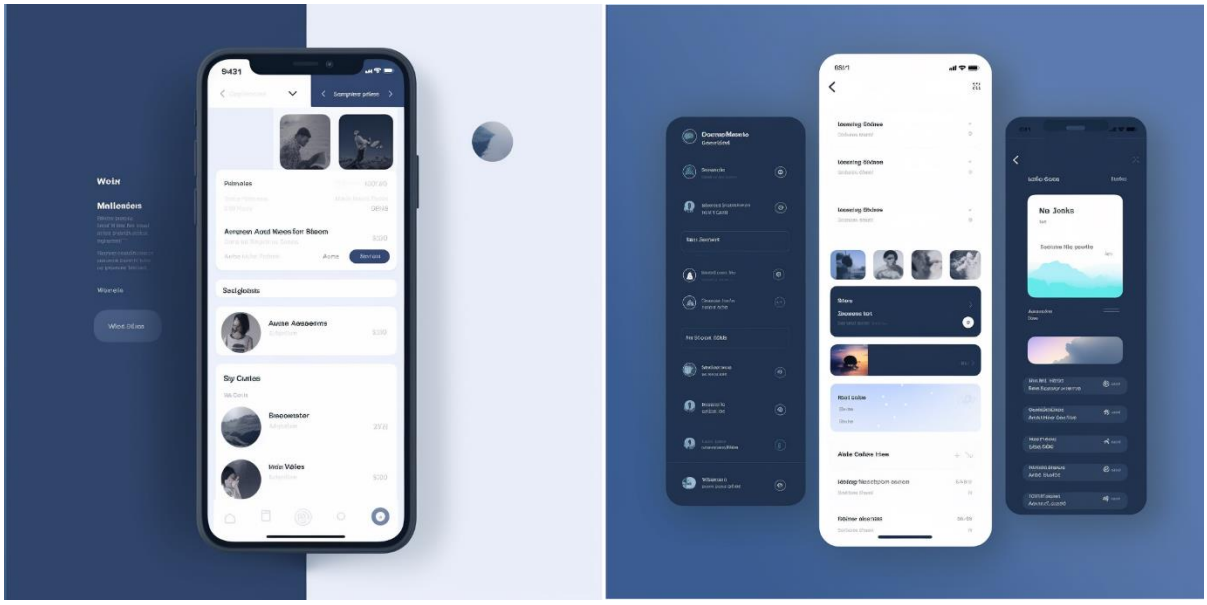


Figure 16: Successful story icon generations using the image weight parameter with a value of 2. The interface within the first image on the left contains three story icons in the right shapes within the upper half of the screen. The second interface within the second image on the right contains four story icons in the middle of the center screen.

In the pursuit of improving the generation of interfaces that closely resemble the wireframe, reducing the value of the image weight to 0.5 did not yield a significant improvement. While this setting did result in some interfaces having structured user profile icons and squared story icons, many generated interfaces still did not resemble the wireframe structure. Figure 17 provides an illustration of this outcome. Similarly, increasing the value of the image weight to 2 resulted in more interfaces having white and light grey colors but did not improve the structure of most generated interfaces. Therefore, neither increasing nor decreasing the image weight led to substantial improvements in generation outcomes.

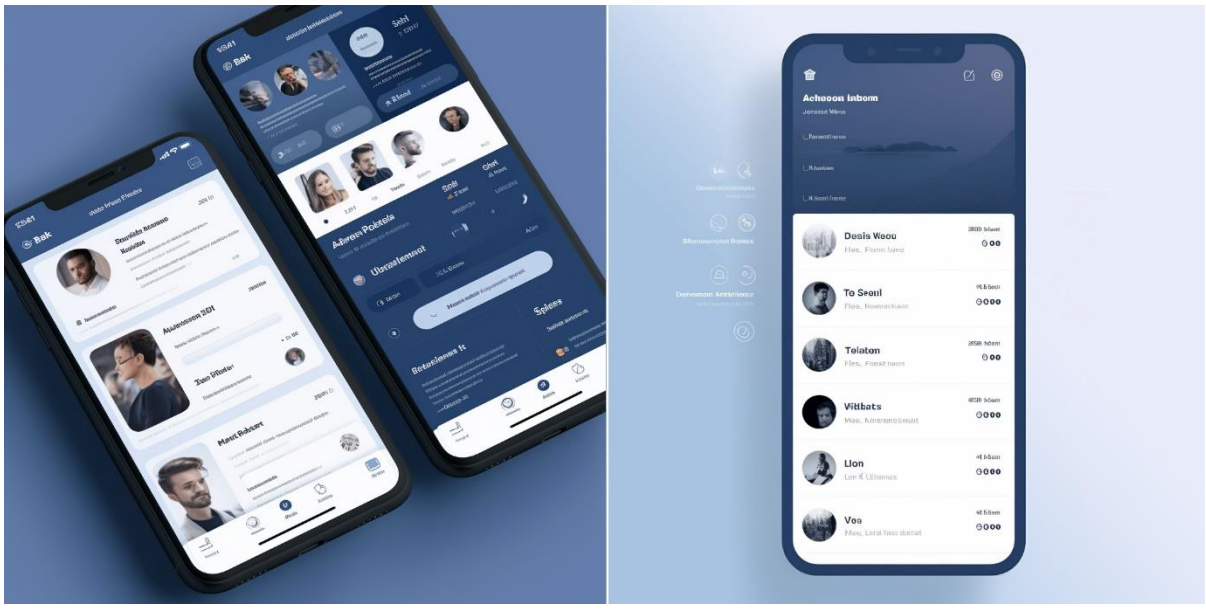


Figure 17. Story or user profile icons are generated successfully using the image weight parameter with a value of 0.5.

3.4.4.2. Chaos parameter results

The present study investigated the effects of varying the chaos parameter on the generated interfaces. Results indicated that setting the chaos (--c) parameter to 0.5, 2, 10, or 20 did not yield any improvement in the generated interfaces' structure compared to the default setting. However, when chaos values of 10 and 20, a 10% and 20% increase from the default setting, respectively, were utilized, the AI model generated interfaces that were completely unrelated to the wireframe's structure, elements, and colors. While setting the value to 10 resulted in many unusual interfaces that bore no resemblance to the wireframe (with some exceptions), it was found that these interfaces were consistently better than those generated by setting the value to 20. Figure 18 displays two sample interfaces, with the left image showing an interface generated using a value level of 10 and the right image having a value level of 20.

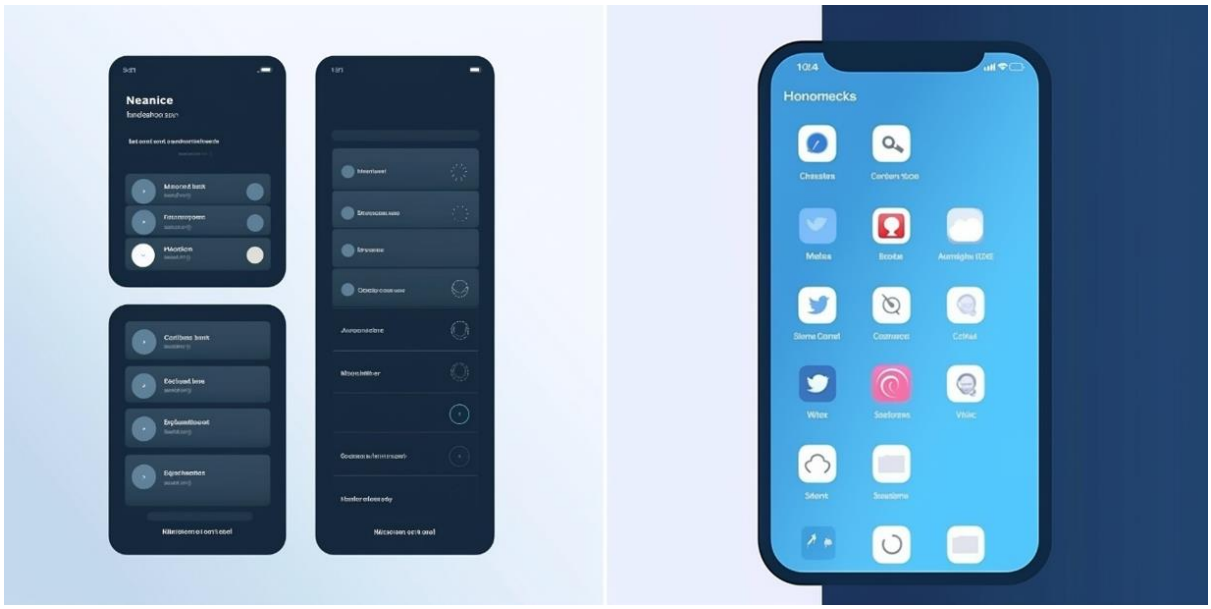


Figure 18: Two interfaces generated with chaos values of 10 and 20. In this analysis, two images generated using different values for the chaos parameter are presented. The first image on the left was produced using a value level of 10, which led to some resemblance to the wireframe with regards to the user profiles being displayed in rows along with the corresponding text. In contrast, the second image on the right was generated using a value level of 20. In comparison to the wireframe, this image showed no resemblance to the structure, or the elements used in the wireframe, except for the presence of rectangles.

A further examination of the chaos parameter's impact on the generated interfaces revealed that a value of 2 resulted in improved outcomes relative to values of 10 and 20. At a setting of 2, the AI model was able to generate interfaces that bore some resemblance to the wireframe's structure, albeit with occasional distortions. However, the generated results at a value of 0.5 were more accurate than those generated at a value of 2. While interfaces consistent with the wireframe in terms of user profile icons and names were generated by chance using both values of 0.5 and 2, the generated interfaces lacked other essential elements such as the navigation icons, main user profile icon on top, and the 'hamburger menu' icon (see Figure 19).

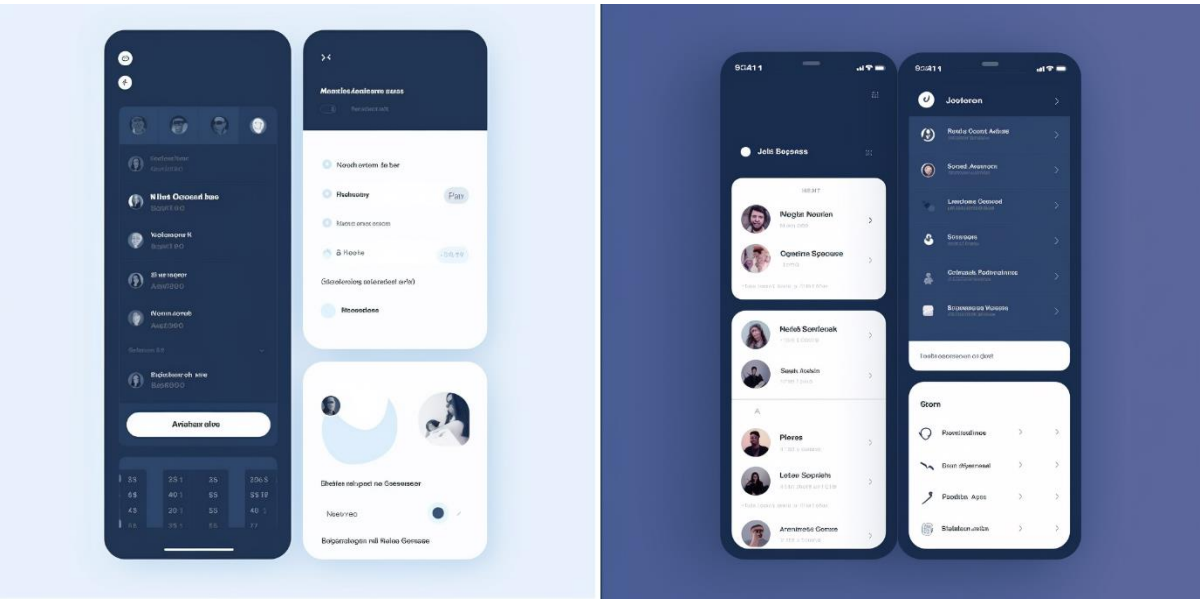


Figure 19. Interfaces using the chaos parameter led to some elements being generated in accordance with the wireframe. The first interface of the image on the left has a chaos level of 0.5 and contains the user profile icons as well as four story icons. The interface on the left side of the image on the right used a chaos level of 2 and only successfully implemented the user profile icons and names.

3.4.4.4. Results of combining both parameters

The experimental results revealed that setting both the image weight (--iw) and chaos (--c) parameters to 2 did not improve the structure of elements in generated interfaces relative to the wireframe. Instead, this setting resulted in an increase of interfaces with symmetrically structured elements and a balance of light and darker colors, as depicted in Figure 20. Notably, these interfaces featured squared boxes containing either text, user profile icons, or icons.

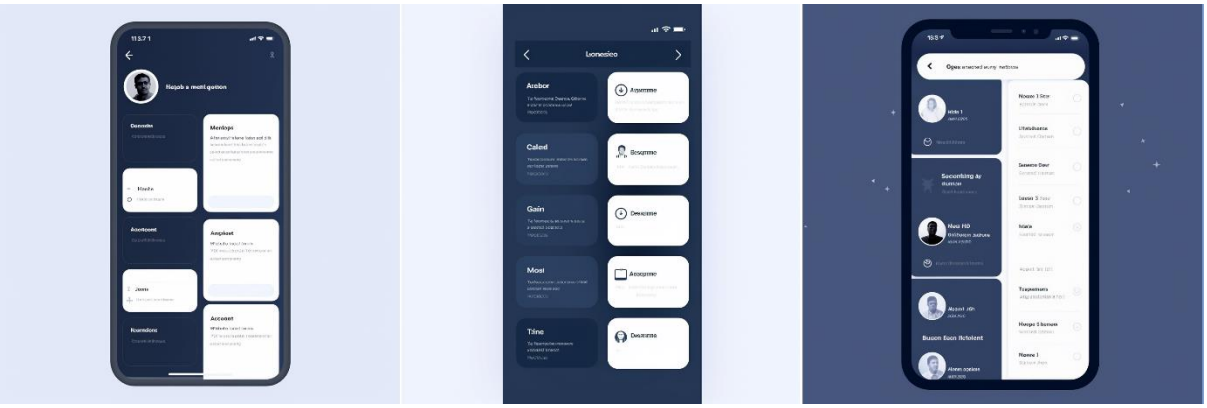


Figure 20: Setting both image weight and chaos parameters to 2 results in a balance in color and symmetrically structured elements.

Reducing the value of the image weight parameter (--iw) to 0.5, while keeping the value of the chaos parameter (--c) at 2, generated more interfaces with darker backgrounds and elements. This is in contrast to setting the image weight parameter to 2, which resulted in interfaces with lighter colors, consistent with the wireframe. Combining an image weight parameter of 0.5 with a chaos parameter of 2 led to the generation of some lighter-colored or mixed-colored interfaces with elements placed

randomly, as illustrated in Figure 20. Although some structured interfaces were produced using these parameters, they still contained randomly placed elements that distorted the overall structure of the interface, as also demonstrated in Figure 21.

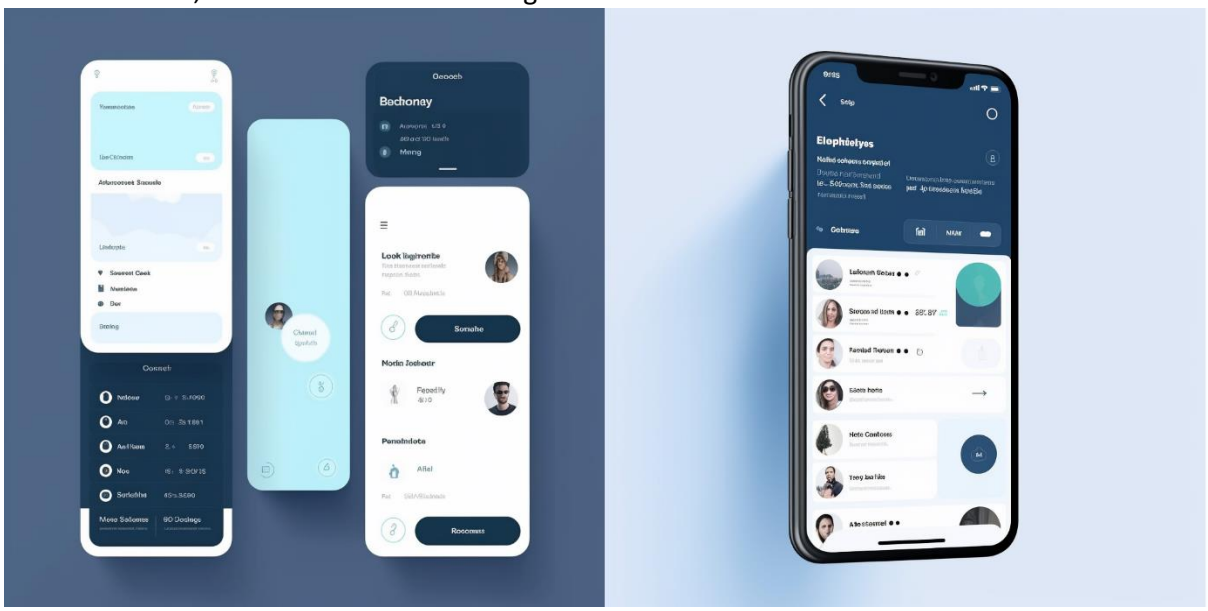


Figure 21: Interfaces using an image weight value of 0.5 and a chaos value of 2. Due to the chaos value being high, elements are randomly placed across the screen. The interface on the (right) managed to maintain some structure with the user profiles despite ellipses being placed in areas that cause the structure to become distorted.

Increasing the image weight (--iw) parameter to 2 and decreasing the chaos (--c) parameter to 0.5 resulted in interfaces with lighter colors and more structured elements. This is in contrast to the interfaces generated with a chaos (--c) parameter of 2, which had elements placed randomly across the screen. However, despite the improved structure, the interfaces did not closely resemble the wireframe. While some interfaces displayed similarity in terms of user profile icons and names, others only partially resembled the wireframe by including navigation icons at the bottom of the screen (as shown in Figure 22).

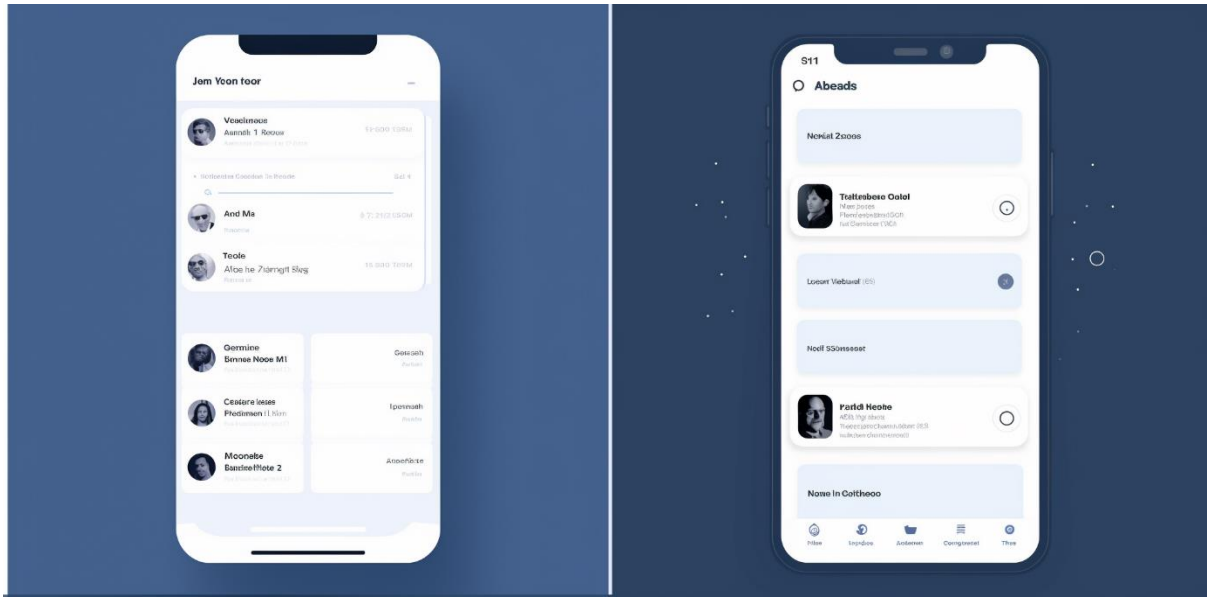


Figure 22: An image weight value of 2 and a chaos value of 0.5 resulted in more structured and lighter-colored interfaces.

Lowering both the image weight (--iw) and chaos (--c) values to 0.5 resulted in a decrease in the frequency of light-colored interfaces being generated. Instead, interfaces with a blue palette background and elements were generated more frequently. The lowered chaos value resulted in interfaces becoming more structured in comparison to when the chaos parameter is given a value of 2. Despite the increased structure within the generated interfaces, most of them did not resemble the structure presented within the wireframe.

However, there was an increase in the number of interfaces being generated that contained up to three element categories within the same interface that were consistent with the wireframe. Some interfaces, as seen within Figure 23, consist of story icons, user profile icons with their names, and navigation icons present. Although the structure and number of elements of each category being generated did not match the wireframe precisely, the AI model did manage to position each element category (user profile icons and navigation icons) in the correct order.

Figure 23: An image weight value of 0.5 and chaos value of 0.5 resulted in more interfaces being generated containing the right element categories being displayed or structured.

In the first image, the left interface displays the user profile icons, names, and navigation icons. The second interface on the right implements the story icons, but they are positioned in the lower half of the screen instead of the upper half as per the wireframe.

Moving on to the second image, it depicts an interface that contains three element categories. The first category, story icons, is displayed as ellipses instead of squares as in the wireframe. The interface also displays the user profile icons and names, but with two icons per row instead of one. Additionally, the interface contains three navigation icons instead of four.

In the third image, there are two screens, with the lighter one on the right being the more interesting. The AI model successfully included the main user's profile icon, as well as user profile icons and names. However, there is an inconsistency in the way user profile icons are structured within the interface. Some icons are placed within a dark rectangle with names displayed in white, while others are not contained within such rectangles.

3.5 Limitations

The stochastic nature of text-to-image generation models makes it challenging to conduct a genuine side-by-side comparison using A/B testing. Thus, the evaluation must be performed subjectively to determine whether any remaining artifacts from the wireframes make their way into the generated results, or if the generated result accurately reflects the wireframe. Since each new generation can result in vastly different results, it is essential to conduct multiple evaluations to increase the level of confidence in the results obtained.

Furthermore, the approach taken in the experiments is heuristic in nature regarding the wireframe variations that work best with the AI model. Exploring which wireframe or prompt variations work best goes beyond the scope of this paper.

The next limitation pertains to the AI model's inability to understand semantics. While text-to-image AI models rely on prompts, they do not function as language models. Thus, any textual content within an image cannot be interpreted semantically, and the AI model may generate semantically incorrect text.

The present limitation pertains to the replication of the output produced by the text-to-image model in an external design or prototyping tool. Typically, when designing an interface, UX designers amalgamate various components to construct the interface, such as text, forms, buttons, and backgrounds. However, a constraint that arises while replicating the generated interface is that the text-to-image model, such as Midjourney, does not allow the UX designer to extract the individual elements from the image. As a result, the UX designer is compelled to reconstruct each element separately to be used within the final prototype. In essence, the background, images, and other elements like buttons cannot be extracted independently, thereby rendering the job more challenging for the UX designer to manually recreate each element.

3.6 Discussions

The pre-evaluation experiments conducted in this study have shed light on both the advantages and disadvantages of utilizing a text-to-image model in conjunction with a wireframe. While using a wireframe as a reference has proven to be useful, it is not expected that the AI model will generate an interface that closely resembles the wireframe.

The results of the experiments demonstrate that employing a wireframe that integrates actual text, rather than lines that symbolize text, enhances the consistency with which the AI model generates text within the interfaces in the appropriate locations.

Also, the experiment results have shown that increasing the image weight parameter places more emphasis on visual elements, such as color, rather than structure. Increasing the image weight results in the colors of the wireframe being prioritized, while the instructions within the prompt are still used but have less impact.

Regarding the chaos parameter (--c), experiments have shown that setting it to values of 10 or 20 resulted in interfaces being generated that bore very little resemblance to the wireframe. However, lowering this value to 2 or lower has shown a significant improvement in generating more structured interfaces that bear resemblance to the wireframe. It is worth noting that a chaos value of 2 has resulted in more distortions being generated more frequently compared to a lower value of 0.5. Despite not being useful in producing interfaces that bear more resemblance to the wireframe, keeping the value for this parameter very low has shown much more reliable results. As such, it is recommended to exclude this parameter when combined with wireframes.

Moreover, the user profile icons with the names next to them are the most recurring elements that resemble the wireframe. This observation could be attributed to the fact that these elements make up most of the wireframe and are repeated patterns. Unfortunately, neither the different formulas nor additional parameters have resulted in interfaces being generated that are more consistent with the structure of the wireframe. Each formula, however, has the potential to generate interfaces that closely resemble the wireframe, but given the stochastic nature of the text-to-image model, these are generated by chance.

3.7 Evaluation Experiments

3.7.1 Method & Setup

The experimental procedures involve the active participation of both participants and researchers, either within a shared physical setting or through remote communication platforms, such as online calls. The experiment itself is structured into three primary phases: (1) completion of the UTAUT questionnaire, (2) interaction with the AI system, and (3) an interview session consisting of a predetermined set of questions. Prior to commencing the experiment, participants receive a detailed briefing that contextualizes the research and explains the specific purpose of their involvement as participants. Subsequently, participants are instructed to fill out the UTAUT questionnaire before proceeding to engage with the AI model during the experimentation phase.

During the experiment, participants are situated at a computer terminal where they log into the software interface that grants them access to the text-to-image generation model. The researcher, either physically present alongside the participant or utilizing screen-sharing software in remote settings, closely observes the proceedings. The wireframe utilized throughout the experiment corresponds to variation B, as depicted in Figure 9. To assist participants in generating their own prompts during the experiment, a predefined set of example prompts is provided. Participants are encouraged to freely explore and generate multiple interfaces as they see fit, with a strong emphasis on experimentation. Moreover, participants are instructed to verbalize their thoughts throughout the experiment, adopting a "think aloud" approach, and are only prompted with additional questions when clarification is deemed necessary.

Throughout the course of the experimentation, participants engage in the generation of multiple interfaces, utilizing both the provided example prompts and prompts they create themselves. Participants conduct a thorough analysis of the generated outputs, offering valuable insights into the effectiveness and limitations associated with employing the text-to-image model for the specific purpose of UX design. Notably, no time constraints are imposed on each individual experiment, allowing participants full autonomy to determine when they conclude the experiment and subsequently proceed to the interview segment.

Regarding the overall duration, the complete experiment encompasses a comprehensive timeframe that includes various stages, starting from the initial briefing and concluding with the participant's responses to the interview questions. On average, the process of interacting with the AI system and conducting an interview session with each participant took approximately 1¼ hours to complete.

3.7.2 Questionnaire and Interviews

To assess the level of familiarity and perspectives held by UX designers regarding the utilization of generative artificial intelligence (AI), the research employs the Unified Theory of Acceptance and Use of Technology (UTAUT) questionnaire. Widely recognized and extensively employed in technology acceptance research (Marsofiyati et al., 2020), the UTAUT questionnaire serves as a valuable tool for comprehending users' intentions and behaviors when adopting novel technologies. By concentrating on pivotal theoretical constructs, including performance expectancy, effort expectancy, social influence, facilitating conditions, familiarity, and behavioral intention, the UTAUT questionnaire presents a comprehensive framework to evaluate users' perceptions and attitudes concerning the integration of generative AI into the realm of UX design. The structured format of the questionnaire, as depicted in Table 4, along with its employment of a Likert scale featuring responses ranging from 1 to 5, enables the quantitative measurement and analysis of

participants' responses. Consequently, this approach yields valuable insights into their beliefs, expectations, and potential intentions with respect to incorporating generative AI within the realm of UX design. Through the utilization of the UTAUT questionnaire, the research endeavors to attain a profound comprehension of how UX designers perceive the advantages, challenges, and prospective capabilities of text-to-image generative models, ultimately contributing to the body of knowledge at the intersection of AI and UX design.

Table 4: Questionnaire based on the UTAUT constructs to help gauge the participants' familiarity & perspective on generative AI.

Theoretical constructs	Description
Performance Expectancy	*I believe that using generative AI in UX design would improve the quality of my work.* *I believe that using generative AI in UX design would help in saving time.* *I believe incorporating generative AI in UX design would be better than sticking to traditional methods.*
Effort Expectancy	*I think learning to incorporate generative AI in UX design will be difficult.* *I think that using generative AI in UX design would make UX design easier.* *I am motivated to learn how to use generative AI in UX design.*
Social Influence	*I feel there is pressure to incorporate generative AI in UX design.* *I am more likely to use generative AI in UX design if I see colleagues use it.* *I am more likely to use generative AI in UX design if I am sure it makes a positive difference compared to traditional methods.*
Facilitating conditions	*I believe that the organization I work for has the necessary technical infrastructure to support the incorporation of generative AI within UX design.* *I believe the organization I work for provides the necessary resources for using generative AI in UX design.* *I believe the tools I currently use are compatible with generative AI being incorporated into UX design.*

	I believe I have full control over using generative AI in UX design. *I believe it is easy to have access to generative AI tools for UX design.*
Familiarity	*I am familiar with AI in general.* *I am familiar with text-to-image generation models.* *I am familiar with the potential of text-to-image generation in UX design.* *I am familiar with the use of generative AI in UX design.*
Behavioral intention	*I predict that within the next two years, generative AI will be fully incorporated into UX design.* *If possible, I would use generative AI in UX design as soon as possible.* *I feel positive about generative AI being used in UX design.*

A series of interviews with UX designers helped to delve deeper into the utilization and efficacy of text-to-image AI models within the UX design process. These interviews served as a valuable means to encourage designers to reflect on their experiences in the transformation of wireframes into high-fidelity interfaces, while simultaneously providing firsthand insights into the capabilities and limitations of the AI model. The selection of interview questions, as shown in Table 5, was carefully crafted to elicit specific feedback pertaining to various aspects of the AI model's performance and its integration into the overall design workflow. By requesting examples of design patterns or elements that posed challenges for the AI model, the intention was to identify its limitations and areas in need of improvement. Conversely, by inquiring about patterns or elements that the AI model excelled at generating, helped uncover its strengths and potential benefits.

Moreover, the interviews aimed to gather opinions regarding the integration of the text-to-image model with traditional design tools, thereby enhancing the overall design process. By exploring the designers' experiences with interfaces that inspired changes or exhibited elements superior to the initial wireframes, helped in evaluating the model's potential in generating innovative design ideas. Additionally, the interviews addressed the practical value and efficiency of the text-to-image model by probing its utility as a starting point and its potential for time-saving benefits.

Lastly, by inquiring about the desired improvements for future AI systems, it helped in obtaining valuable insights that could inform further development in this field.

Table 5: The set of 9 interview questions conducted after a participant interacted with the AI system.

Question number	Interview question
Q1	In your opinion, what are some examples of design patterns/elements that the text-to-image model struggles with?
Q2	Were there any specific design patterns or elements that the AI model was particularly good at generating?
Q3	Did you find that the AI model was able to generate interfaces that closely resembled the wireframe you uploaded? If so, what were the factors that contributed to you thinking that way?
Q4	Do you think the text-to-image model can be used in conjunction with traditional design tools to enhance the design process? If so, how?
Q5	Did you find interfaces that inspired you to make changes in the wireframe itself?
Q6	Did you find interfaces that contain elements or structures that are better than the wireframe itself?
Q7	Do you think that using a text-to-image model could be useful as a starting point for interface design, or is it better to rely on more traditional methods?
Q8	Do you think the text-to-image model can help save time in the design process? If so, in what ways?
Q9	What would you like to see in a new AI system that is an improvement on this one?

3.7.3 Participants

In order to evaluate the effectiveness of the AI model within the context of UX design, a cohort of ten participants, all possessing a background in UX design, actively participated in the experimentation process. The selection of these participants was conducted with great care, considering their expertise and practical experience within the field. The majority of participants specialized in Interaction Design, while a subset held additional qualifications in related domains such as Graphic Design. This deliberate selection ensured a diverse range of perspectives and insights regarding the application of the AI model in UX design.

The participants' professional experience in UX design spanned from 1 year to 4.5 years, collectively bringing a wealth of knowledge and understanding to the research endeavor. The variation in years of experience further contributed to the diversity of viewpoints, as participants had encountered different design challenges and problem-solving scenarios throughout their respective careers. This heterogeneity of experience was instrumental in enriching the feedback and insights provided by the participants.

Table 5 provides an overview of each participant, including their current occupation, years of experience in the field, and educational background. By capturing this information, a comprehensive snapshot of the participants' profiles is presented, highlighting the varied backgrounds and

qualifications that contribute to their expertise in UX design. It is through the amalgamation of these individual profiles that it is possible to leverage the participants' extensive knowledge base to evaluate the efficacy of the AI model, ultimately gathering valuable feedback and insights for our research.

Table 6: Overview of participants' background, level of experience measured in time, and current occupation.

PARTICIPANT NUMBER	CURRENT OCCUPATION	EXPERIENCE IN UX DESIGN	MAJOR
P1	UX/UI Designer	2 years	Interaction Design
P2	Visual & UX design	2 years	Interaction Design
P3	Web designer & SEO expert	4 years	None
P4	UX Designer & Social Media Manager	2 years	Interaction Design
P5	Technical Marketing Support	2 years	Interaction Design
P6	Strategic digital designer	2 years	Graphic Design specializing in UX design
P7	Interaction Designer	3 years	Interaction Design
P8	UX Design and Front-end Developer	1.5 years	Interaction Design
P9	UX/UI Professional	4.5 years	Interaction Design
P10	UX designer	1 year	MA Data Driven Design

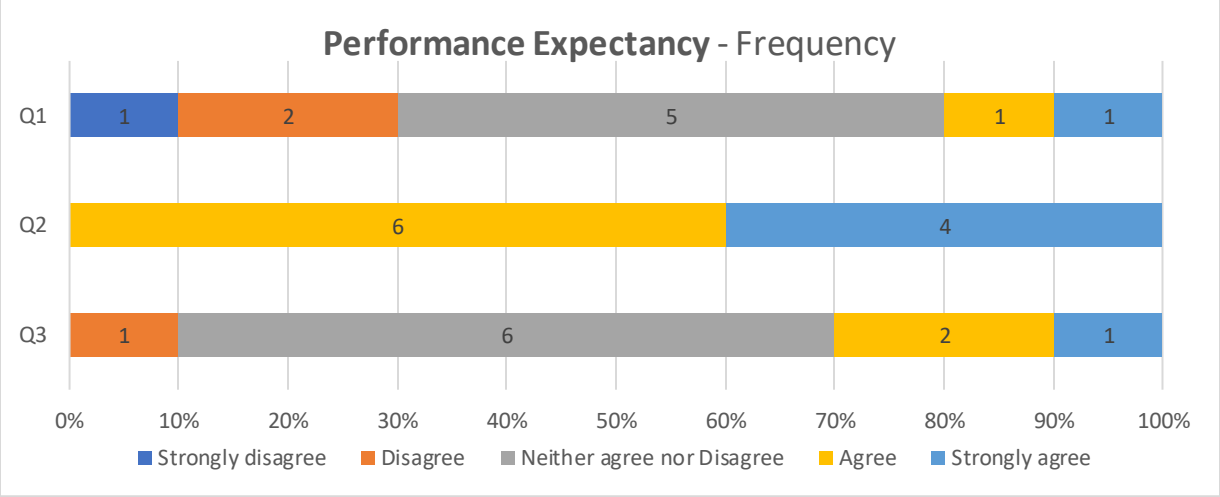
4. Results

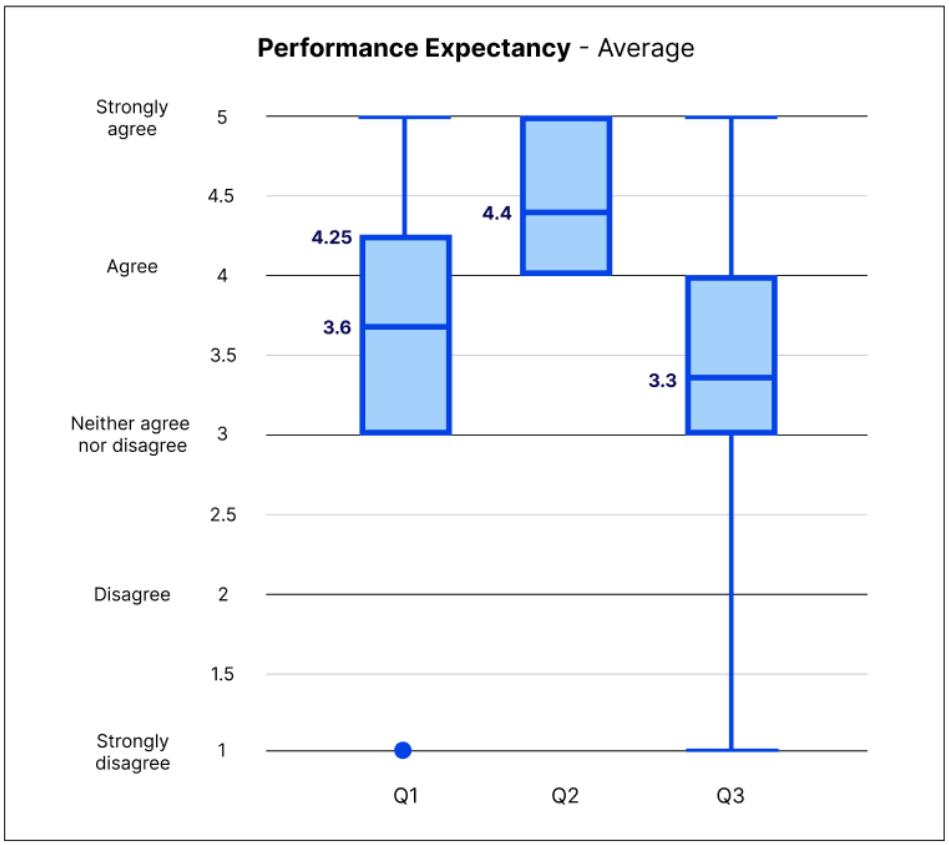
4.1 UTAUT Questionnaire results

The quantifiability of the results obtained from the UTAUT (Unified Theory of Acceptance and Use of Technology) questionnaire is evident. Each question is measured in terms of the frequency of responses across all participants, as well as the mean value. This analysis is visually represented using box plots and stacked bar graphs. To facilitate the readability of the data, the questions are assigned unique identifiers and categorized according to the six UTAUT theories.

Performance Expectancy

QUESTION IDENTIFIER	UTAUT QUESTION
Q1	I believe that using generative AI in UX design would improve the quality of my work.
Q2	I believe that using generative AI in UX design would help in saving time.
Q3	I believe incorporating generative AI in UX design would be better than sticking to traditional methods.

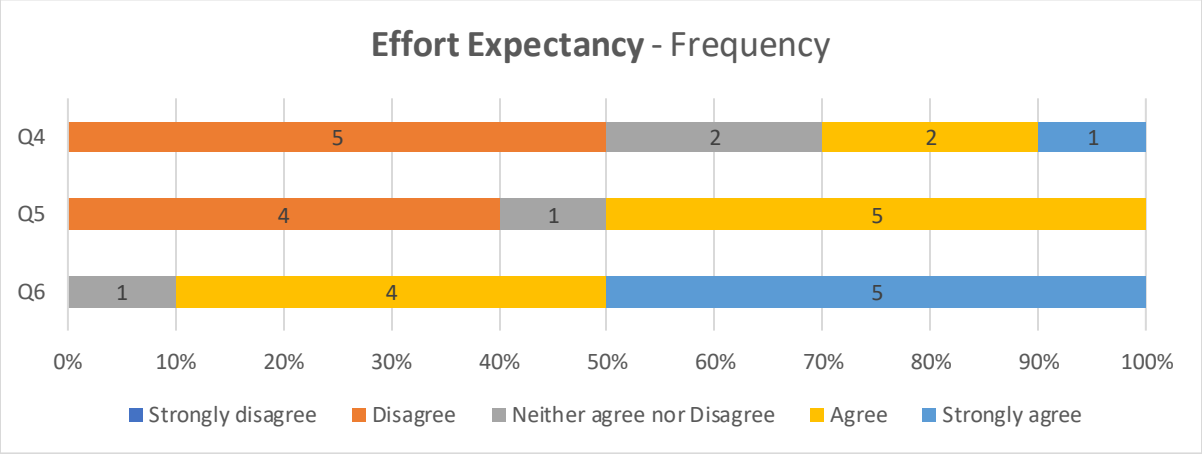


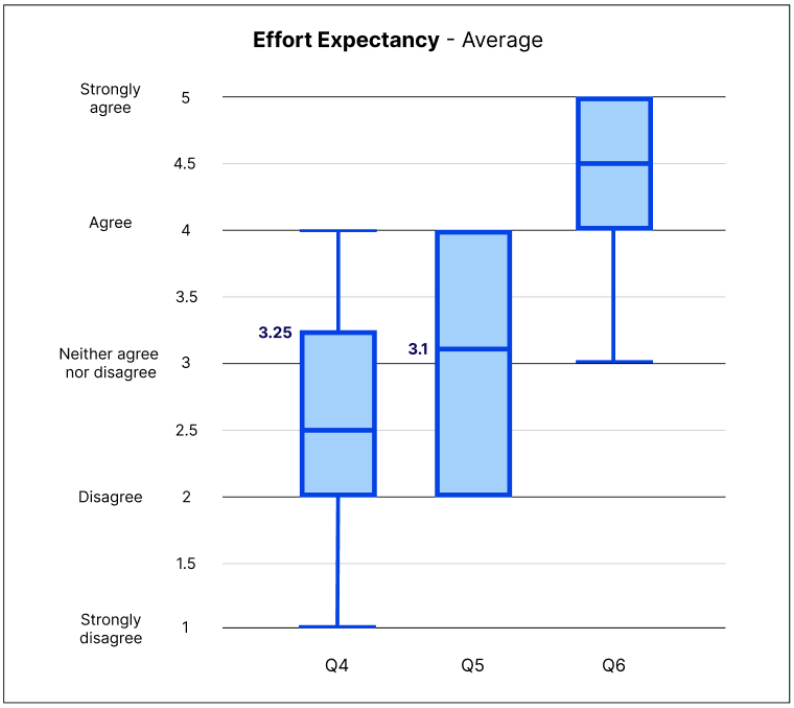


In terms of performance expectancy, the findings indicate that the majority of participants (6 out of 10) held a neutral viewpoint regarding the potential of AI to enhance work quality. Conversely, the remaining responses were divided between agreement (2 participants) and disagreement (3 participants). Nonetheless, all participants unanimously agreed on the time-saving benefits of employing generative AI. Despite this perception, an intriguing discovery emerged: the majority of participants (6 out of 10) expressed neutrality when considering the integration of generative AI in UX design as opposed to traditional methods. Only one participant disagreed, while the others were in agreement.

Effort Expectancy

QUESTION IDENTIFIER	UTAUT QUESTION
Q4	I think learning to incorporate generative AI in UX design will be difficult.
Q5	I think that using generative AI in UX design would make UX design easier.
Q6	I am motivated to learn how to use generative AI in UX design.

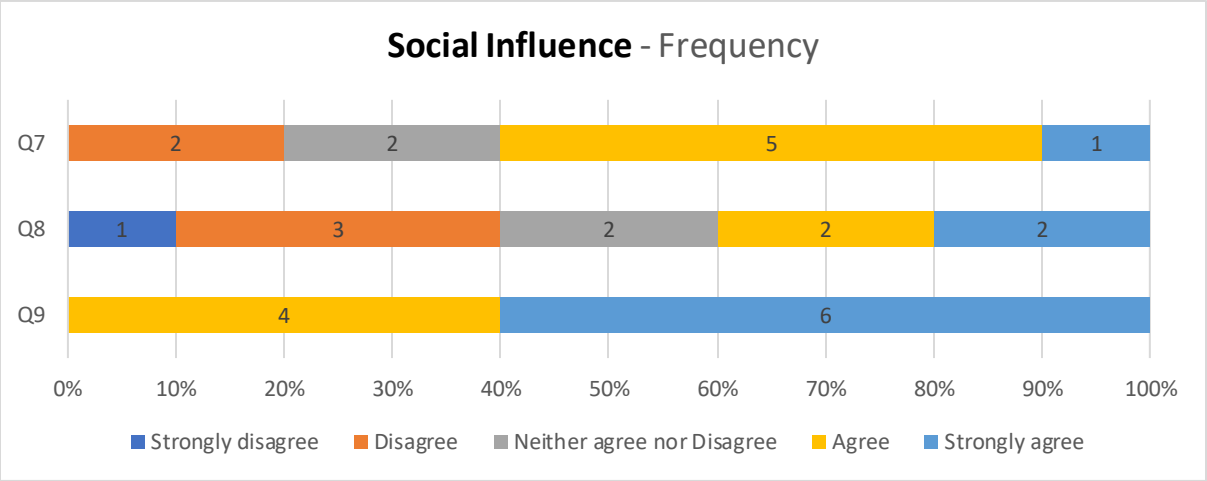


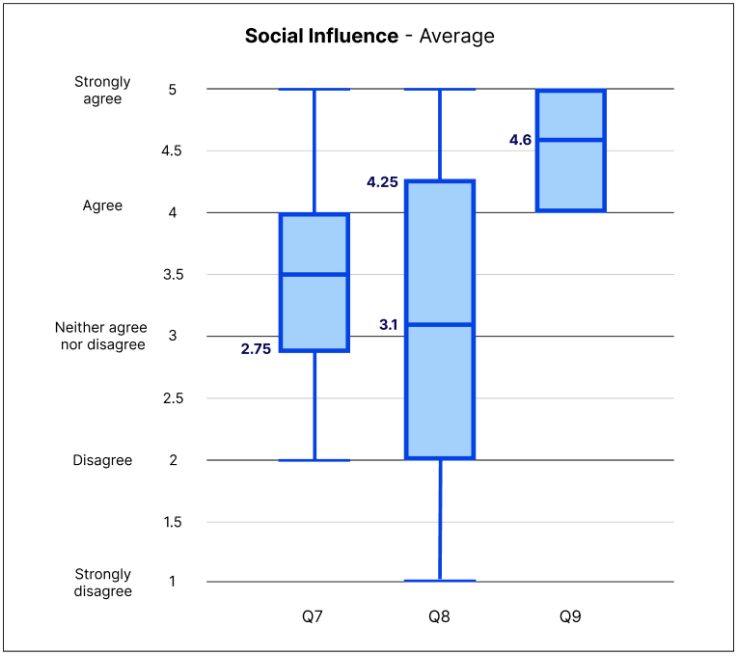


Regarding effort expectancy, the majority of participants (5 out of 10) did not perceive incorporating generative AI into the UX design process as challenging. However, the remaining participants were either neutral (20%) or believed it would be difficult (30%). Despite most participants perceiving no difficulty, opinions were evenly divided as to whether generative AI would actually simplify the UX design process. While half of the participants believed it would, 40% did not share this belief. Nevertheless, almost all participants (90%) expressed a desire to learn how to utilize generative AI in UX design.

Social Influence

QUESTION IDENTIFIER	UTAUT QUESTION
Q7	I feel there is pressure to incorporate generative AI in UX design.
Q8	I am more likely to use generative AI in UX design if I see colleagues use it.
Q9	I am more likely to use generative AI in UX design if I am sure it makes a positive difference compared to traditional methods.

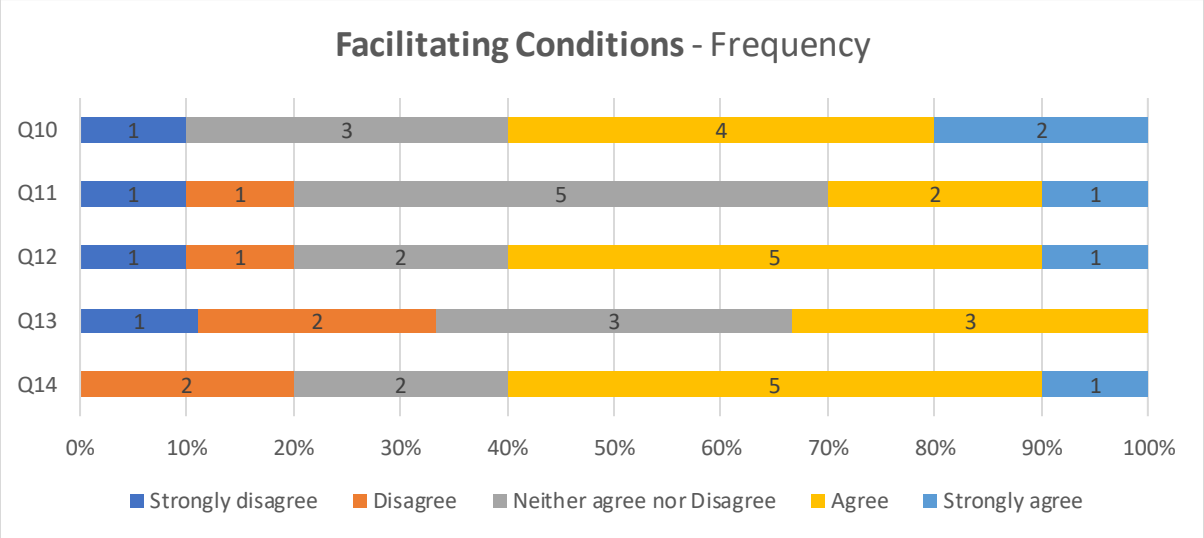


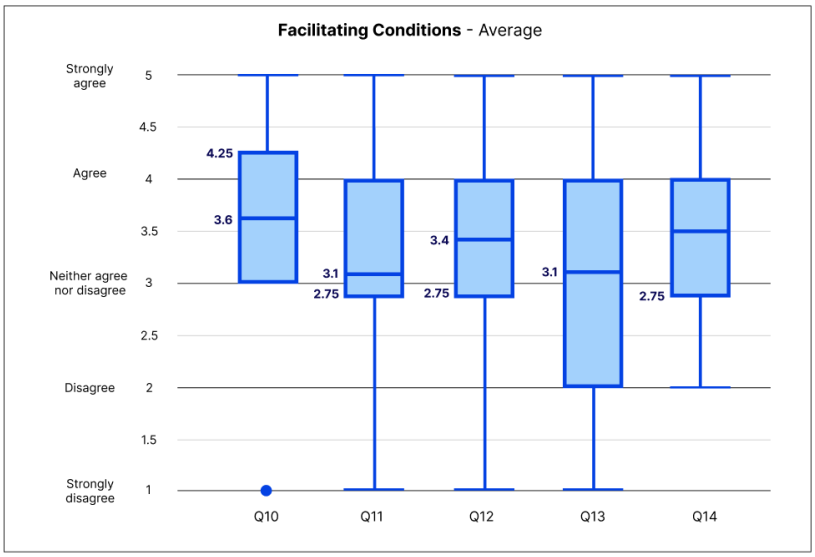


Concerning social influence, the majority of participants felt pressure to incorporate generative AI in UX design. However, participants' responses were equally divided on the agreement or disagreement of using generative AI when observing colleagues utilizing it, with only 20% expressing neutrality.

Facilitating Conditions

QUESTION IDENTIFIER	UTAUT QUESTION
Q10	I believe that the organization I work for has the necessary technical infrastructure to support the incorporation of generative AI within UX design.
Q11	I believe the organization I work for provides the necessary resources for using generative AI in UX design.
Q12	I believe the tools I currently use are compatible with generative AI being incorporated into UX design.
Q13	I believe I have full control over using generative AI in UX design.
Q14	I believe it is easy to have access to generative AI tools for UX design.

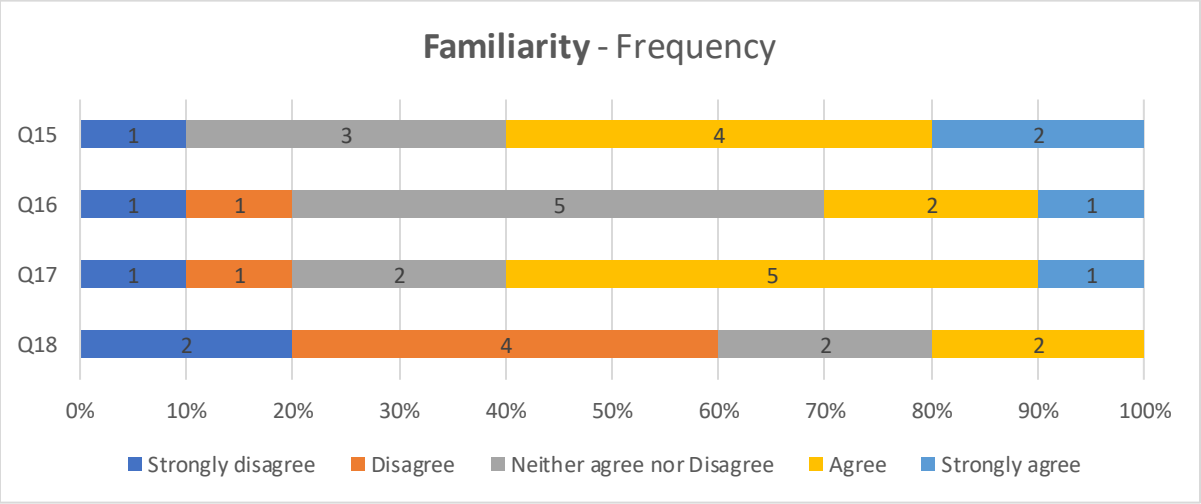


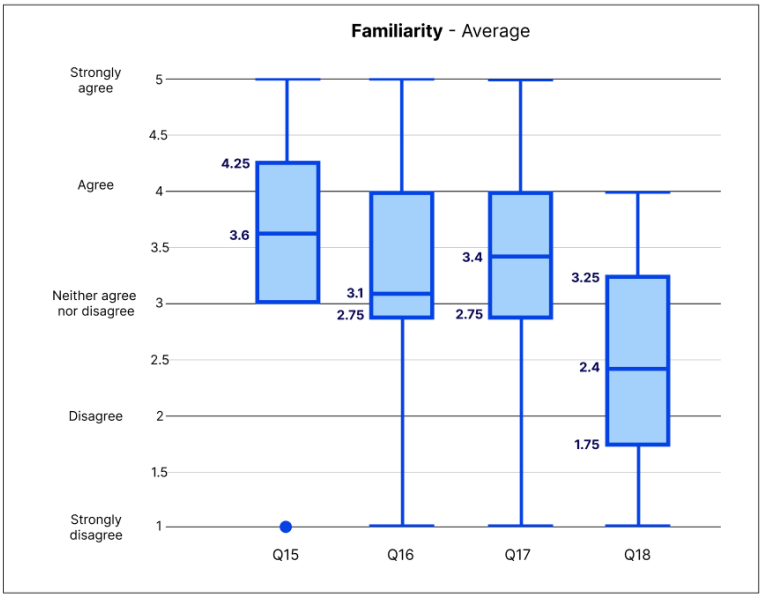


Regarding facilitating conditions, 60% of participants believed that their organization's technical infrastructure supported the incorporation of generative AI, with 30% remaining neutral. However, participants held mixed opinions on whether their organizations provided the necessary resources for incorporating generative AI, with 30% in agreement, 20% in disagreement, and 50% remaining neutral. Interestingly, 60% of participants believed that the current tools used in UX design were compatible with the use of generative AI. Nevertheless, participants' opinions on whether they believe they have full control over the use of generative AI were evenly divided among those who remained neutral, agreed, or disagreed. Only one participant abstained from answering the question.

Familiarity

QUESTION IDENTIFIER	UTAUT QUESTION
Q15	I am familiar with AI in general.
Q16	I am familiar with text-to-image generation models.
Q17	I am familiar with the potential of text-to-image generation in UX design.
Q18	I am familiar with the use of generative AI in UX design.

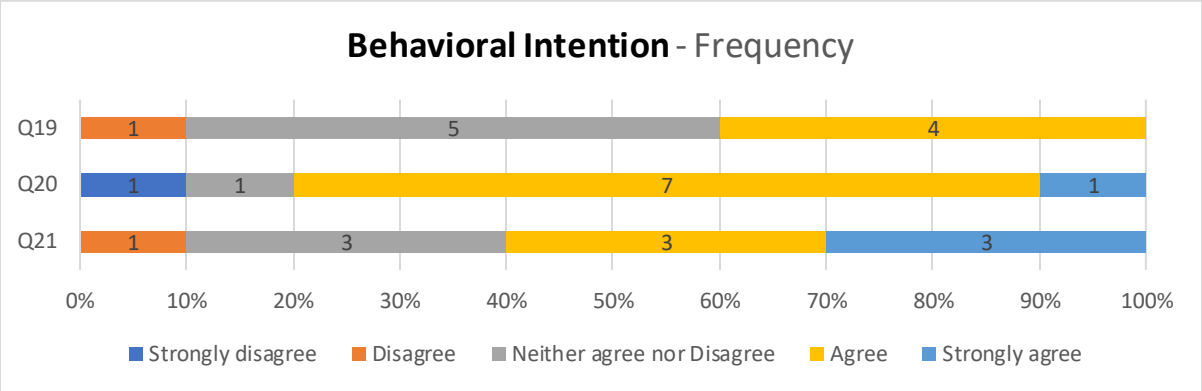


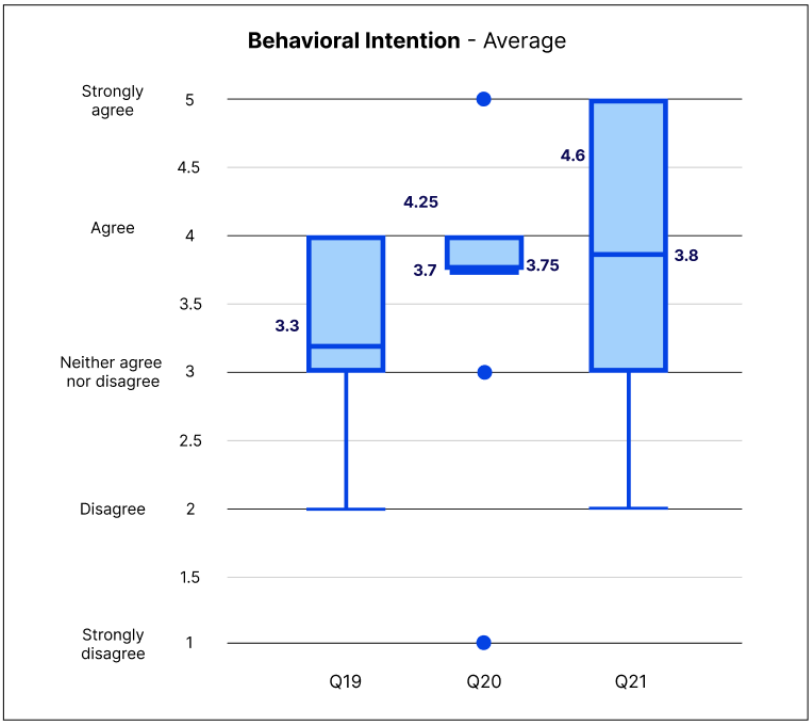


In spite of 60% of the participants indicating their familiarity with AI in general, a notable majority (70%) expressed a lack of familiarity with text-to-image models. Among this 70%, 50% maintained a neutral stance, while the remaining 20% disagreed with being acquainted with such models. The prevalence of neutral responses suggests that there exists some level of awareness regarding the concept of text-to-image models. Conversely, out of the total participants, the remaining 30% did affirm their familiarity with text-to-image models. It is intriguing to note that 60% of all participants acknowledged being familiar with the potential of text-to-image generation in the context of user experience (UX) design.

Behavioral intention

QUESTION IDENTIFIER	UTAUT QUESTION
Q19	I predict that within the next two years, generative AI will be fully incorporated into UX design.
Q20	If possible, I would use generative AI in UX design as soon as possible.
Q21	I feel positive about generative AI being used in UX design.





Concerning behavioral intention, 50% of participants were unsure about the full incorporation of generative AI in the next two years. While 40% agreed to some extent, the remaining participants either disagreed or remained neutral. However, 80% of participants expressed a willingness to use generative AI as soon as possible when given the opportunity, with the remaining 20% either disagreeing or remaining neutral. Lastly, 60% of participants agreed or strongly agreed to feel positive about the utilization of generative AI in UX design, while 30% remained neutral and the remaining participants disagreed.

4.2 Participant Expressions and Actions during Experimentation

During the course of the evaluation experiments, participants were instructed to engage in a cognitive process known as 'thinking aloud' while actively manipulating wireframes using the AI mode. In order to document and analyze the participants' actions and expressions during this phase of experimentation, a comprehensive table was created, containing pertinent information regarding their interactions with the wireframes. The table serves to highlight the behaviors and reactions exhibited by the participants in chronological order throughout the duration of the experiment.

PARTICIPANT	EVENT DURING EXPERIMENTATION
P1	- The participant expresses notice that the generated interface is structurally not based on the wireframe's structure. - The participant says that despite the distorted structure, what is being generated can perhaps be used as inspiration for how the wireframe can look as a hi-fi interface. - The participant says that what is being shown in the generated interfaces can also be found in other technologies, such as websites that provide inspiration. - The participant expresses that the tool requires an understanding of how the prompts work before being able to work efficiently with the tool itself. - The participant expresses that the AI is not hard to use once the user knows how to use it, but the UX designer requires an interface for the AI itself to be able to use it efficiently. - The participant expresses that the AI can be used for quick and live presenting of interfaces to stakeholders, making it more useful for presenting ideas rather than using it as a tool within UX design itself. - The participant expresses having noticed that the AI experiments by adding extra elements not shown in the wireframe, and that it can be useful in generating new ideas. - The participant expresses that the extra elements generated by the AI would only be useful if they make sense in meeting the user's needs. - The participant wonders whether AI would be able to think along with the UX designer in producing interfaces that align with the user's needs, rather than just generating elements. - The participant says that they would consider using the AI when already having a hi-fi interface and using it to generate ideas for improvements. - The Participant expresses to see potential in the AI, but it requires improvement by having functionalities such as being able to choose HEX colors, and being able to target specific components within the interface.
P2	- The participant mentions that the structure is distorted and feels like they have to get the prompt right in one go. - The participant writes out prompt instructions in full sentences. - The participant used a different interface (non-wireframe) to create a new interface rather than the wireframe. - The participant tries a Balsamiq wireframe and found out that it didn't work. - The participant expresses that the AI can be used more as inspiration. - The participant says that being able to use Hex colors in the AI would be appreciated. - The participant expresses a desire to get details of individual elements such as pixels, colors, shadowing, etc.

P3	- The participant expressed not having expected the AI to generate two interfaces next to each other, and the generated interfaces are too long in height. - The participant used technical UX terms such as "border radius" to instruct the AI. - The participant tried to be more specific in the prompt by instructing the AI on how to display specific elements. - The participant is worried about whether they were specific enough. - The participant mentions that some instructions are followed up when being specific enough, and being specific enough would lead to the desired results. However, not being specific enough can also lead to preferred results. - The participant states that the more ambiguous the prompts are, the more creative the results are. - The participant points out that it can be time-consuming to come up with prompts as you have to type out instructions. - The participant mentions that it is not useful to use it with time constraints as it can take up time.
P4	- The participant says that the generated interfaces are messy and filled with unnecessary elements despite including "minimalistic" in the prompt. - The participant attempts to be more specific about what the AI should be minimalistic about by adding "minimalistic design and features" and also requesting to "make it less noisy" within the prompt. It did work to some extent, but the system continues to generate what it wants stochastically. - The participant tries to add more instructions to the prompt because the interfaces are not user-friendly. - The participant attempts to direct the system on what to do with specific elements. - The participant instructs the AI to "use its UX knowledge." - The participant fills the prompt with specific instructions, but the AI does not generate the given instructions. - The participant notices that technical UX/UI terms do not work and tries to adapt to the AI by changing terms (e.g., hamburger menu → mobile menu).
P5	- The participant attempts to reiterate on the generated interfaces by using the V3 option and provides feedback. - The participant mentions that the layout is good, but the elements are not consistently structured. - The participant upscales an image and uses it as input to iterate, giving a specific command to place a button on top of the interface. The results are unpromising. - The participant observes that the AI does not understand technical UX/UI design terms such as "sliding carousel." - The participant tries giving full-sentence instructions without the use of technical terms. However, the AI does not produce the desired results, causing frustration. - The participant expresses that they would use a generated wireframe as a basis to manually construct the interface. They would also incorporate elements from other generated interfaces as a reference.

P6	- The participant mentions utilizing ChatGPT for generating content, such as generating fake names or importing user needs to construct website content instead of using lorem ipsum text. - The participant expresses disappointment that not every element is included in the generated interface. - The participant finds it useful for inspiration for the visual aspects. - The participant notes that the AI consistently generates list elements. - The participant mentions that they would use the AI for inspiration but not import a wireframe to gather ideas, mainly because the AI struggles with converting the necessary elements. - The participant points out that the AI doesn't produce usable icons. - The participant appreciates that the system creates distinguishable sections by differentiating them with different colors. - The participant is unimpressed because the generated interfaces are not usable.
P7	- The participant notices that the AI uses the prompt to determine the color palette and the structure of the shapes in the wireframe. - The participant is impressed by the visual fidelity of the generated interfaces by the AI. - The participant observes that the wireframe's structure has not been replicated exactly, but the AI incorporates key elements from the wireframe into its generated shapes. - The participant comments that the alignment of elements such as titles and icons is not optimal, with some elements being too close to each other. - The participant appreciates that the AI generates drop shadows, as it can be time-consuming to create them manually, and the AI does a good job in generating them. - The participant finds that the consistency between font categories like headers and sub-headers is well done. - The participant notices that some interfaces lack consistency in the shaping of elements. For example, while most elements have rounded borders, some elements deviate from this, disrupting the overall consistency. - The participant attempts a prompt without the wireframe, but the results differ too much from the wireframe and do not align with the intended use.
P8	- The participant feels that the generated interfaces do not closely resemble the wireframes, except for certain elements like the wireframe itself and the hamburger menu. - The participant appreciates that the AI handles the structure of elements well, such as placing the navigation at the bottom or the search button at the top. - The participant observes that in some interfaces, the context shifts from social media to something like a music app or banking interface. - The participant finds the variety of interfaces provided by the AI inspiring, particularly in terms of structuring elements and the inclusion of elements like call-to-actions or highlighting the navigation icon with a circle. - The participant wishes that the generated interface would include the color palette or style guide on the side to assist in replicating the color choices. - The participant suggests that the AI should show an interface with all different components separately and be able to extract them.

	- The participant desires a step-by-step system, where they can upload the wireframe in step 1, choose colors in step 2, add keyword instructions in step 3, generate results, and select the desired interface in step 4. They believe this would be better than relying solely on text instructions. - The participant suggests incorporating font detection capabilities in the AI, similar to what is used in logos. - The participant envisions a future AI that asks initial questions about colors, logos, wireframes, etc., and then progressively transforms the wireframe into a final interface step-by-step. - The participant feels that the current technology is too broad or ambiguous and prefers to be guided throughout the design process instead of being expected to have all the answers. - The participant finds that the results generated with fewer instructions are often better. - The participant believes that the AI interprets terms too literally, such as generating literal hexagon shapes when provided with a hex color code.
P9	- The participant points out that the AI does not accurately display the elements as shown in the wireframe. While it uses the elements, it often generates something completely different. - The participant notices that the number of elements, such as navigation icons, increases from 4 to 5 in the generated images. - The participant believes that making iterations is acceptable, but there should still be some resemblance to the wireframe. - The participant observes that the AI generates elements that do not appear in the wireframe, which can provide ideas and inspiration for application. - The participant finds that the variation in iterations helps deliver visual inspiration for their role as a UX designer. - The participant suggests that the AI-generated images can provide ideas for testing various element sizes in A/B testing. - The participant suggests that while the AI-generated results can be used as inspiration, they should not be showcased to clients or used for true A/B testing. Instead, the UX designer would need to manually reconstruct the interfaces. - The participant suggests that it would be useful in the future to link the AI to third-party design tools, which would allow individual elements to be edited and customized.
P10	- The participant's first impression is positive, being impressed by the speed in generating, clean design, and colors of the generated interfaces. - The participant is amazed that the AI can produce designs with minimal instructions, saving time in the design process. - The participant suggests that it would be helpful if the AI could provide a visual basis such as grids or tables, which could be exported to third-party design tools. - The participant mentions that they explored using AI for work, but the company declined due to concerns about data leaks and the possibility of AI like ChatGPT sharing information with rival companies. AI is currently used for obtaining templates but not for inserting personal information. - The participant acknowledges that the AI does a good job in generating similar patterns as those found in the wireframe.

- The participant is experimenting with different prompts, including those without the instruction of "minimalistic."
- The participant states that this AI could be valuable when the visual direction of a design is uncertain. Rather than solely relying on websites for inspiration, this AI could be used to gain inspiration without necessarily creating a full design.
- The participant emphasizes that privacy rules should be taken seriously when using AI.

4.3 Prompts Used by Participants

Throughout the evaluation experiments, every participant interacted with the AI model, employing both image inputs and text prompts. The ensuing table presents a comprehensive compilation of the exact prompts utilized by each participant, along with the frequency of their usage and the corresponding types of images they were linked with. The items within the list are organized in a chronological sequence.

Participant number	Exact prompts used	Times used
P1	**<wireframe>** UI design of a social media app, Modern, Classy, Minimalistic, Purple Color Palette on Dribble, High Resolution --v 5	1
	<wireframe> UI design of a social media app, Classy, Minimalistic, Elegant, Navy Blue and red color palette, High Resolution --v 5	1
	<wireframe> UI Design of a social media app , Modern, Classy, Minimalistic, Dreamy mint Color, High Resolution --v 5	1
	<wireframe> UI Design of a social media app --v 5	1
	<wireframe> UI design of a social media app, Modern, Classy, Minimalistic, Purple Color Palette on Dribble, High Resolution --v 5	1
P2	**<wireframe>** UI design menu at top left and profile picture right --v 5	1
	<Participant's randomly picked hi-fi mobile chat interface> Create a high fidelity user-interface with Inter as font family where there are four cards promoting videos and has social messaging app.	1
	<Participant's own second wireframe> create a user-interface for a e-commerce webshop product detail page fleece hoodie multiple sizes	1
	<Participant's own third wireframe> create an app e-commerce shirts buying G-Star high-fidelity	1
	<wireframe> UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	1
	<Participant's randomly picked hi-fi desktop blog interface> create a user interface website for blogs high-fidelity professional blue color palette	1

	<none> & **<Participant's randomly picked hi-fi mobile interface> create** a food app with minimalistic design flat illustrations clean high resolution --v 5	2
P3	**<wireframe>** modern social media application	1
	<wireframe> add a story function (like instagram) on top of the design	1
	<Generated Interface Variant> add a sliding carousel of square images at the top of the screen.	1
	<Generated Interface Variant> keep the design and lay-out the same, but add one row of square images that go off the screen on the right	1
	<wireframe> modern social media application	1
	<Generated Interface Variant> make the images a circle	1
	<wireframe> modern minimalistic social media application with chat function	1
	<none> make an interface for a social chat application	1
	<none> make a modern and minimalistic interface for a social chatt application	2
P4	**<wireframe>** Social media app UI, Modern	1
	<wireframe> Social media app UI, user friendly, Minimalistic --v 5	1
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours --v 5	1
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the important message function, use a dribble design --v 5	1
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the important message function, use a dribble design, make a clear information hierarchy, use your Ux knowledge --v 5	1
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, also make a profile--v 5	1
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, High Resolution, modern--v 5	1

	<wireframe> & **<none>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, make a grid, make an Hamburger menu, High Resolution, modern, use emojis --v 5	2
	<none> & **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, make a grid, make an mobile menu, modern, use emojis	2
	<wireframe> Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation in the bottom, make a grid, make an mobile menu on the top, modern, use emojis	1
P5	**<wireframe>** Chat overview UI for Mobile, Minialistic design, gradient colors from light red to light orange --v 5	1
	<wireframe> Social Media App UI for Mobile, Minialistic design, gradient colors from light red to light orange --v 5	1
	<wireframe> Social Media App UI for Mobile, Minialistic design with accents of gradient colors from light red to light orange --v 5	1
	<wireframe> Social Media App UI for Mobile, Outstandig 3Ddesign with border accents of gradient colors from light red to light orange, menu at the bottomright. --v 5	1
	<wireframe> Social Media App UI for Mobile, Outstandig 3Ddesign, with borders accents of gradient colors from light red to light orange, the border only exist on UI elements, round button of the menu at the bottomright. --v 5	1
	<wireframe> Social Media App UI for Mobile, the ui elements of the design are having a border with color from the accents of glight red to light orange in a gradient. The most important elements/icons are dark blue. The profile pictures are on the left of the chat overview elements. The menu is on the bottom of the screen. With the selected menu item is the color red/orange. Searchbar in the top of the screen. --v 5	1
	<wireframe> A Social Media App UI for Mobile. Chat elements with profile pictures on the left. Status of the chats are red, orange, or green and are small circles. Accents colors of the UI are red/orange. The background is white. The menu is at the bottom of the screen. The searchbar is at the top of the screen.	1

	<wireframe> A Social Media App UI for Mobile. Chat functions with red/orange elements --v 5	1
P6	**<wireframe>** Create a mobile app design with a list of 5 chats, with 'stories' on top of the screen. Style the icons in the menu bar. Use a navy blue theme with blue highlights, photorealistic, 4K, mock-up	2
	<none> Desktop website for a yellow bugatti chiron with large imagery, add details in buttons and background effects in the same yellow tint. Use a top screen nav-bar and a large catchy title, 4K, photorealistic, dark-themed	1
	<none> Desktop website with a top screen nav-bar and a large catchy title, advertising a yellow bugatti chiron with large imagery, 4K, photorealistic, dark-themed	1
	<none> create a visual design for a chat app. Use a burger-menu in the top-left corner, a profile badge in the top-right, a horizontal scroll with stories uploaded by users, and a nav-bar at the bottom of the page with the following icons; home, search, activity and settings. mock-up, 4k, photorealistic, light-theme, minimalistic	1
	<wireframe> UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	1
	<wireframe> UI Design of a social media app , Modern, Classy, Minimalistic, Dreamy Pastel Color, High Resolution --v 5	1
P7	**<wireframe>** Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	3
	<wireframe> Social media app with a focus on dating with the color green as main color, High resolution, focus on visuals --v 5	2
	<wireframe> Social media app with a focus on dating with a green color palette, High resolution, focus on visuals --v 5	1
	<none> Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	1
	<wireframe> Social media app UI interface, minimalistic, supports stories with a purple and blue gradient as palette, dividing elements --v 5	1
	<wireframe> Social media app UI interface, minimalistic, supports stories with a purple and blue gradient as palette, dividing elements --v 5	1
	<wireframe> Social media app UI interface, minimalistic, supports stories gradient, dividing elements --v 5	1

P8	**<wireframe>** Social media app UI, Modern, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution	2
	<wireframe> bottom menu white, modern, social media app, people, trending dribbble orange white color scheme, hamburger navigation, profile picture	2
	<wireframe> Coca Cola color scheme, Social Media app to connect with people, fun, likes, dislikes, stories	1
	<wireframe> hexcolor #7F9172	1
	<wireframe> bottom menu white, modern, social media app, people, trending dribbble orange white black color scheme	2
P9	**<wireframe>** Social media app UI, Industrial, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5	1
	<wireframe> Social media app UI, Creative, Images, Graphs, Yellow on Dribble, High Resolution --v 5	1
	<wireframe> & **<none>** Analytics app UI, Graphs, Minimalistic, Data High Resolution --v 5	2
	<wireframe> Social media app UI, Desktop, Creative, Images, Graphs, Yellow on Dribble, High Resolution --v 5	1
P10	**<wireframe>** Social media app UI, Modern, Classy, Minimalistic, Trending Pink Color Palette on Dribbble, High Resolution --v 5	1
	<none> Social media app UI, Old school, Minimalistic, Green, High Resolution v 5	1
	<none> Social media app Ui, High Resolution, Old school v 5	1
	<none> Social media app UI, Minimalistic, Green, High Resolution v 5	2

4.4 Interview results

1. *"In your opinion, what are some examples of design patterns/elements that the text-to-image model struggles with?"*

All participants agree that there is an inadequacy of the AI system in generating interfaces while maintaining consistency within a structure similar to the wireframe. Participants P2 and P3 drew attention to the lack of logical structuring of elements such as menus, and the AI's struggle to appropriately present overlays with the required depth. Participants P4 and P8, on the other hand, reported distinct difficulties encountered with the AI's comprehension of technical terminology and adherence to specific instructions, respectively. Moreover, participant P4 observed that the system tended to populate interfaces with superfluous elements, resulting in visual clutter.

P5 raised concerns regarding the AI's inability to adhere to the prescribed layout and structure, producing inconsistent outcomes that deviated from the intended wireframe, particularly in relation to the vertical dimensions of elements and the integration of a 'hamburger menu' icon. Participant P6 highlighted multiple areas of struggle for the AI, encompassing issues with structure, logic, the generation of usable icons, and limitations in generating standard text. Similarly, participant P7 identified problems related to spacing inconsistencies, variations in element size, and the arbitrary inclusion of icons or buttons, all of which contributed to interface clutter.

Furthermore, participant P9 underscored additional issues with the AI system, specifically relating to the visualization of text, incorrect margin and padding settings, and the generation of unfamiliar elements. Finally, participant P10 expressed reservations regarding the AI's performance, emphasizing its reliance on the clarity and specificity of instructions, while expressing concerns about the limitations imposed on creative thinking.

2. *"Were there any specific design patterns or elements that the AI model was particularly good at generating?"*

Multiple participants in the study, namely P2, P3, P6, P7, P8, P9, and P10, reported positive aspects of the AI system's performance with respect to the generation of specific design patterns or elements. These positive aspects encompassed the AI's capacity to produce visually appealing aesthetics, mood boards, and atmospheric stylings, as noted by participant P2. Furthermore, participants acknowledged the AI's proficiency in generating "cards," effectively organizing and distinguishing elements, as well as displaying names and accompanying text adjacent to profile icons. Additionally, participants P3, P6, P7, and P9 commended the AI system for its ability to create pleasing color palettes.

The AI's aptitude for accurately placing universal icons and recognizing patterns in menu placement and time display was recognized by participants P2, P4, and P7. Moreover, participants specifically highlighted the AI's competence in generating navigation menus at the bottom of interfaces, applying appropriate shadowing techniques, and skillfully combining and distinguishing colors to enhance visual appeal.

Participant P8 drew attention to the AI's capability in identifying and replacing certain elements with faces, as well as its proficiency in filling in missing elements not explicitly depicted in the wireframe.

3. *"Did you find that the AI model was able to generate interfaces that closely resembled the wireframe you uploaded? If so, what were the factors that contributed to you thinking that way?"*

Participants P1, P2, P4, P8, and P10, expressed dissatisfaction with the AI-generated interfaces, noting significant deviations from the intended wireframe designs. These discrepancies were primarily observed in terms of structural variations, the absence of crucial elements such as the navigation and hamburger menu, and incorrect rendering of message boxes and story boxes.

Participants P3, P5, P6, P7, and P9, did identify certain positive aspects in the generated interfaces. For instance, participants P3 and P7 appreciated the inclusion of user profile icons accompanied by names, as well as the accurate generation of the "chat" section, referring to the 'cards' that comprised user-profiles and associated names. Participant P5 acknowledged the presence of the navigation menu and the satisfactory generation of 'cards', despite variations in their display. Similarly, participant P6 noted a resemblance between the generated list of 'cards' (including user profiles and text) and the wireframe, although the total number of elements generated did not align with the wireframe specifications. Additionally, participant P9 recognized the utilization of similar elements and shapes, particularly within the context of mobile design.

4. *"Do you think the text-to-image model can be used in conjunction with traditional design tools to enhance the design process? If so, how?"*

Participants P1, P4, P5, P7, and P10 acknowledged the model's capability to serve as an inspiration tool, utilizing it to gather ideas, extract specific elements from various interfaces, and experiment with different prompts. Participant P1 particularly emphasized the advantage of generating multiple interfaces simultaneously, which provides a multitude of ideas at once. Participant P5 highlighted the manual combination of selected elements in an external tool to create a final interface, showcasing the model's potential as a creative aid.

In contrast, participants P2, P6, P8, and P9 expressed skepticism or limitations regarding the current usability of the model. They expressed hopes for future improvements and viewed the model primarily as an inspiration tool rather than a comprehensive design creation tool. Participants mentioned utilizing the model for tasks such as color extraction or image enhancement. Participant P8 underscored the requirement for users to have a clear design direction when utilizing the AI, as clarity may not always be present during the design process. Similarly, participant P9 emphasized the model's current limitations in practically transforming wireframes into high-fidelity interfaces. However, according to P9, the AI model can play a valuable role in inspiring designers and aiding in design decision-making.

5. *"Did you find interfaces that inspired you to make changes in the wireframe itself?"*

Participant P1 drew inspiration from interfaces that prioritize spacing and incorporate buttons adjacent to users and their names. Similarly, participant P2 found inspiration in interfaces that effectively group elements or rearrange containers and div elements. Participant P3 highlighted the inspiration derived from a vertical side menu, which provides opportunities for experimenting with unconventional element placements and navigation icons. Participant P4 expressed being inspired by interfaces that emphasize messages and incorporate symbols or icons alongside user names to convey status.

Participant P5 mentioned the AI's ability to assist in filling in missing elements from the wireframe, such as labels beneath navigation icons. Participant P6 found inspiration in interfaces featuring status icons positioned on the right side of user profiles and utilized margins to separate elements within a list. Participant P7 emphasized the value of incorporating call-to-action elements and utilizing card-based designs with shadowing effects to enhance visual distinction.

Participant P8 emphasized that wireframes should remain unchanged, with modifications applied to higher fidelity versions instead. Participant P9 found inspiration in manipulating element sizes to save space and utilizing call-to-action elements in conjunction with cards. Lastly, participant P10 drew inspiration from the display of elements, particularly the sizes of squares, and identified the absence of certain elements, such as a back-button.

6. *"Did you find interfaces that contain elements or structures that are better than the wireframe itself?"*

Participant P1 noted that the introduction of appropriate spacing between elements and the inclusion of buttons adjacent to user profiles and names contributed to an improved design. Participant P2 observed that incorporating border-radius, shadowing effects, and more distinct colors enhanced the original design. They also emphasized the utilization of lines as visual dividers between elements, which were absent in the wireframe. Participant P3 appreciated how interfaces effectively differentiated elements through the strategic use of lines and colors.

Participant P4 identified the highlighting of messages as a beneficial improvement; however, they expressed a general concern that many interfaces appeared overly complex. Participant P5 emphasized the significance of utilizing lines to separate cards and incorporating text beneath navigation icons located at the bottom of the screen. Participant P6 believed that interfaces facilitated structural changes aimed at improving ease of use, particularly for comfortable thumb interaction, and enhancing element margins.

Participant P7 highlighted the advantages of incorporating titles and call-to-action elements that were not initially depicted in the wireframe. Participant P8 expressed a preference for interfaces that added a playful touch to the design, rendering them visually engaging. Nonetheless, they also acknowledged the difficulty of comparing interfaces to the wireframe when there was minimal resemblance between the two. Participant P9 found that while the wireframe itself was minimalist in nature, interfaces provided valuable ideas on element positioning and "filling in" the wireframe with additional elements. Participant P10 acknowledged the simplicity of the wireframe and recognized how interfaces helped identify missing elements, such as the back-button. However, they also expressed a desire for the AI to offer more innovative solutions.

7. *"Do you think that using a text-to-image model could be useful as a starting point for interface design, or is it better to rely on more traditional methods?"*

Participants P1, P3, and P6, recognize the value of utilizing the model as a source of inspiration or as a tool for generating design suggestions rapidly. Participant P5 suggests a combination approach, utilizing external applications or websites for inspiration and subsequently experimenting with the AI-generated interfaces to extract specific elements for the final design. Participants P9 and P10 also perceive potential in using the text-to-image model as an inspiration tool, particularly when faced with a lack of clear visual direction.

Participant P2 emphasizes the current limitations of AI technology and asserts that relying on traditional methods is preferable due to the errors and time required for image reconstruction. Participants P4 and P7 share the sentiment that the AI model should not serve as an actual starting point for design but can instead be employed to explore additional interface options or gather inspiration from design trends.

8. *"Do you think the text-to-image model can help save time in the design process? If so, in what ways?"*

Participants P1, P6, P7, and P10 expressed a belief in the potential time-efficiency of the model, considering it as a means of quickly gaining inspiration or gathering designs that could be utilized to fill in certain elements. In contrast, participants P2, P3, P4, P5, P8, P9, and P10 expressed skepticism regarding the model's current effectiveness in saving time. These participants cited concerns such as the model's high error rate, the necessity for detailed instructions, the existence of faster alternatives available on the internet, the lack of practical applicability, and the potentially time-consuming nature of developing prompts.

9. *"What would you like to see in a new AI system that is an improvement on this one?"*

Participants P1, P6, and P8 underscored the significance of being able to edit and customize the designs generated by the AI, encompassing elements, wireframes, and margins. Participant P1 additionally expressed the desire for a user-friendly graphical interface and the capability to import existing designs from other tools.

Participants P2 and P5 emphasized the necessity for an AI system that can automatically recognize and adjust elements while adhering to design principles and rules. They also highlighted the importance of having the flexibility to override or modify design restrictions as needed. Participant P5 further emphasized the desire for the AI to possess an understanding of technical design terms.

Participants P3, P4, and P10 put forth suggestions for additional features that could enhance the AI system. Participant P3 emphasized the importance of the AI providing hints and information about generated elements, generating animations, and guiding users toward desired design styles. Participant P4 desired the AI to possess an understanding of technical UX terms, accurately follow instructions, and offer suggestions for improving existing designs. Participant P10 emphasized the need for an AI system that assists in the design process by providing suggestions, improving UX accessibility, verifying user-friendly content, and maintaining data privacy.

Participants P7 and P9 presented more specific requirements. Participant P7 desired features that allow for targeting specific elements or sections of the interface and working with multiple variations of the same interface, which may include interactive components like forms or drop-down menus. Participant P9 suggested integrating the AI system with external design tools to facilitate easier editing of individual elements, while also stressing the importance of responsive design for multiple devices and incorporating design rules to ensure more logical designs.

5. Discussions & Conclusion

5.1 Analysis of the UTAUT Questionnaire Results

The findings of the UTAUT questionnaire indicate the presence of uncertainty regarding the potential of generative AI to enhance the workflow of UX design. Additionally, there is a lack of familiarity among UX designers concerning generative AI, particularly in relation to text-to-image models. The lack of familiarity with generative AI may explain the hesitancy among UX designers in determining its usefulness in producing high-quality work within the field of UX design. These two factors, namely indecisiveness and unfamiliarity, likely contribute to the reluctance of UX designers to adopt generative AI in their workflow.

Despite harboring doubts about the technology's ability to enhance their workflow, UX designers express a strong desire to acquire the necessary knowledge and skills for its implementation. The belief that generative AI can potentially enhance time efficiency is a primary motivating factor driving this interest. Other factors contributing to this inclination may stem from the perceived professional pressure to incorporate generative AI into their workflow. However, this pressure does not appear to be significant enough to compel UX designers to adopt generative AI when they observe their colleagues utilizing it. This observation suggests that the perceived pressure is not widespread among peers in the UX design community. The precise source of this pressure remains unexplored in the present study. One explanation for this perceived pressure could be the increasing prevalence of AI in fields related to UX design or concerns about the potential impact of AI on the UX design domain, as noted by Akhmedov (2022). However, this hypothesis requires further investigation. Nevertheless, the UTAUT questionnaire effectively highlights the willingness of UX designers to embrace AI rather than oppose it, thus warranting further research on integrating future AI systems into the UX design workflow to bridge the gap between AI systems and UX designers.

5.2 Participant Expressions and Actions Analysis

During the assessment of AI-generated interfaces, participants consistently observed a structural distortion whereby the output deviated significantly from the original wireframes. The AI often introduced additional elements or departed from the intended structure, indicating its struggle to accurately replicate the desired design. Notwithstanding this limitation, participants found value in utilizing the AI as a source of inspiration and idea generation. The generated interfaces served as a reference point for enhancing existing designs or exploring novel concepts. Participants appreciated the AI's capacity to generate new elements and creative variations.

The participants emphasized the importance of generating interfaces that align with user needs. Although the AI introduced extra elements, they were deemed valuable only if they served a purpose and fulfilled the user's requirements. Further examination revealed that the level of specificity in the text prompts influenced the outcomes. Providing specific instructions within the text prompt often led to undesirable results, while leaving instructions more ambiguous yielded more promising outcomes.

Regarding the AI's ability to design elements, participants appreciated the AI's consistency in structuring elements, even though the resulting structures did not closely resemble those presented in the wireframes. Additionally, participants valued the consistency in the generation of color palettes and font categories. However, inconsistencies were noted in the AI's inability to consistently generate borders around shapes.

It is evident that participants perceive the AI model as a source of inspiration and consider the strength of a text-to-image model to lie in its ability to rapidly present design ideas to stakeholders in real-time. However, participants expressed that the current technological capabilities are not sufficiently advanced for the AI to be an effective design tool. Throughout the experimentation, participants frequently suggested improvements for a future system. One suggestion pertained to generating usable icons and targeting specific components within the interface to enhance usability. Additional suggestions were provided for desired features such as the ability to select HEX colors, target specific components, have the system detect fonts, and provide step-by-step guidance for the UX designer throughout the design process.

5.3 Participant Text-Prompt Analysis

Upon analyzing the text-prompts utilized by the participants, a clear differentiation among the participants into two distinct groups becomes evident. The first group demonstrated a comprehensive understanding of what they aimed to achieve and design, while the second group displayed limited to no conceptualization of the desired appearance of the hi-fi variant of the wireframe. Instead, the latter group adopted a more exploratory approach, relying heavily on the provided example prompts. This distinction can be discerned by examining the frequency of example prompts employed and the specificity of the instructions provided.

The group possessing a clearer vision of the hi-fi wireframe design was more inclined to create their own prompt instructions, relying less on the provided examples. They utilized the example prompts as a foundation to guide the AI while incorporating specific instructions tailored to their desired outcomes. Conversely, the group with minimal or no preconceived notions heavily depended on the example prompts, making only minor adjustments or occasionally removing the wireframe altogether to observe the impact on the generated interfaces. Nonetheless, as these participants continued to experiment with the AI and prompts, some began to develop a sense of the design direction they wished to pursue. As a result, their prompts gradually became more precise, gradually diminishing their reliance on the example prompts.

A discernible pattern emerged among the participants who possessed a clear design direction. These individuals formulated highly specific instructions within their prompts, focusing on the generation and placement of elements and components within the interface. The formulation of these prompts was characterized by direct instructions, indicating the participants' efforts to assert control over the generation process of the interfaces.

5.4 Interview Results Analysis

The primary concern commonly reported in relation to the text-to-image model pertains to its inherent incapacity to maintain a consistent structure akin to the structure outlined within the wireframe. Furthermore, the model frequently fails to consistently present essential user interface (UI) components, including icons or the navigation menu, in each generated output. In addition to these shortcomings, the AI model encounters difficulties in comprehending UX terminologies and accurately rendering overlay depth. Despite the lack of structural fidelity to the wireframe, participants noted that the AI model excelled in artistic visualization aspects, such as color selection, as well as appropriately arranging elements and components in the correct hierarchical order.

Regarding the incorporation of the AI model as a tool alongside traditional design tools, participant opinions were divided. Some participants reported utilizing the AI model as a source of inspiration for design direction, generating ideas for the inclusion of supplementary components (e.g., call-to-

action elements), or for live presentation purposes. Conversely, others expressed reservations, contending that the technology's level of sophistication is insufficient for active integration into the design process. They further argued that attempting to employ the AI model for active design tasks could potentially consume more time, as achieving satisfactory results might necessitate significant iterations, but not when used as an initial source of inspiration.

Furthermore, participants conveyed several suggestions for desirable features in future iterations of the system. These encompassed the ability to exert greater control over editing specific components, the automatic adjustment of elements based on established design rules, a better understanding of design principles and technical design terminology, and real-time collaboration and suggestions throughout the design process.

5.5 Conclusion

This research study provides valuable insights into the perceptions and experiences of UX designers regarding the effectiveness of text-to-image models in the conversion of wireframes into hi-fi interfaces. By engaging UX designers with professional expertise, this investigation successfully obtained the necessary quantitative and qualitative data to achieve the research objective of determining whether text-to-image models can transform wireframes into hi-fi interfaces.

The quantitative data analysis revealed that the participating UX designers exhibited limited familiarity with the utilization of text-to-image models and expressed uncertainty regarding the potential usefulness of incorporating generative AI within the UX design process. However, the designers acknowledged the potential time-saving benefits of generative AI and expressed a willingness to acquire the necessary skills for its utilization.

The results obtained from the experimentation assessments, in conjunction with the qualitative data gathered through interviews, indicated that the existing technology of text-to-image models lacks the sophistication required to render them truly valuable as tools integrated into the design process. Notably, these models often fail to generate interfaces that closely resemble the original wireframe structure and frequently misplace or leave out crucial components. The participants emphasized that the current technology of text-to-image models makes these models best employed as sources of inspiration for design directions or as a means to rapidly present design concepts to stakeholders. However, the study participants did express their recognition of the potential for text-to-image models to be beneficial when improved.

Furthermore, the study participants expressed a desire for an enhanced AI system that actively engages in design collaboration by demonstrating an understanding of technical terms and design principles, generating interfaces that accurately mirror the given wireframes, providing designers with control over the modification of specific components, and offering suggestions throughout the design process.

5.6 Limitation and future work

While the study presented provides valuable insights, it is subject to several limitations that should be considered. Firstly, the sample size was limited to only 10 participants. It is important to acknowledge that this number is insufficient to draw definitive conclusions that can be generalized to the broader population of UX designers. Moreover, the small sample size restricts the depth of insights that could have been obtained. Conducting future studies with a larger number of participants would not only enhance the generalizability of the findings but also facilitate a more

comprehensive understanding of UX designers' perspectives on the utilization of this AI model in the UX design process.

Secondly, another limitation arises from the lack of diversity in the participants' years of experience as UX designers. The majority of participants in this study were early-career professionals with less than three years of experience. Consequently, the valuable insights and perspectives of senior UX designers are absent from the analysis. Including senior UX designers as participants in future studies would not only fill this gap in the data but also shed light on the differential thought processes between young professionals and their more experienced counterparts.

The third limitation pertains to the potential ambiguity in the interpretation of the UTAUT (Unified Theory of Acceptance and Use of Technology) questions. Although the UTAUT questions serve as a useful tool for gauging UX designers' familiarity with and perspectives on generative AI, there remains uncertainty regarding how participants actually comprehend and interpret the presented questions. This ambiguity in interpretation could impact the accuracy and validity of the results, as participants may answer questions without fully grasping their intended meaning. Future studies should employ precautionary measures to ensure participants possess a correct understanding of the questions and terminologies employed.

Lastly, the lack of real-world experimentation represents a further limitation. In this study, a controlled experiment was conducted where participants were provided with a wireframe they are unfamiliar with. This unfamiliarity may have contributed to some participants having a limited understanding of the intended direction for the hi-fi design of the wireframe. Conducting experiments within real-world projects, while challenging, would not only allow for the assessment of efficacy in practical settings but also yield valuable insights as participants would be more attuned to the projects they are working on.

Despite these limitations, this study successfully evaluated the efficacy of the current text-to-image technology within the context of UX design. However, a future study could build upon these findings by incorporating a prototype of the desired AI system and testing it within real projects to assess its effectiveness. By addressing these limitations and expanding upon the current research, a more comprehensive understanding of the potential applications of AI in UX design can be achieved.

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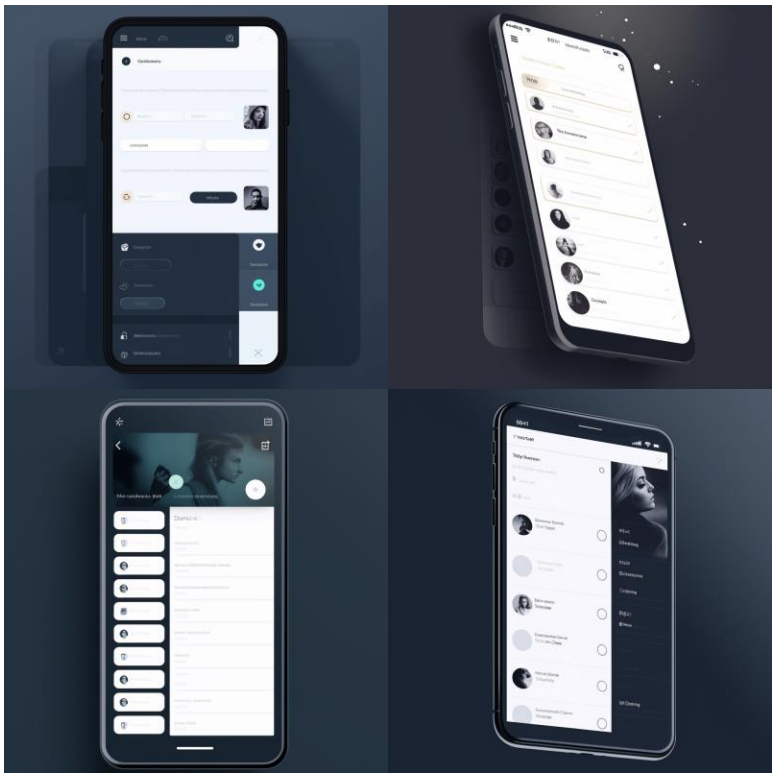
Appendix

Pre-Evaluation Experiment 2: Testing wireframe element variations and prompt formulas

Figma wireframe with lines as text.

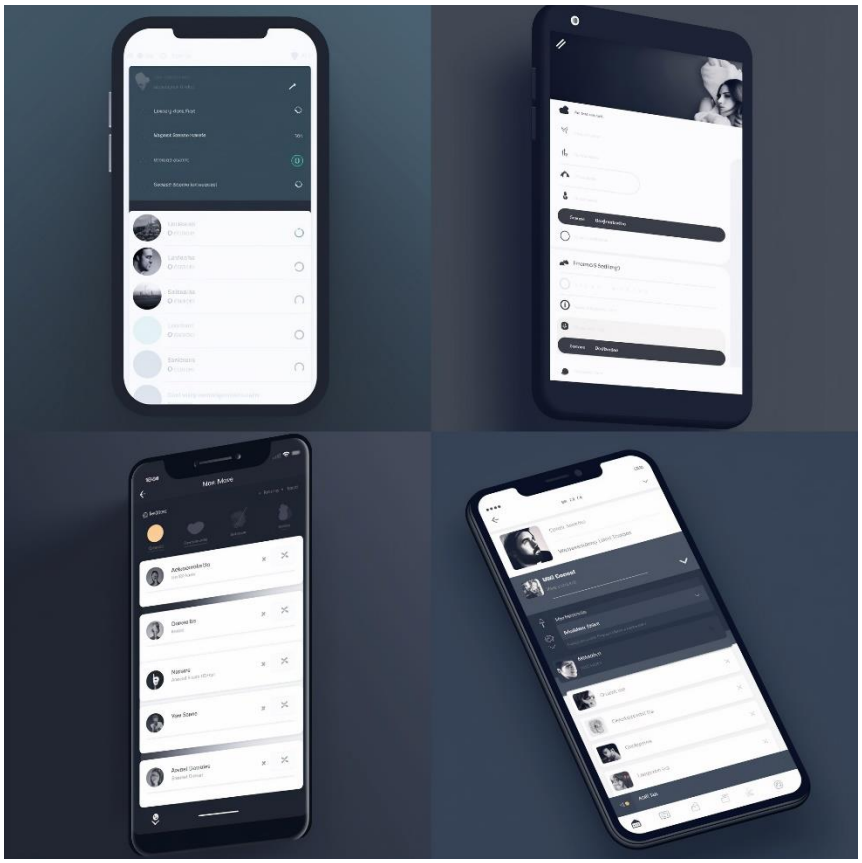
Prompt: **UI design of a social media app, Modern, Classy, High end, High Resolution --v 5**

Generation 1:

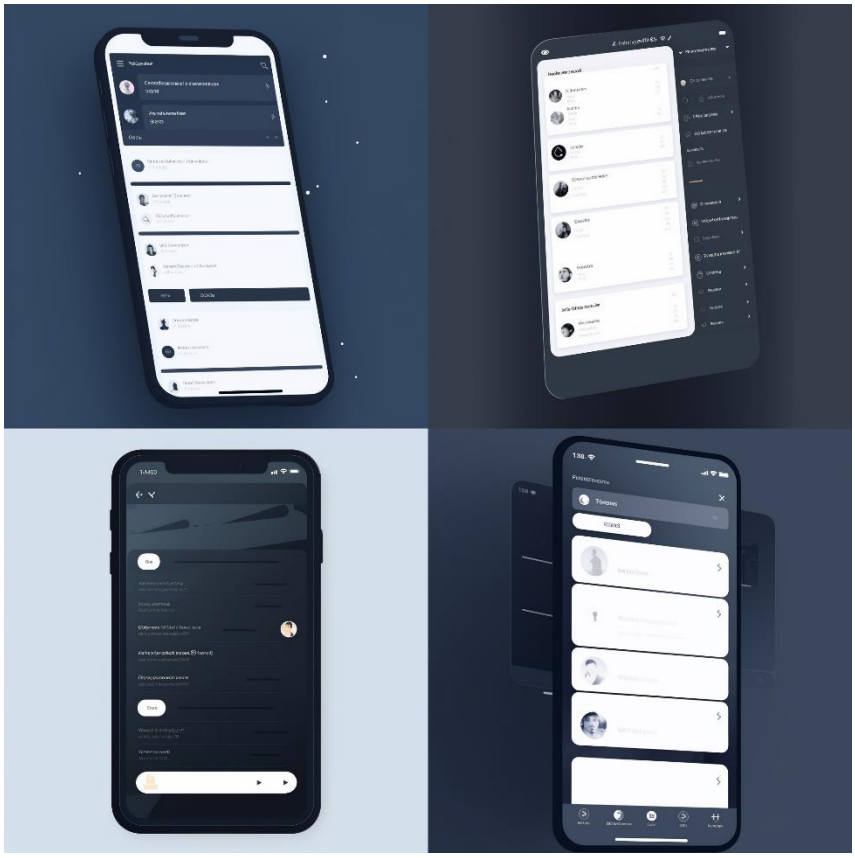


Generation 2:

Generation 3:

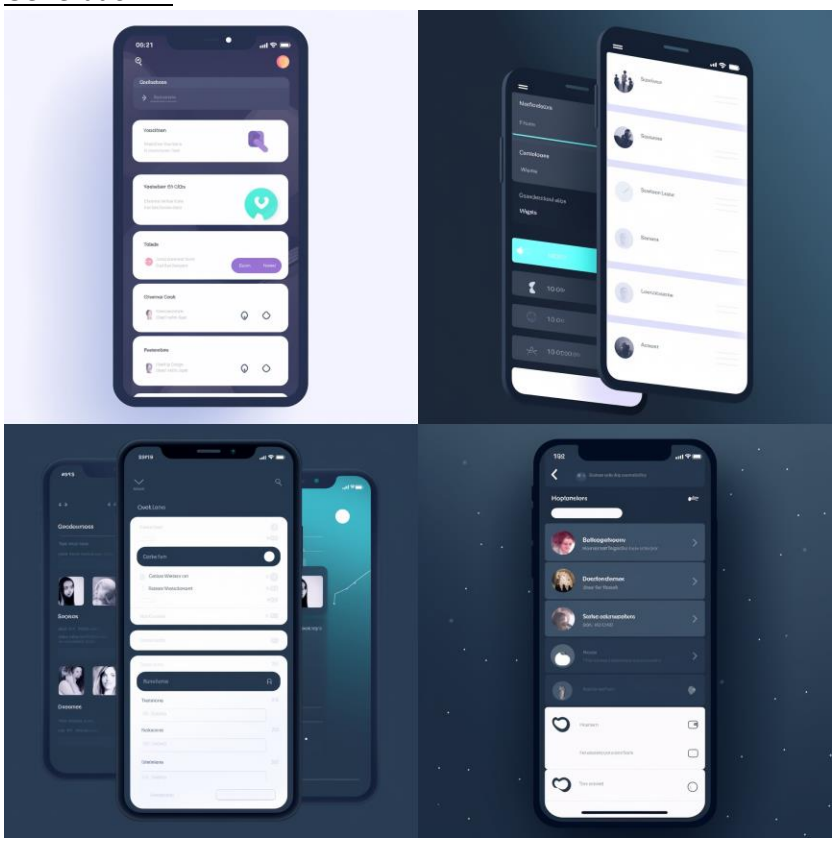


Generation 4:

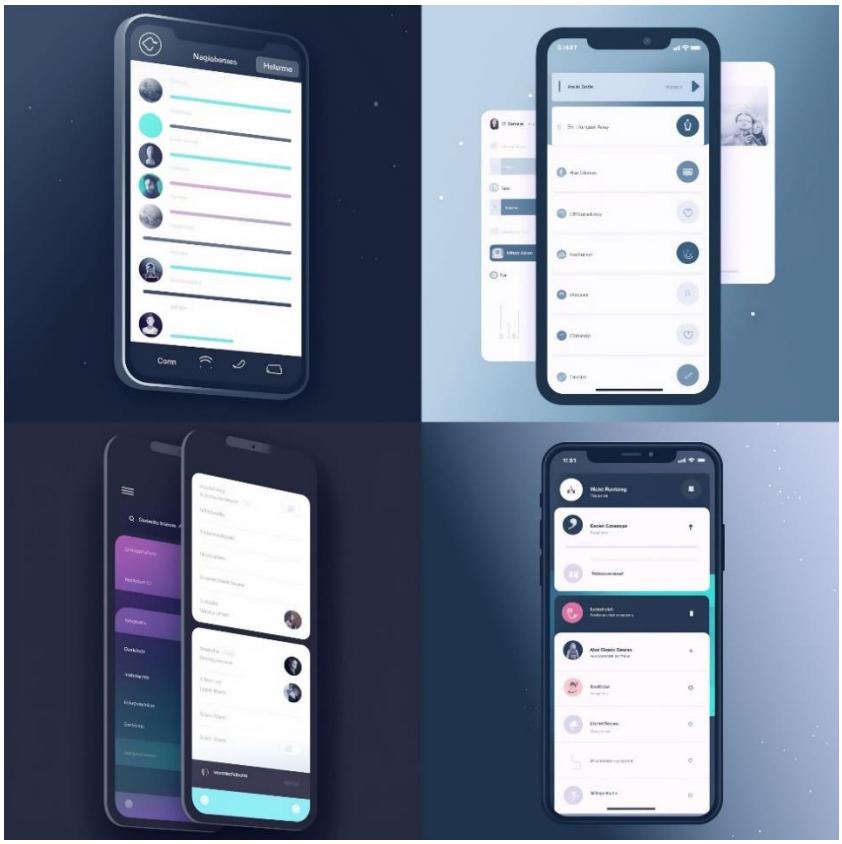


Prompt: **Social media app UI, Modern, Classy, High end, High Resolution --v 5**

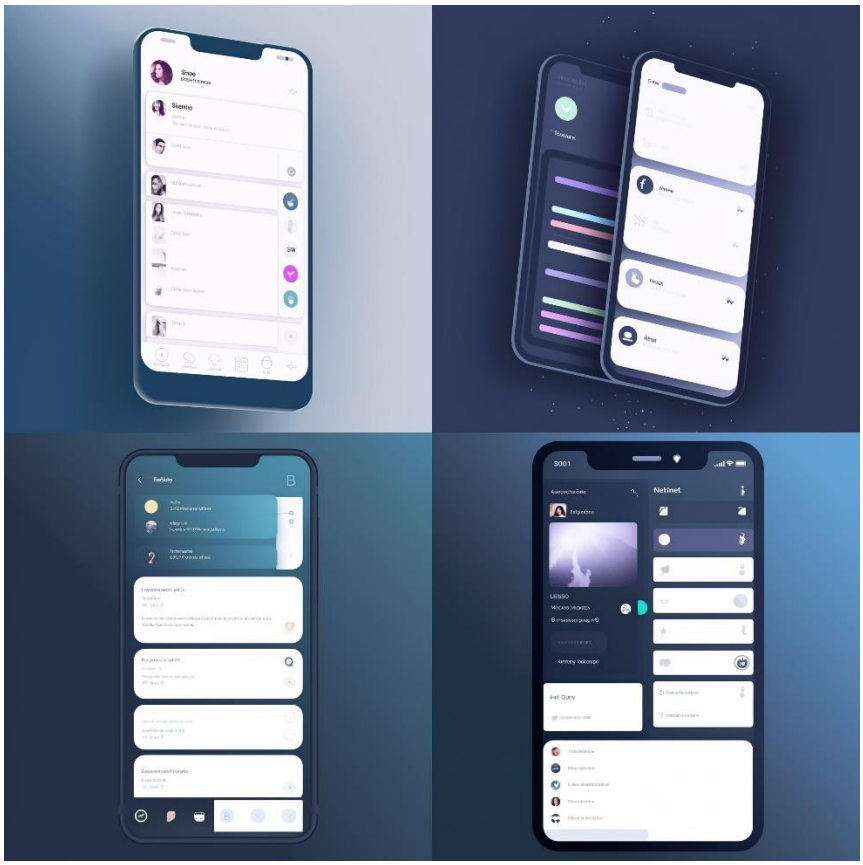
Generation 1:



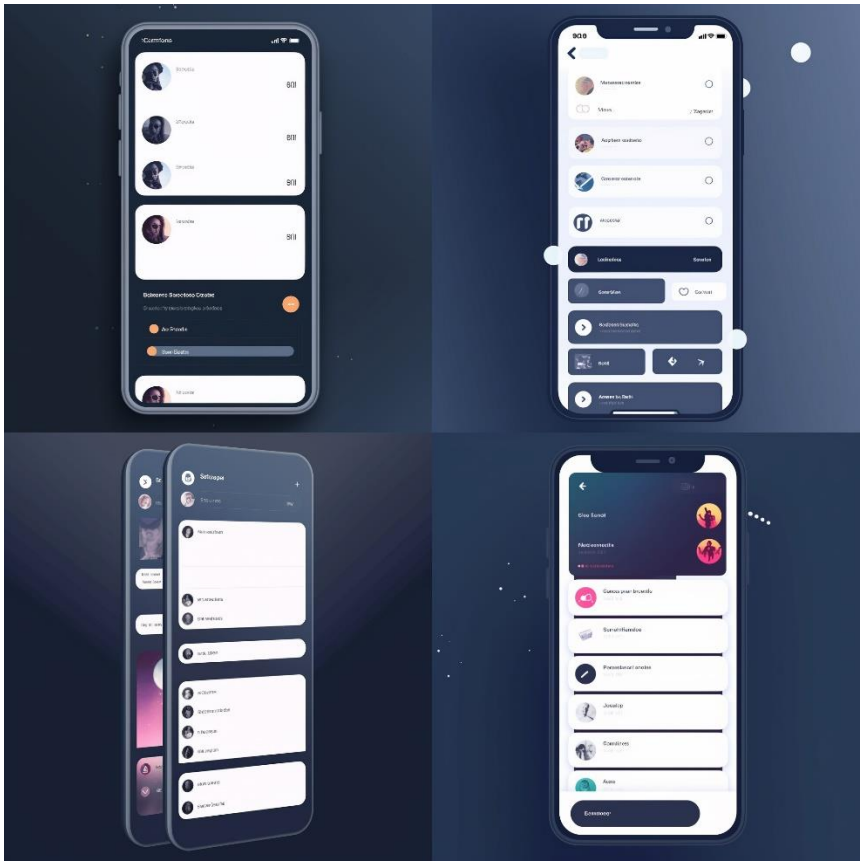
Generation 2:



Generation 3:

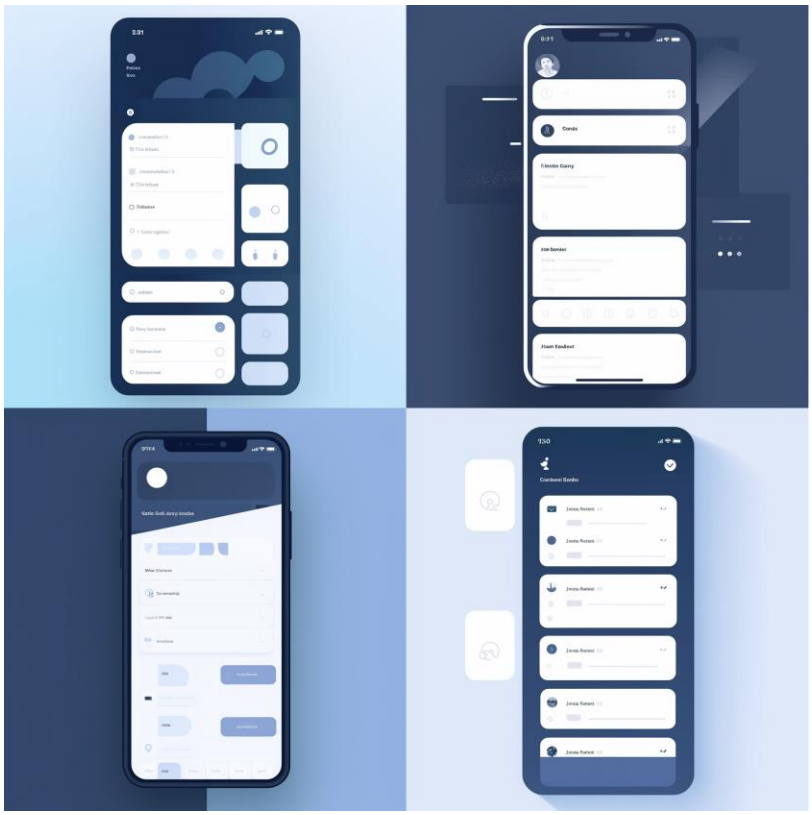


Generation 4:

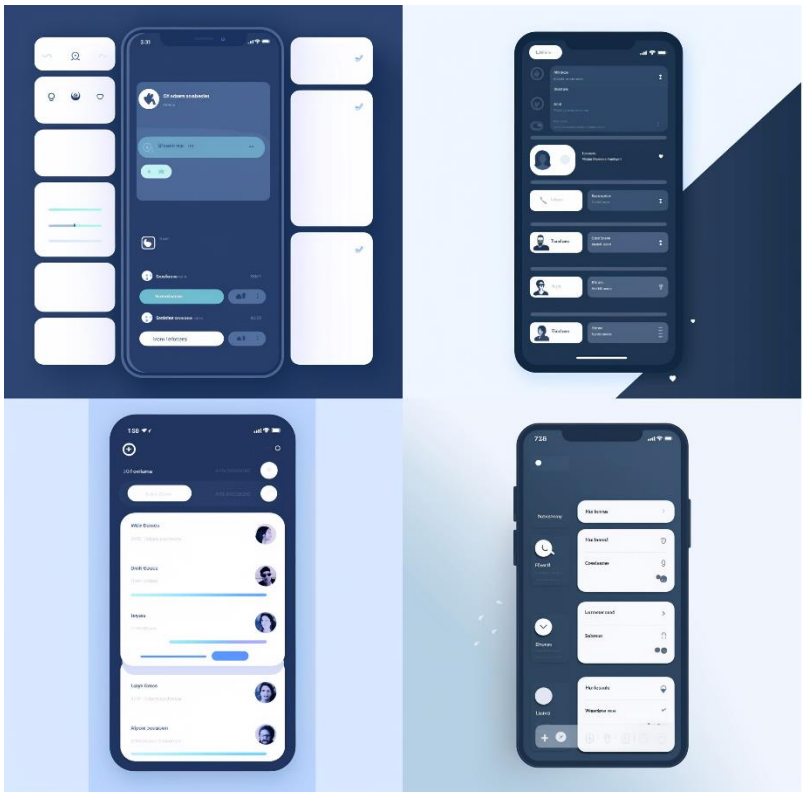


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --ar 4:3 --v 5**

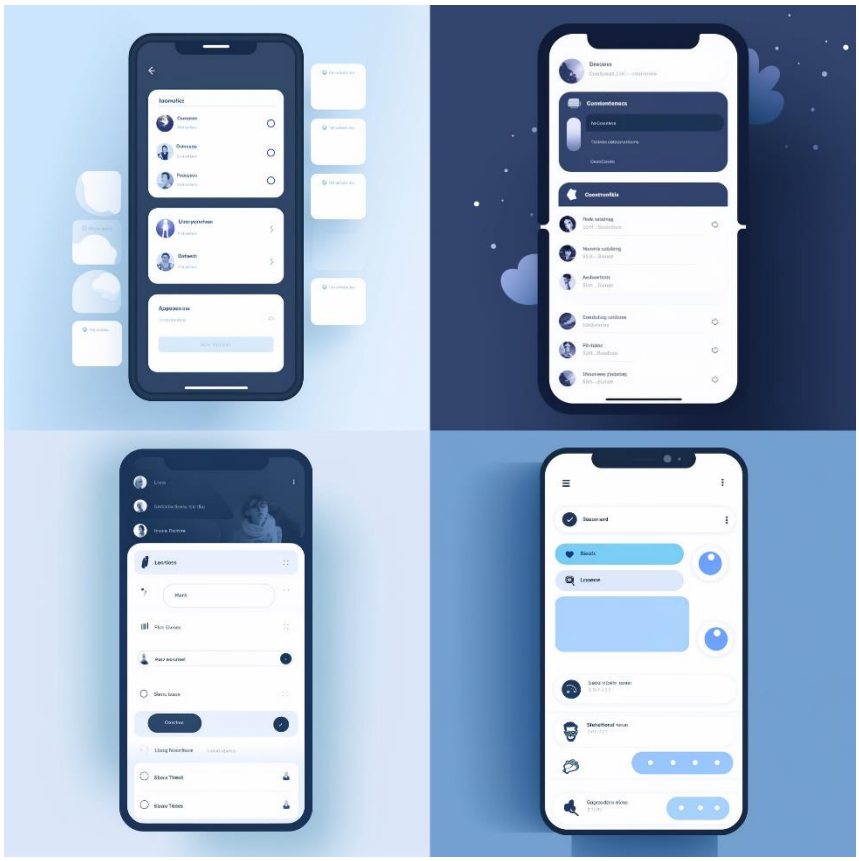
Generation 1:



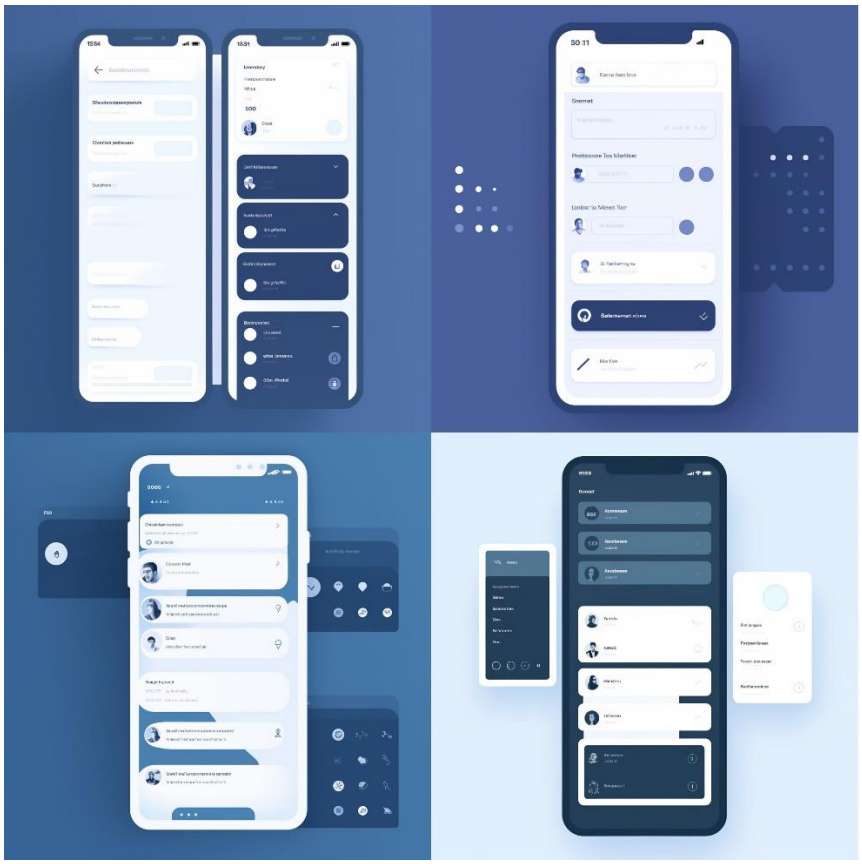
Generation 2:



Generation 3:

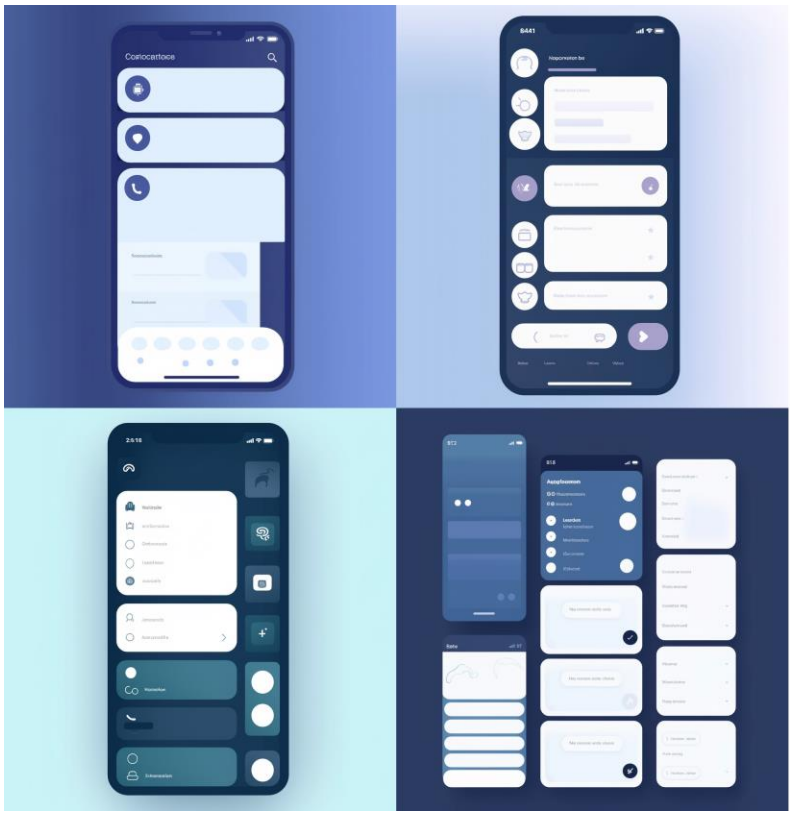


Generation 4:



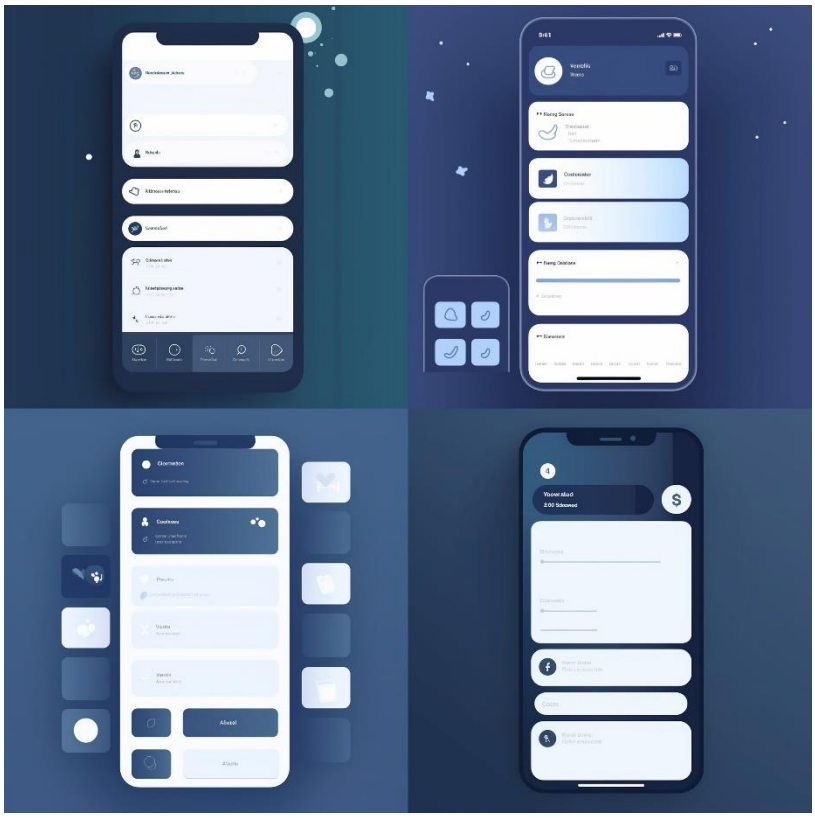
Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5**

Generation 1:

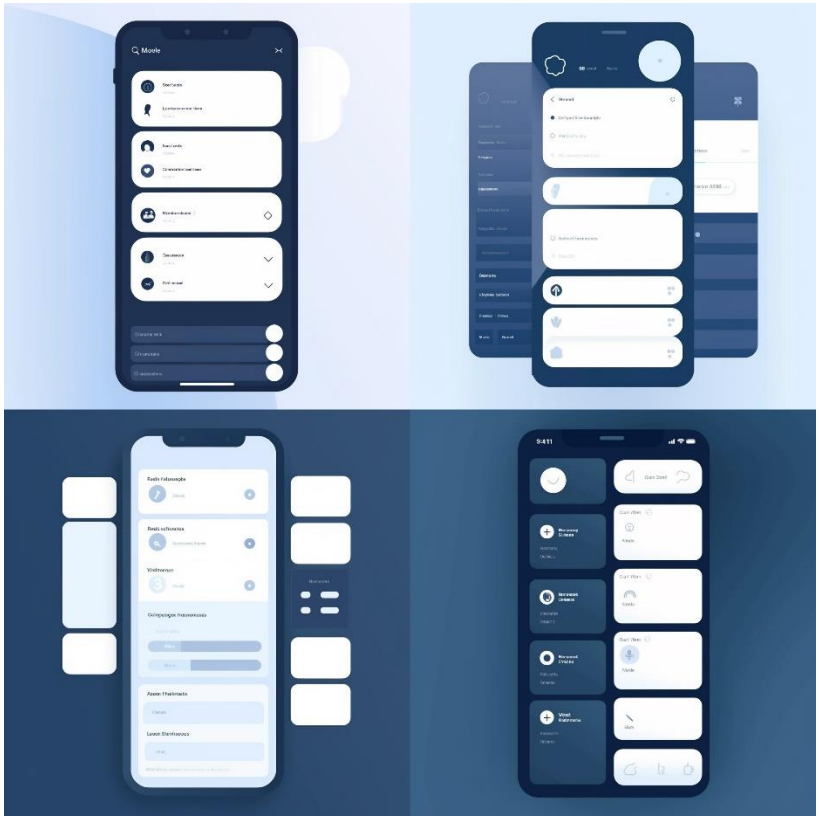


Generation 2:

Generation 3:



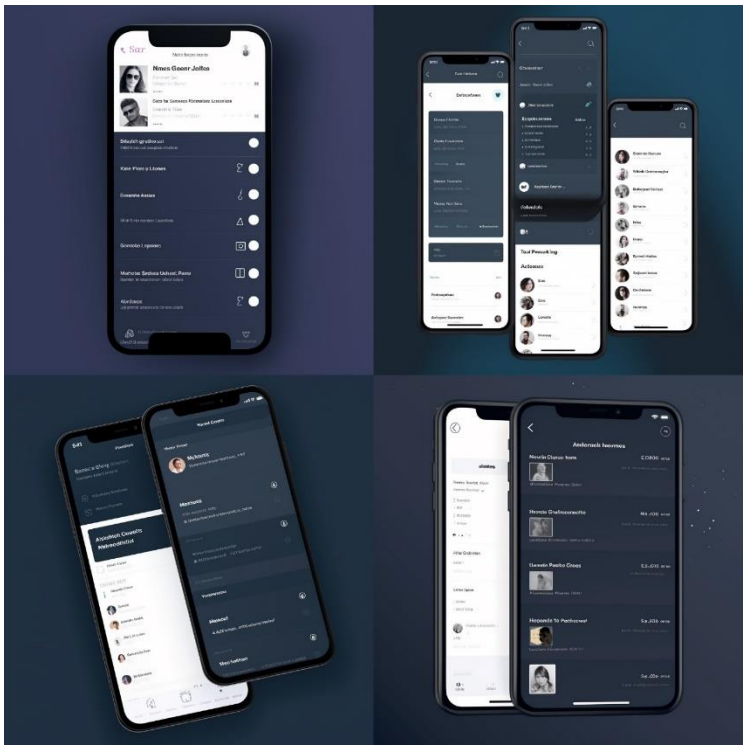
Generation 4:



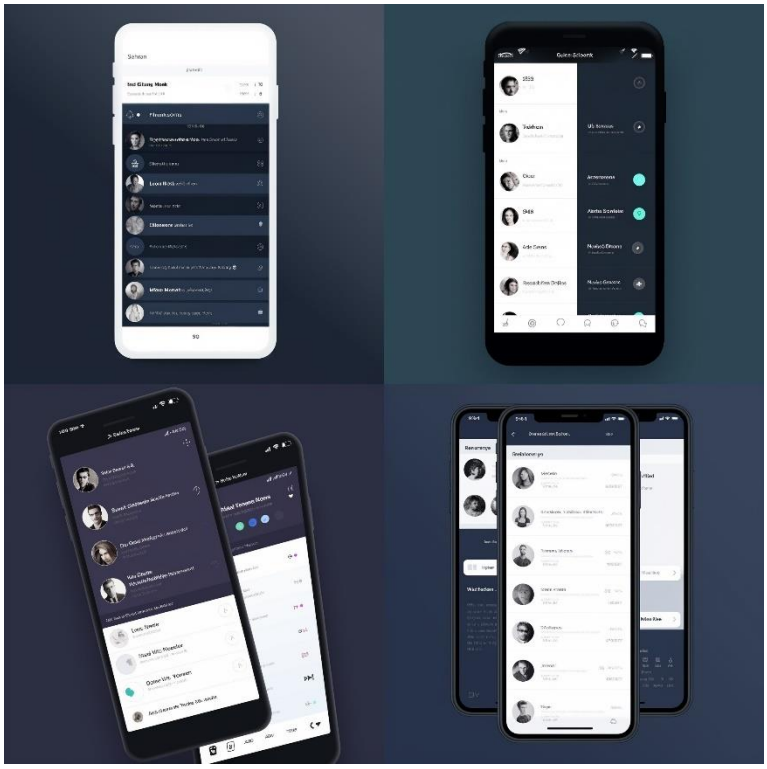
Figma-styled wireframe with actual text.

Prompt: **UI design of a social media app, Modern, Classy, High end, High Resolution --v 5**

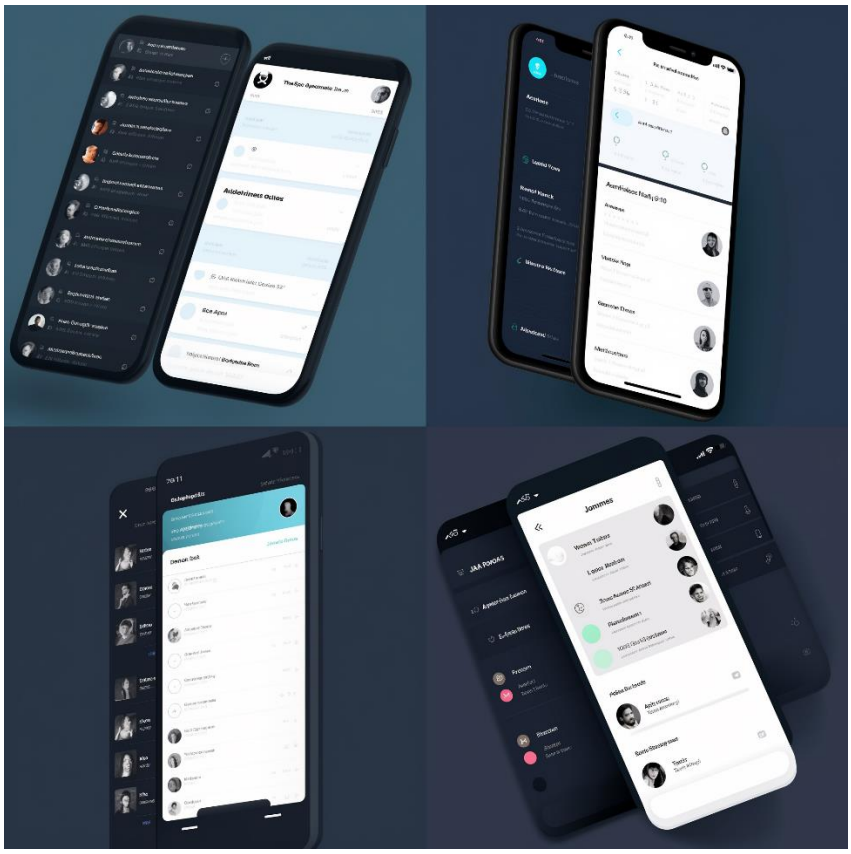
Generation 1:



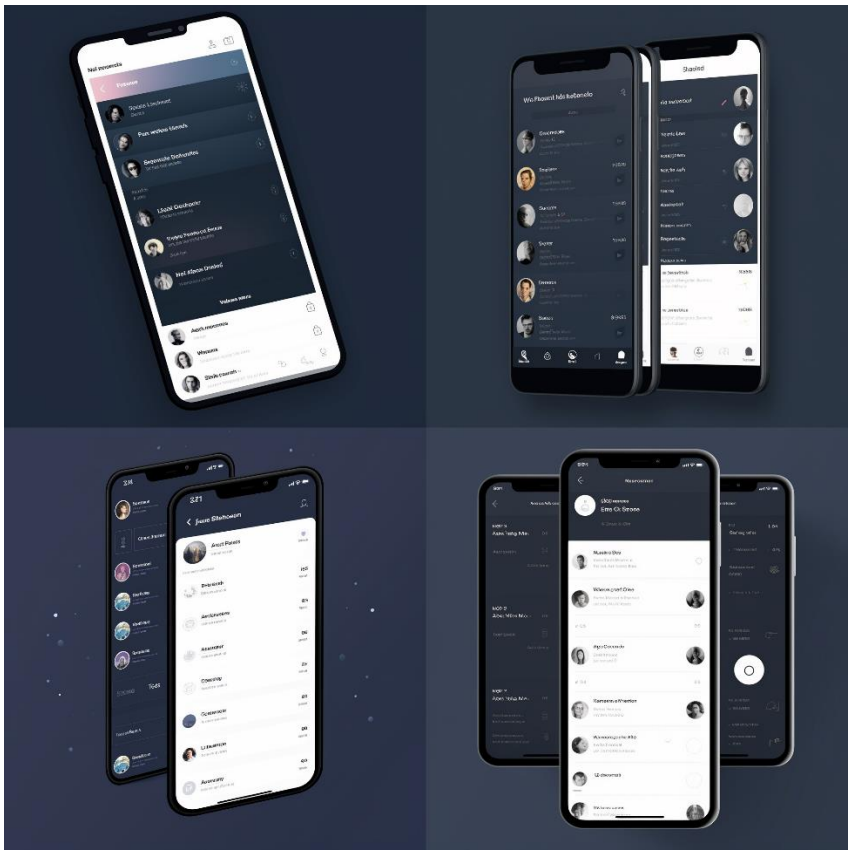
Generation 2:



Generation 3:

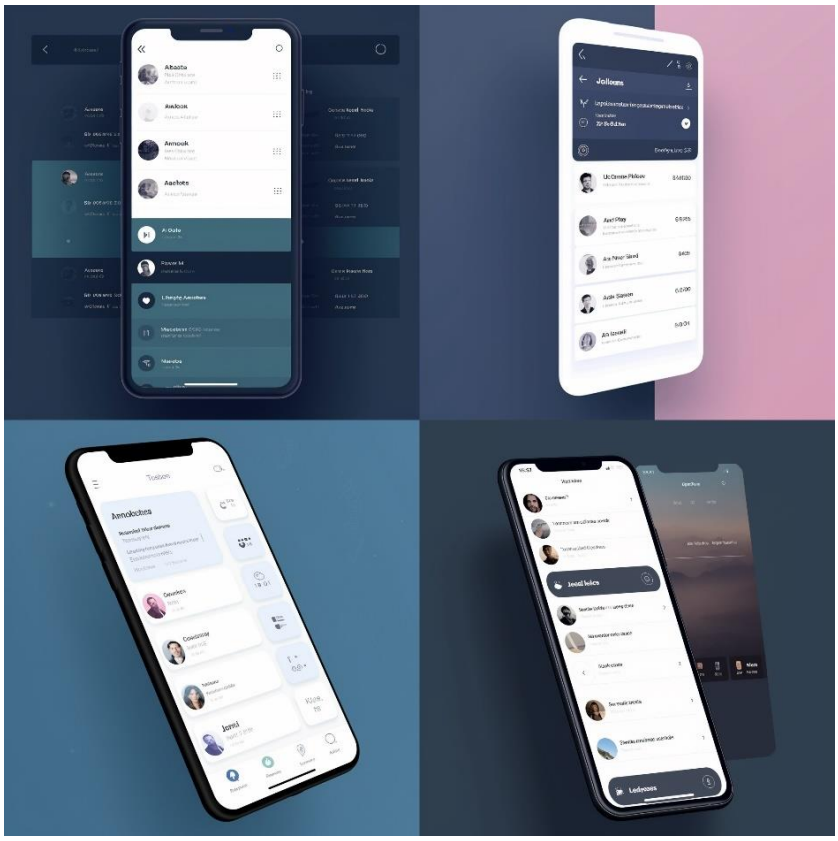


Generation 4:



Prompt: **Social media app UI, Modern, Classy, High end, High Resolution --v 5**

Generation 1:



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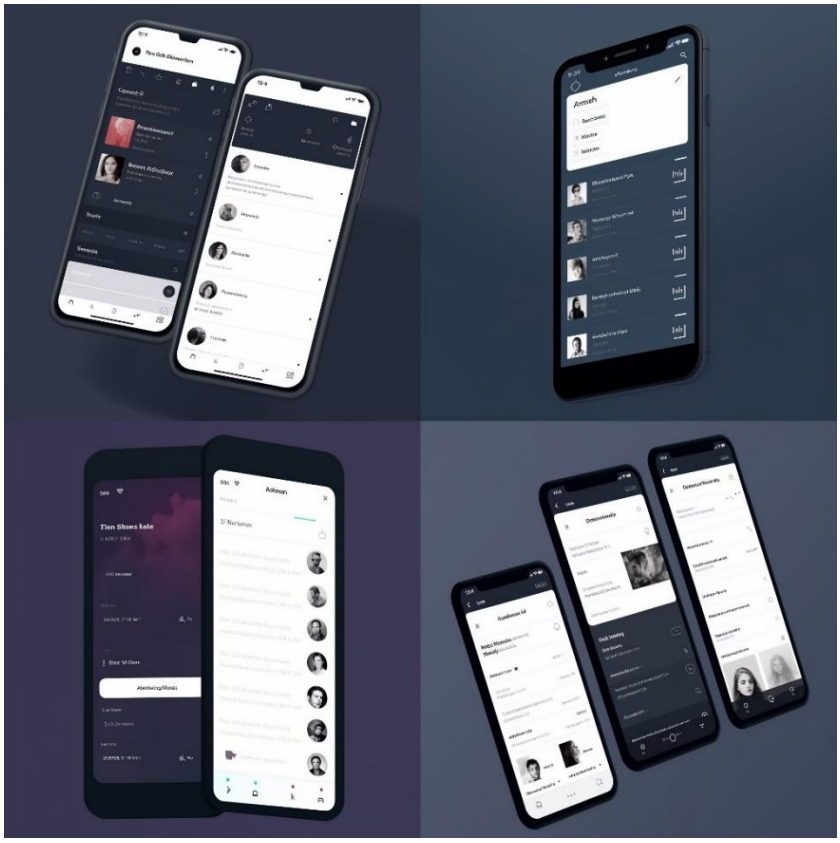

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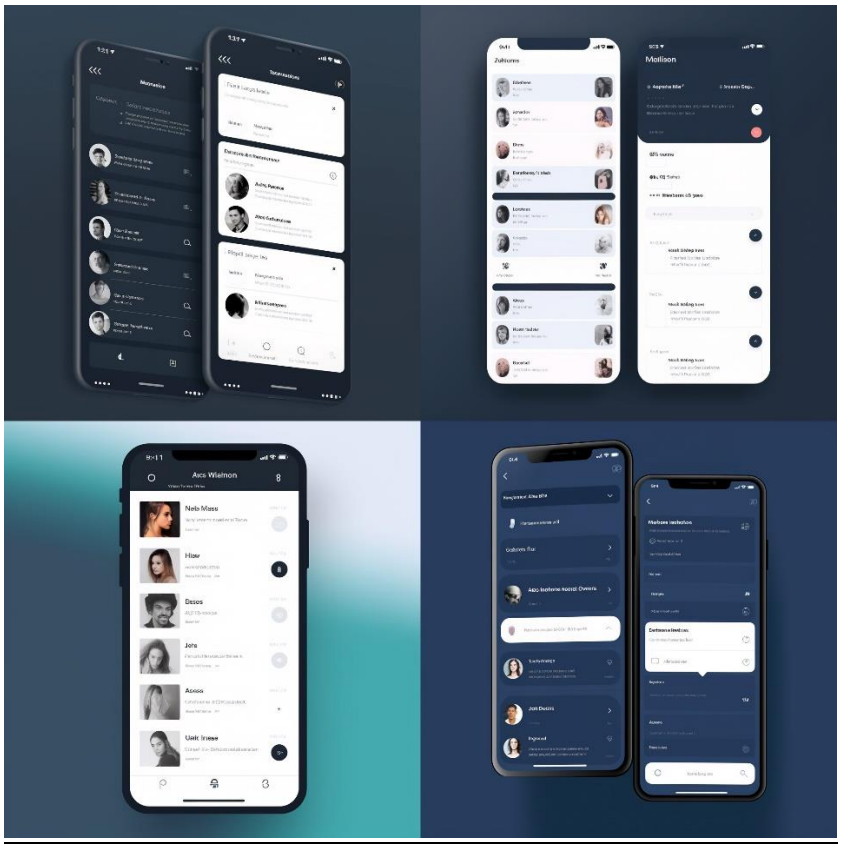
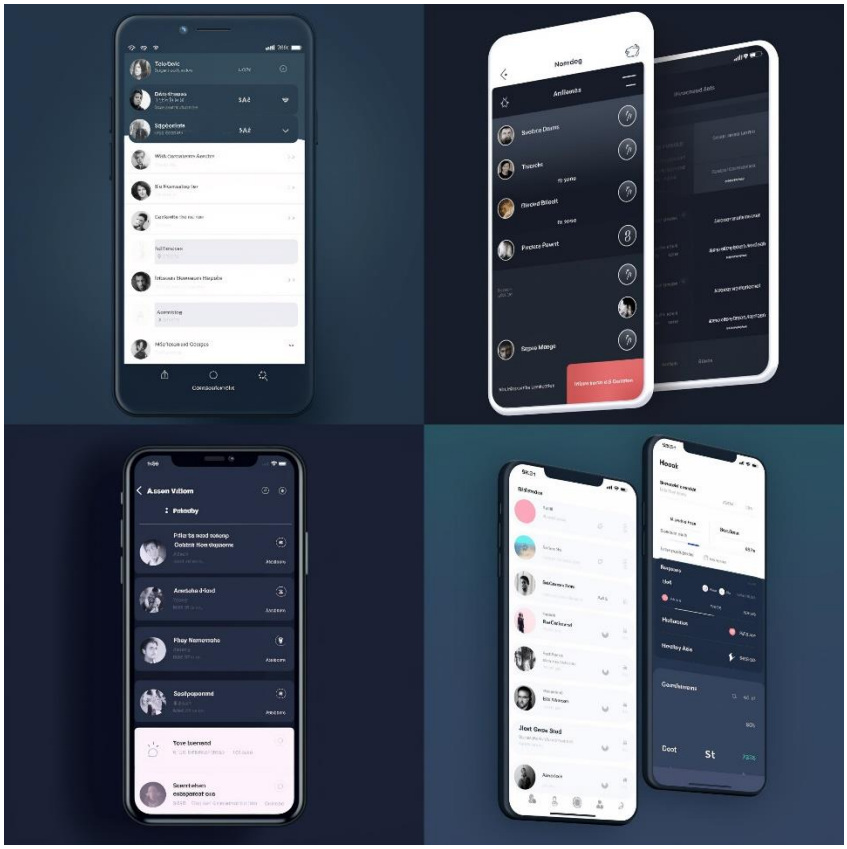
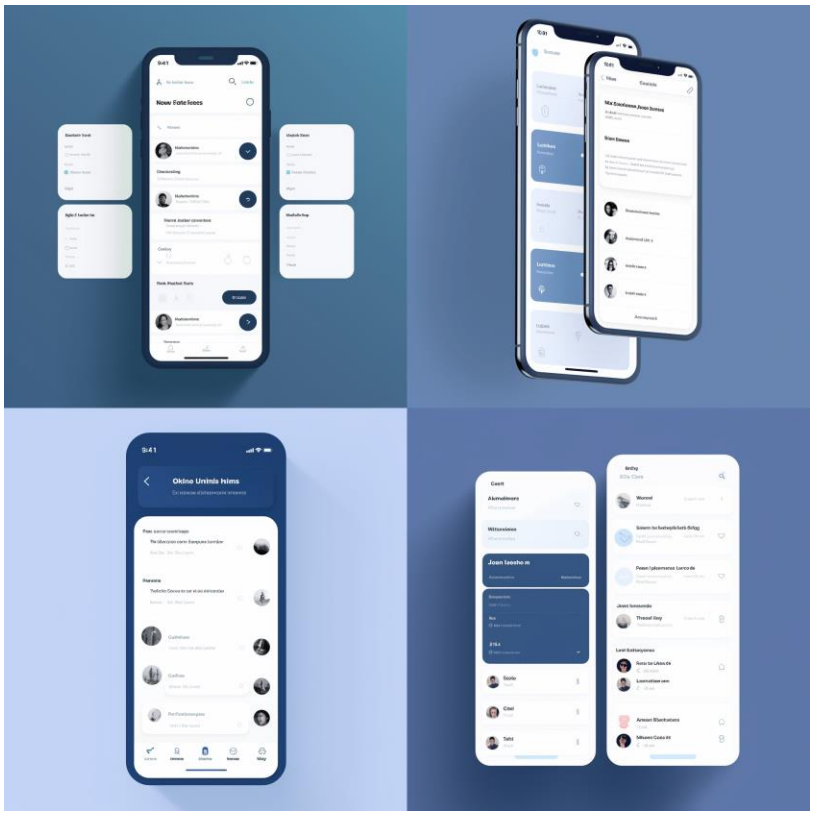


Generation 4:

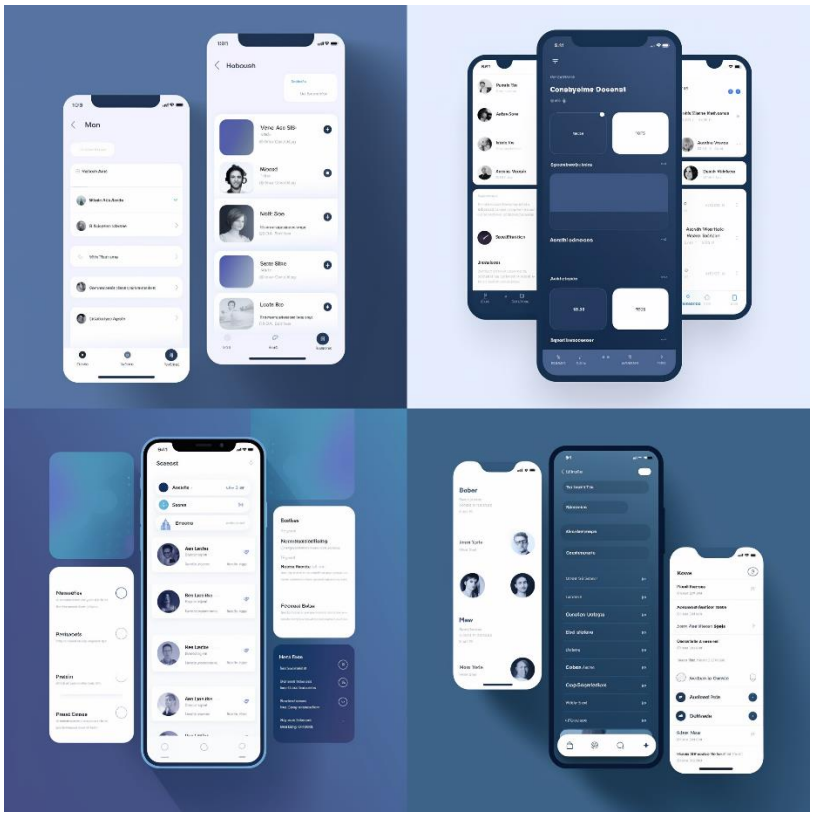


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5**

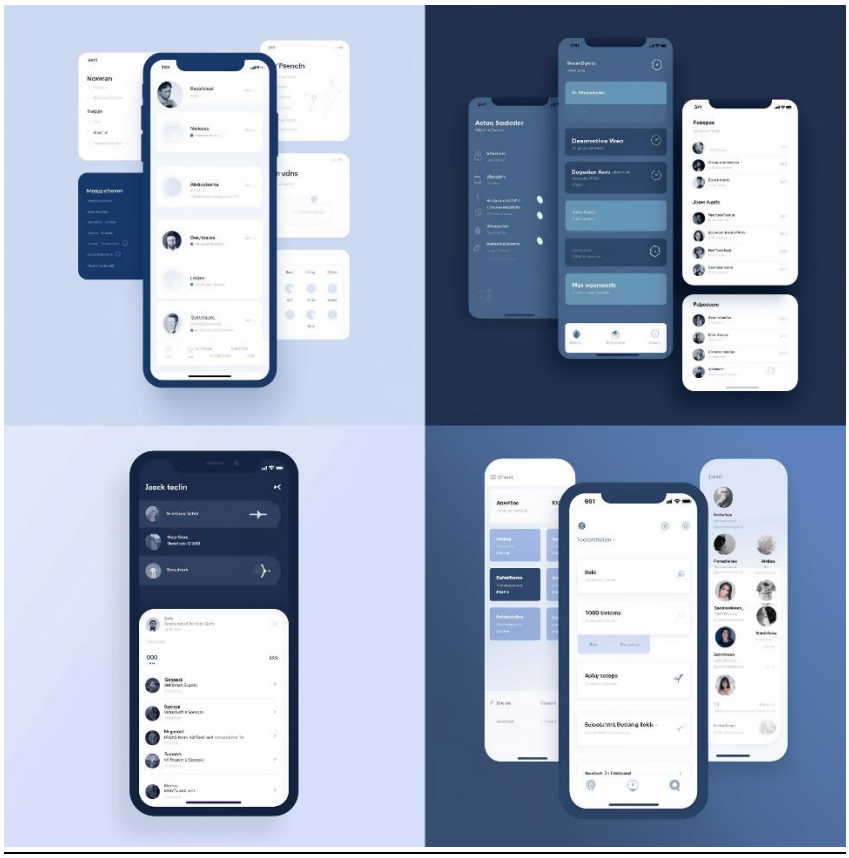
Generation 1:



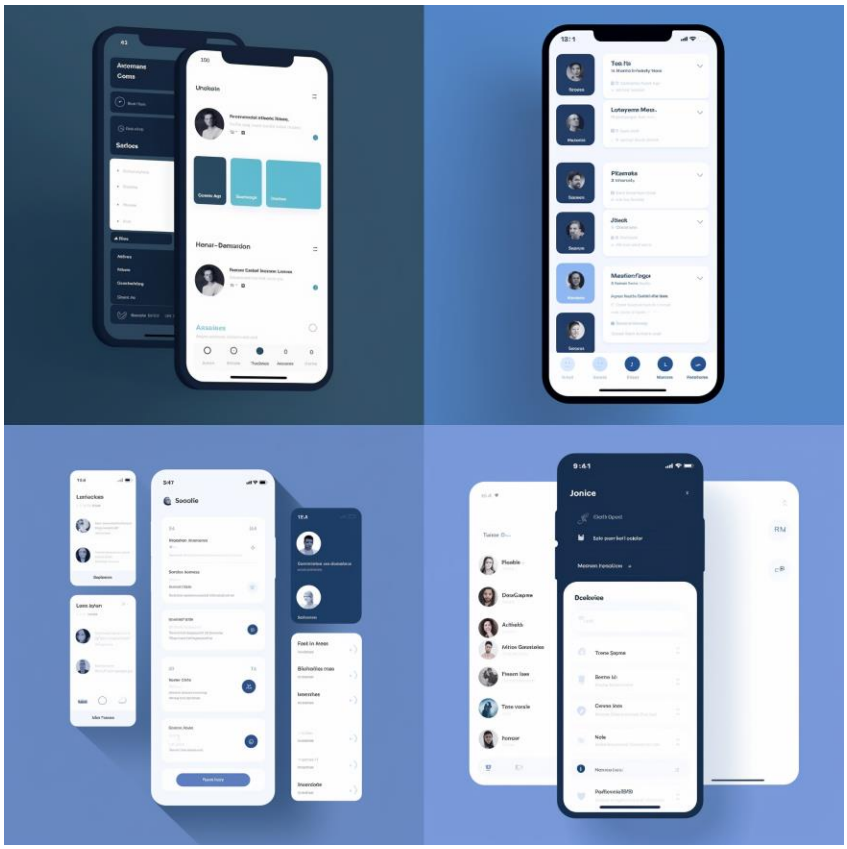
Generation 2:



Generation 3:

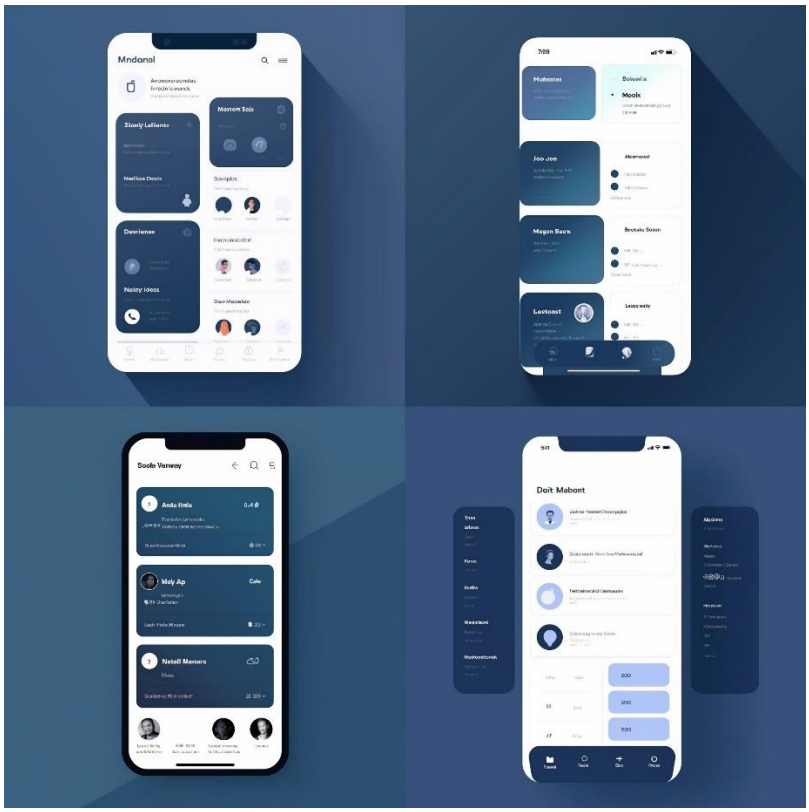


Generation 4:

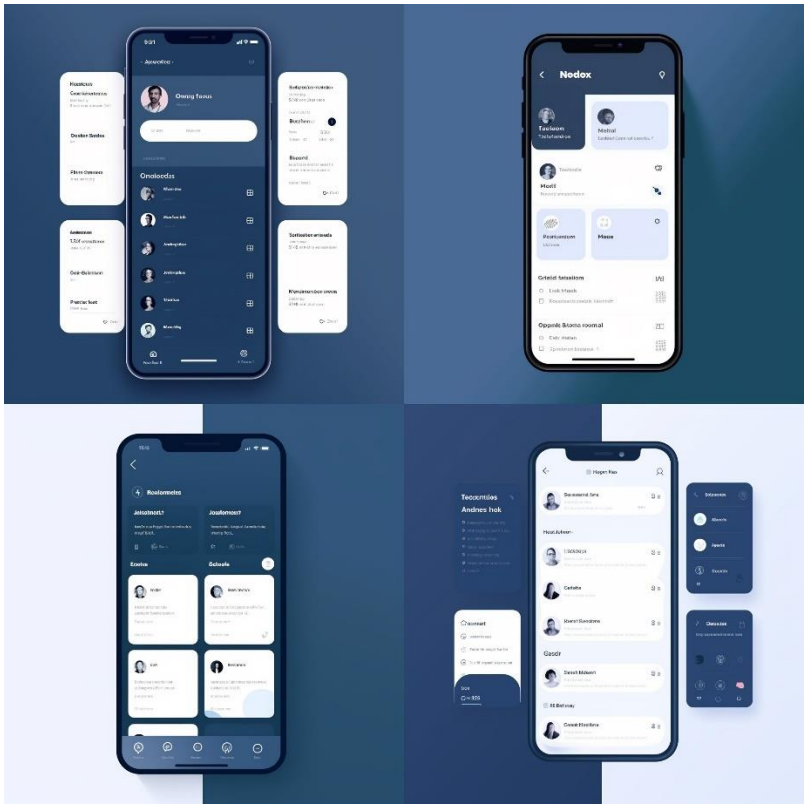


Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5**

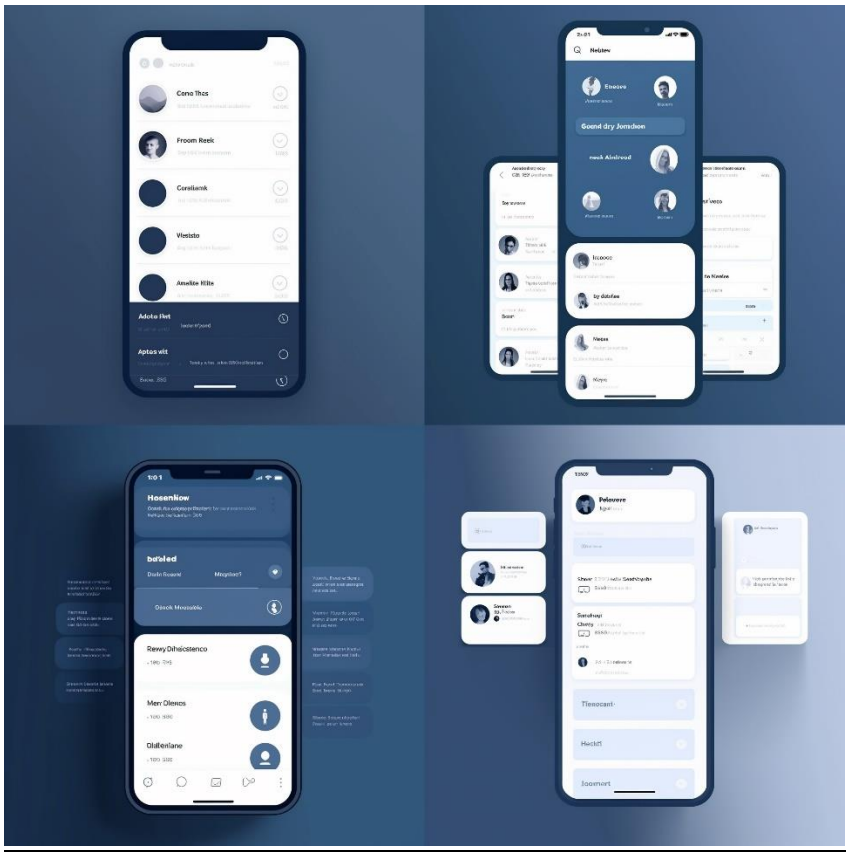
Generation 1:



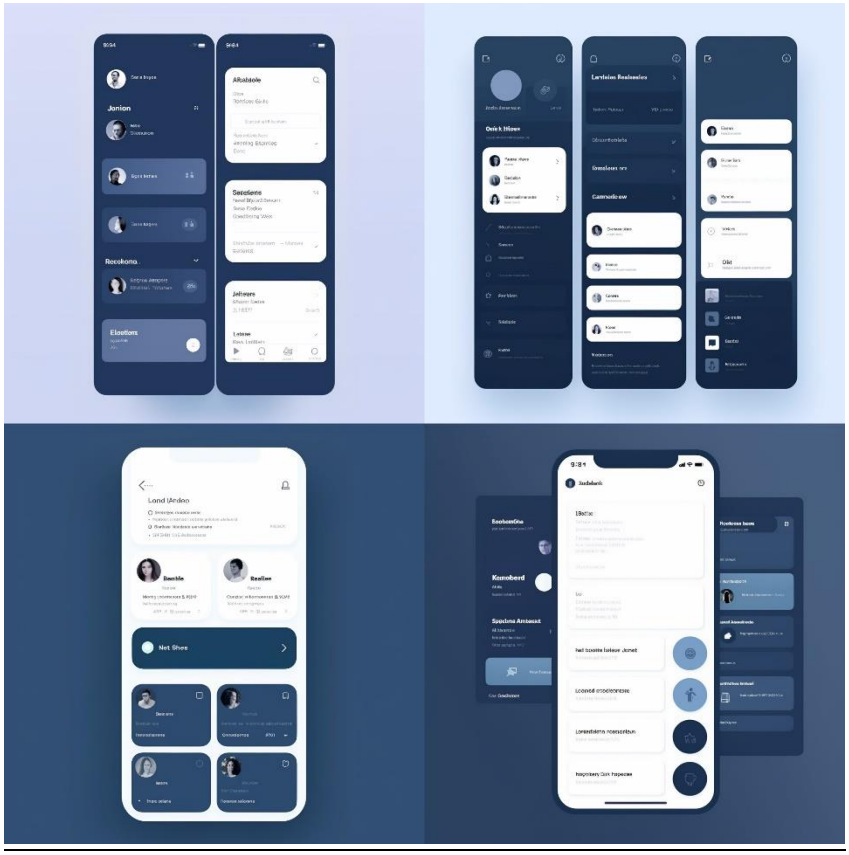
Generation 2:



Generation 3:



Generation 4:

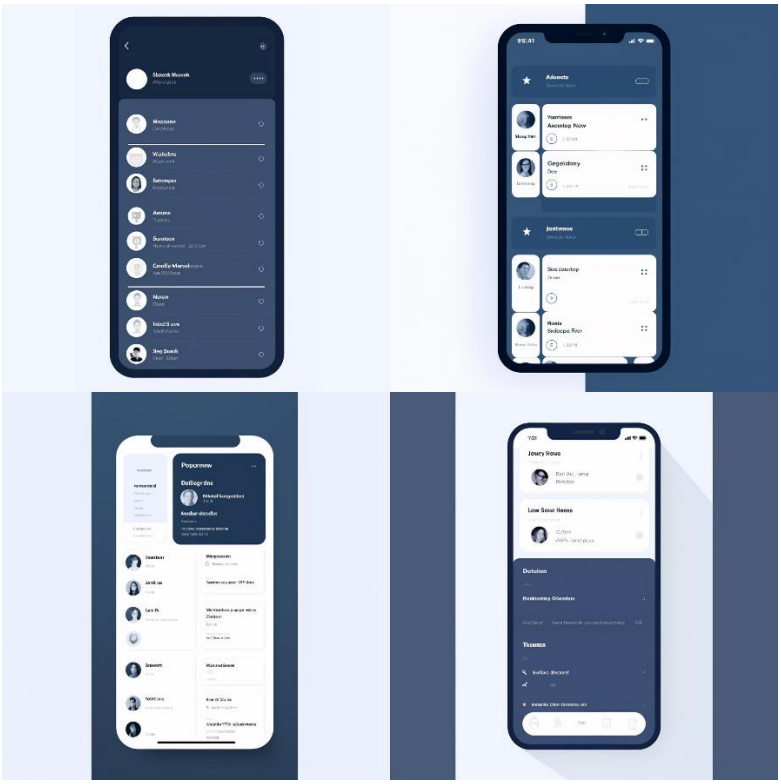


Experiment 3: Exploring the effect of additional parameters

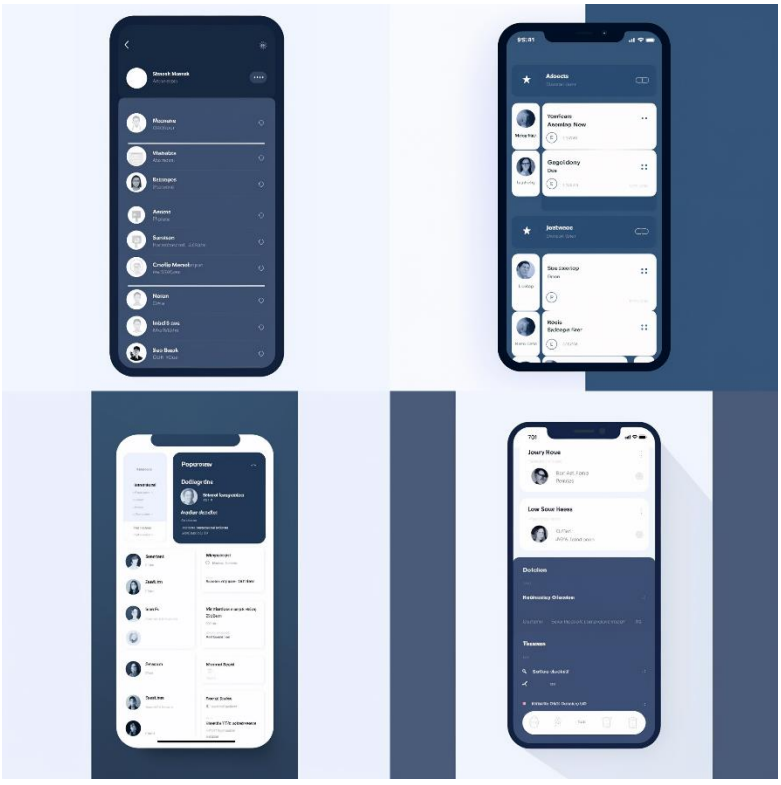
Testing the image weight parameter with a value of 2

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --v 5**

Generation 1:

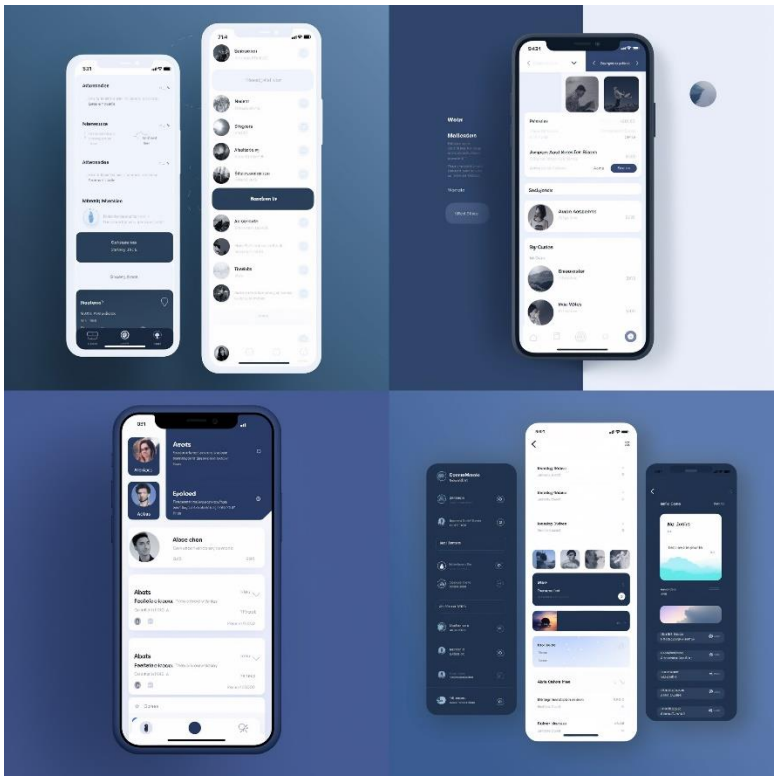


Generation 2:

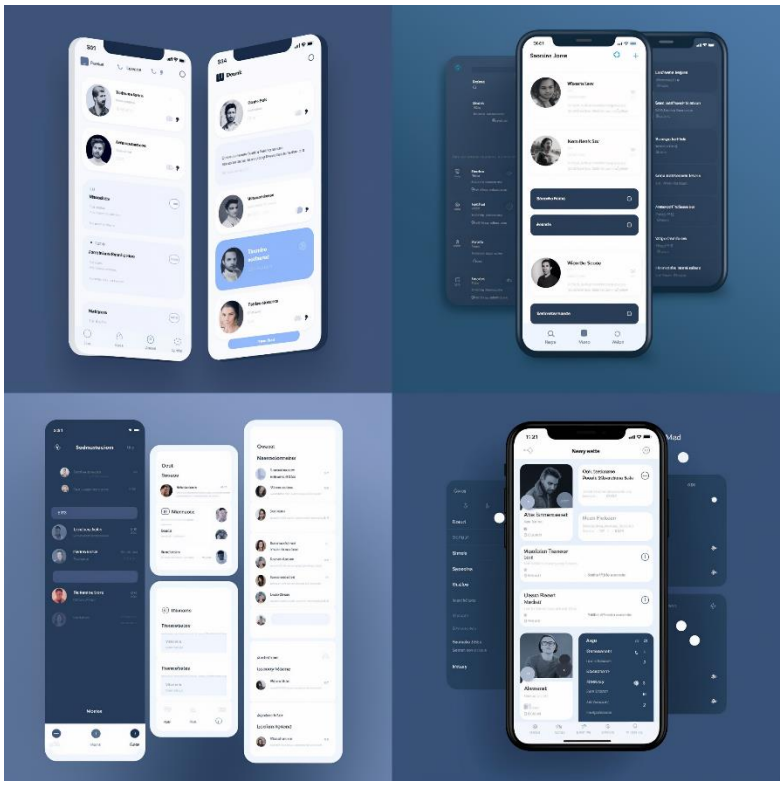


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --v 5**

Generation 1:



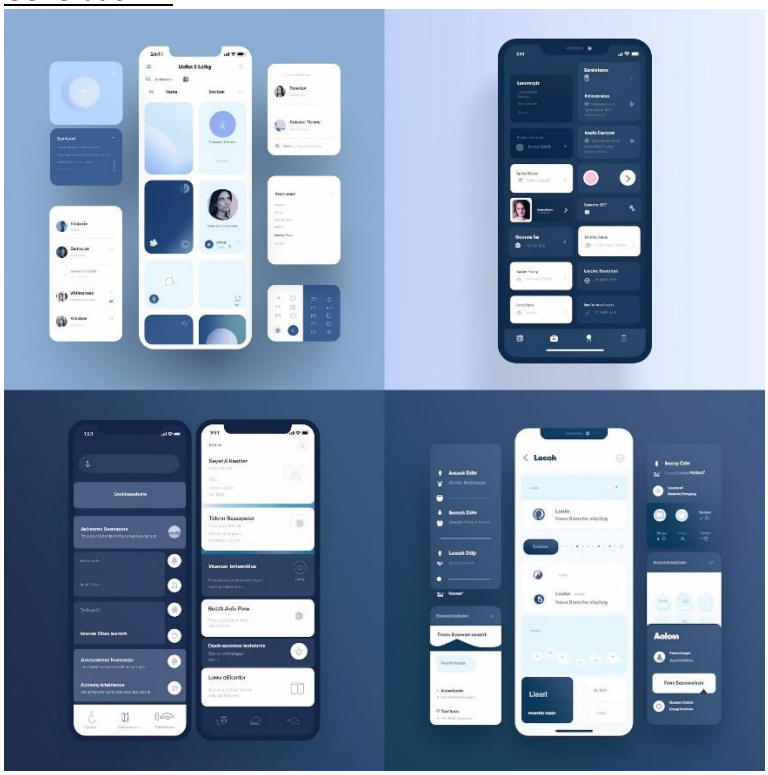
Generation 2:



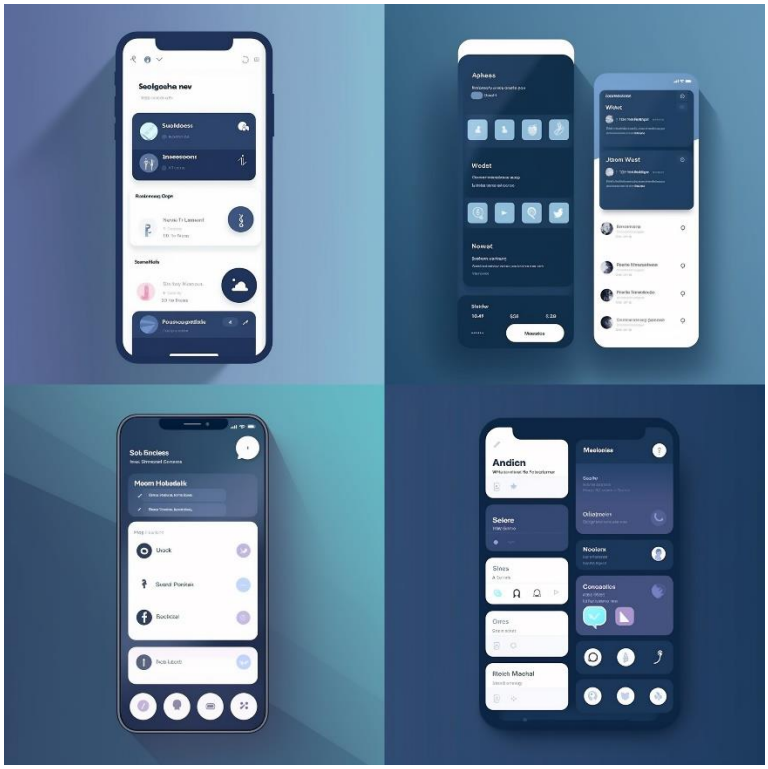
Testing the image weight parameter with a value of 0.5

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --v 5**

Generation 1:

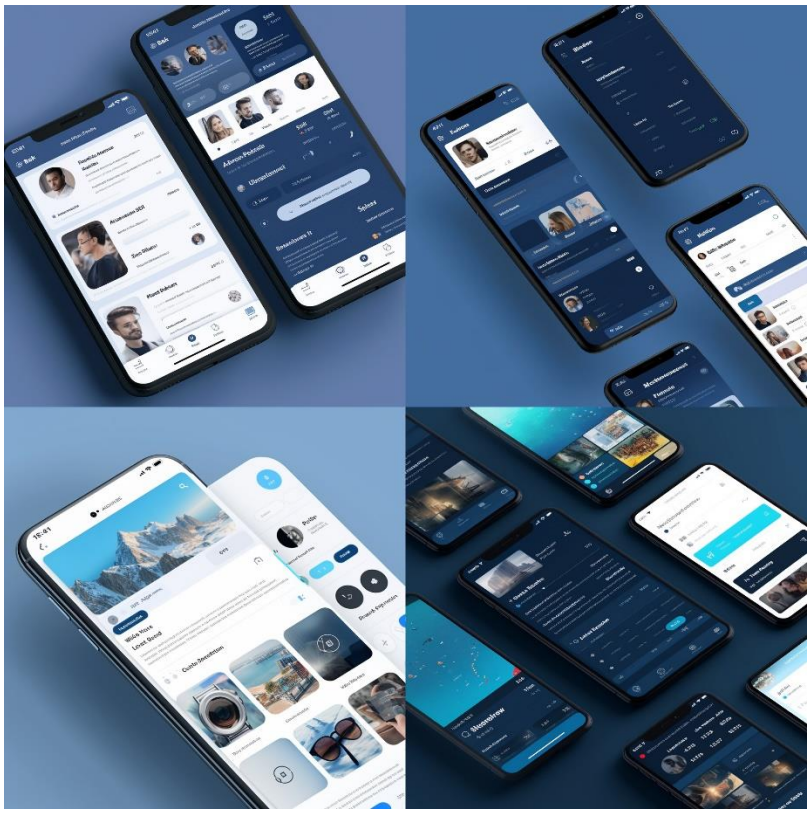


Generation 2:

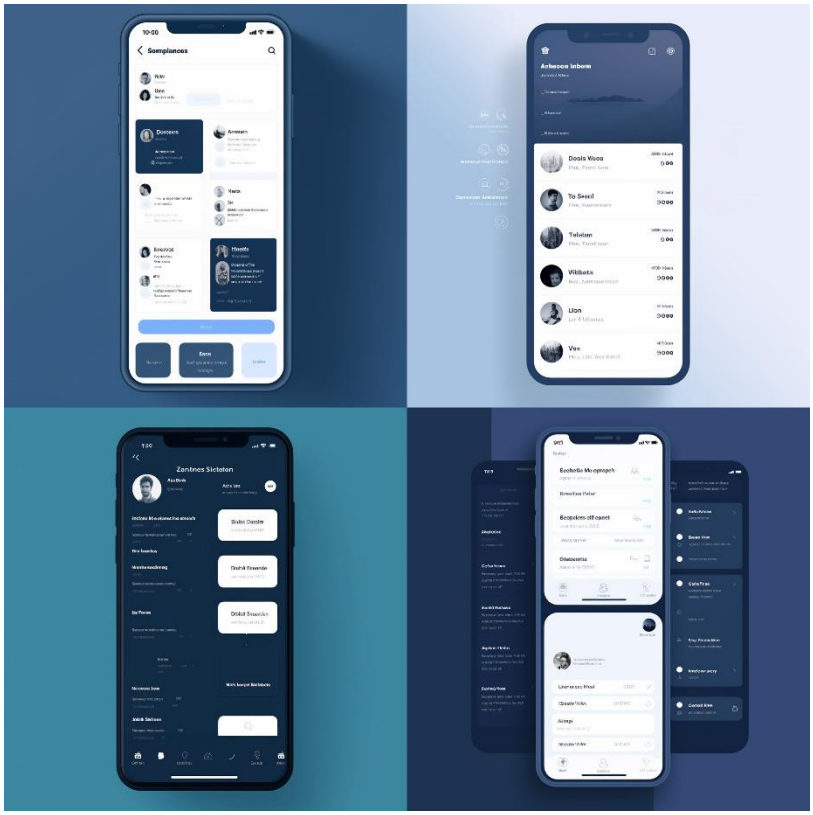


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --v 5**

Generation 1:



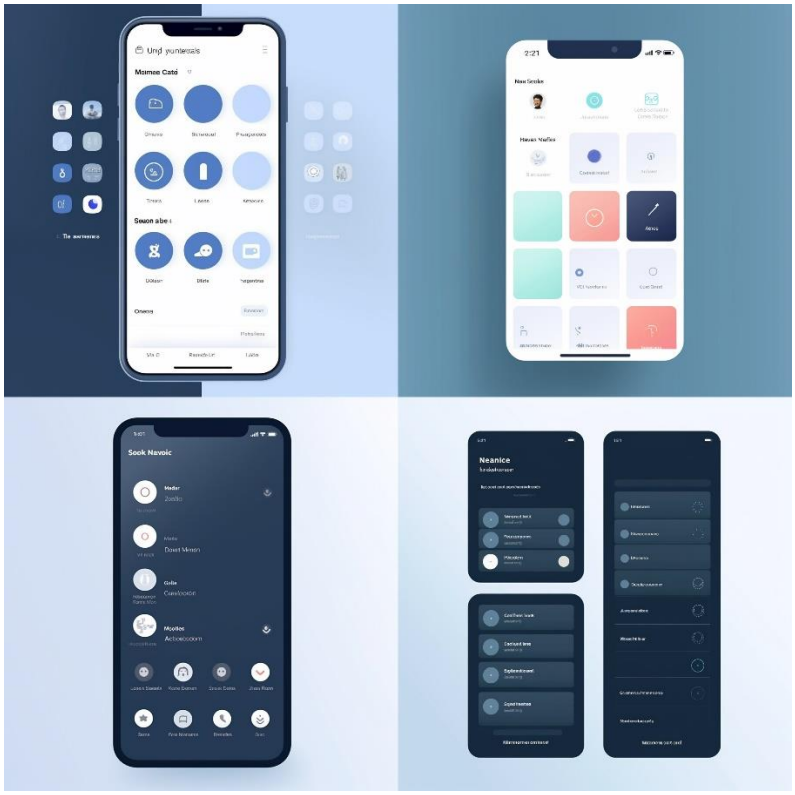
Generation 2:



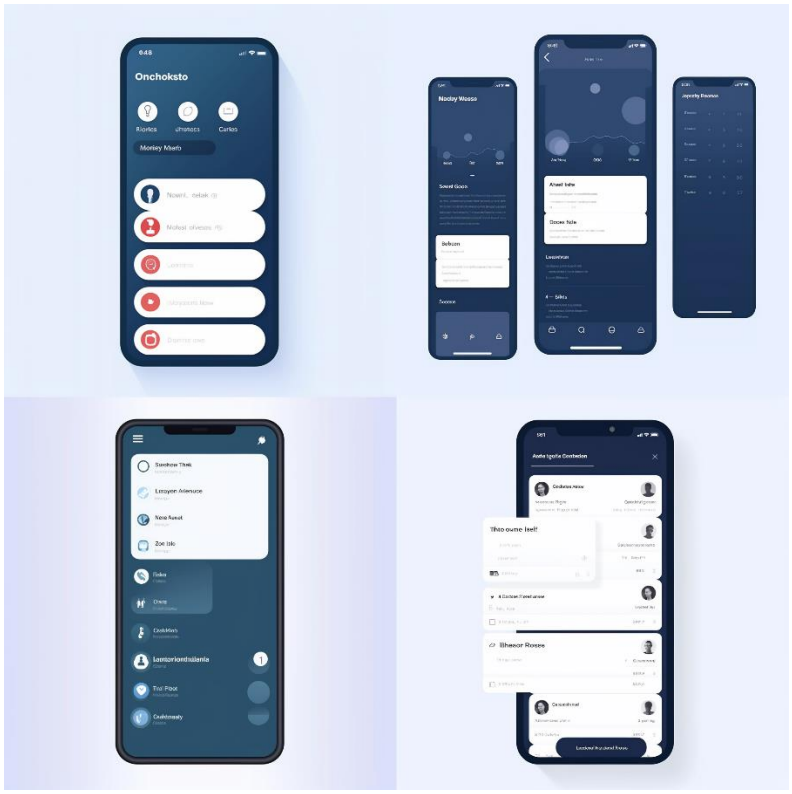
Testing the chaos parameter with a value of 10

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 10 --v 5**

Generation 1:

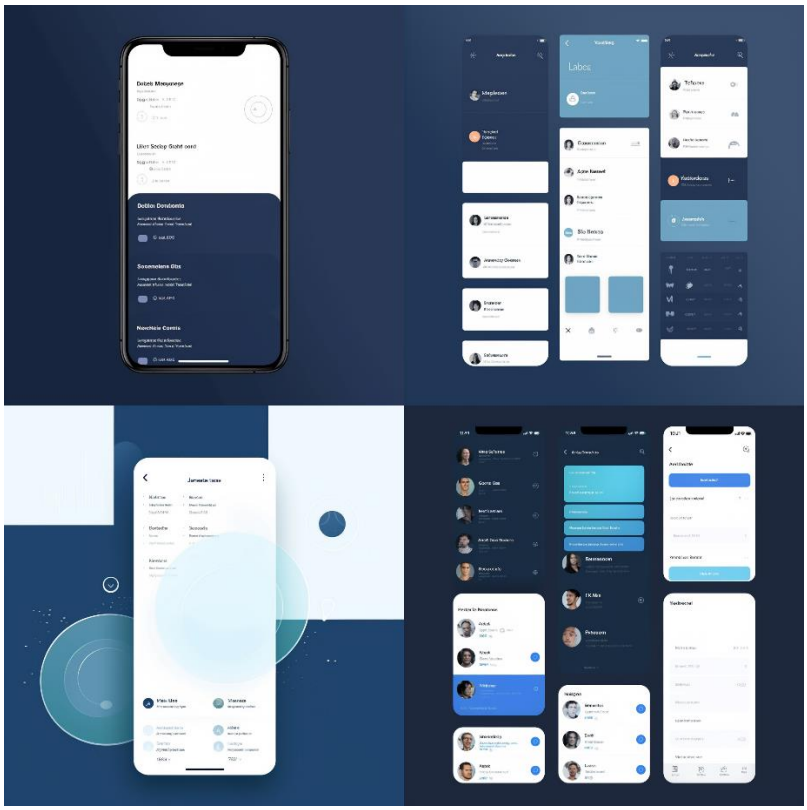


Generation 2:

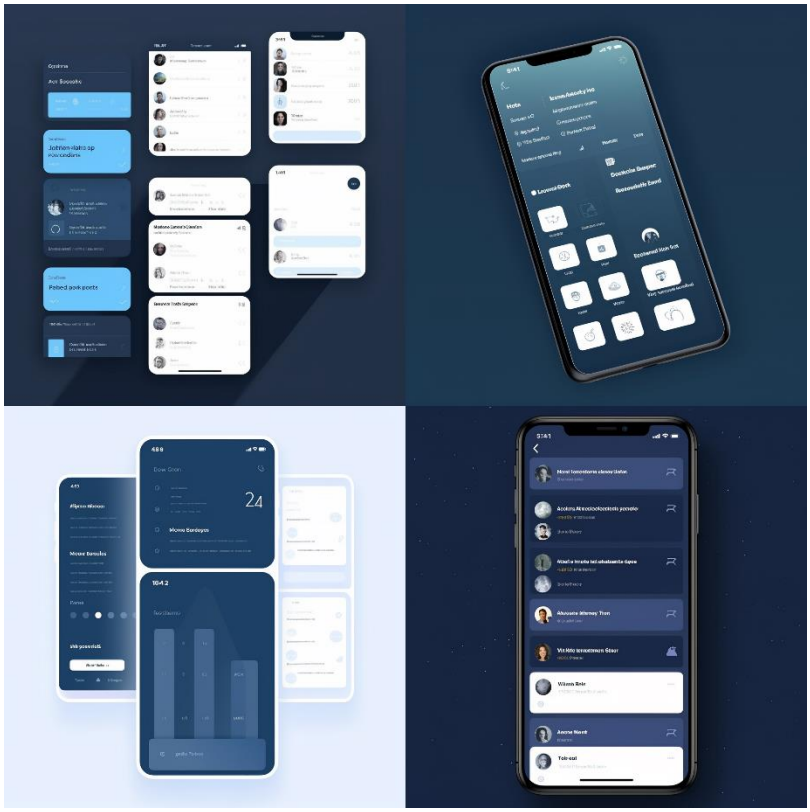


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --chaos 10 --v 5**

Generation 1:



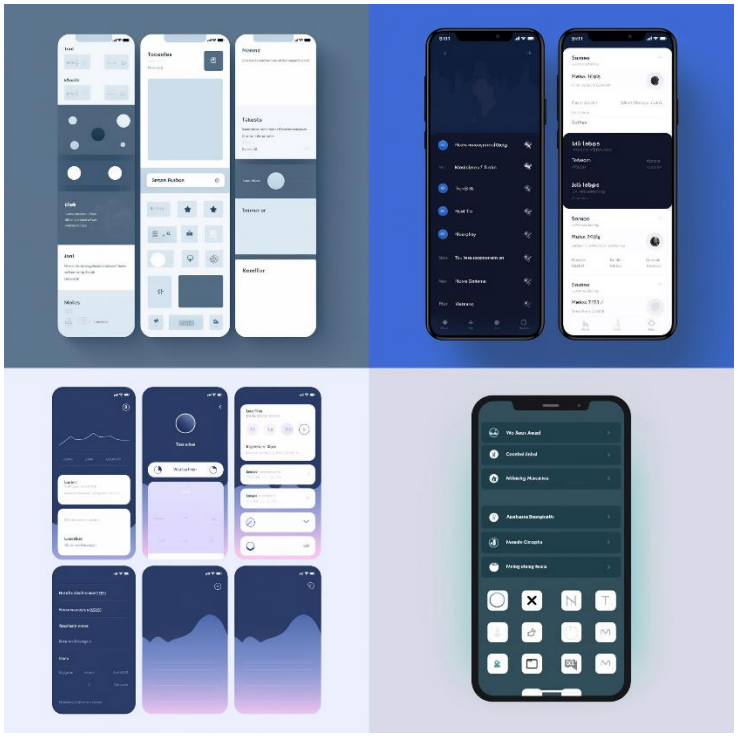
Generation 2:



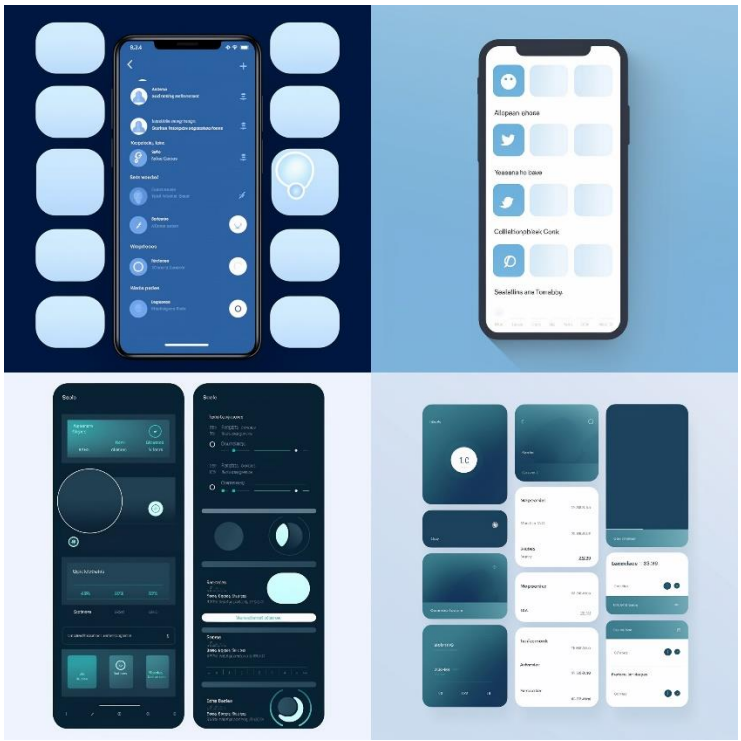
Testing the chaos parameter with a value of 20

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 20 --v 5**

Generation 1:

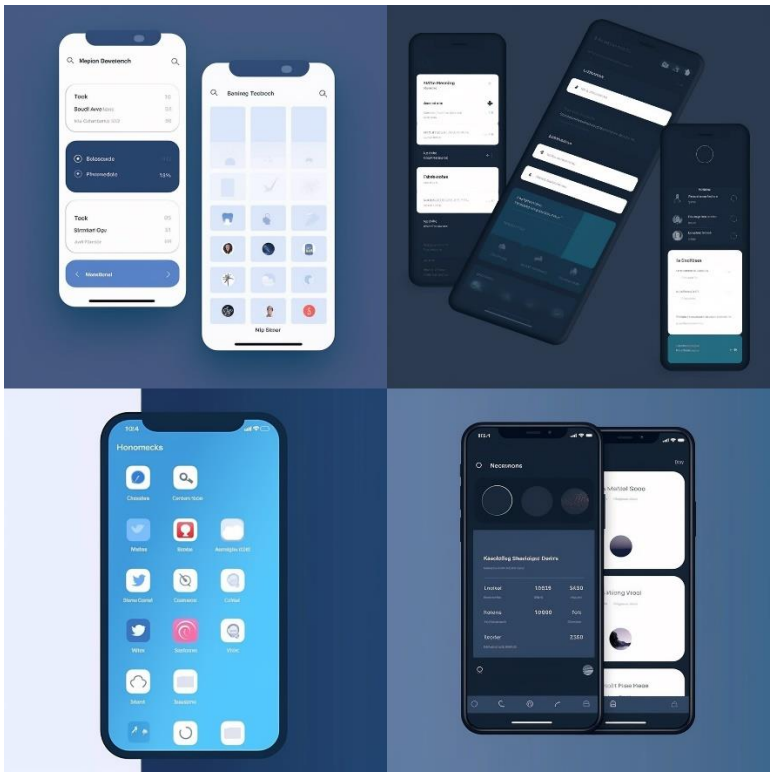


Generation 2:

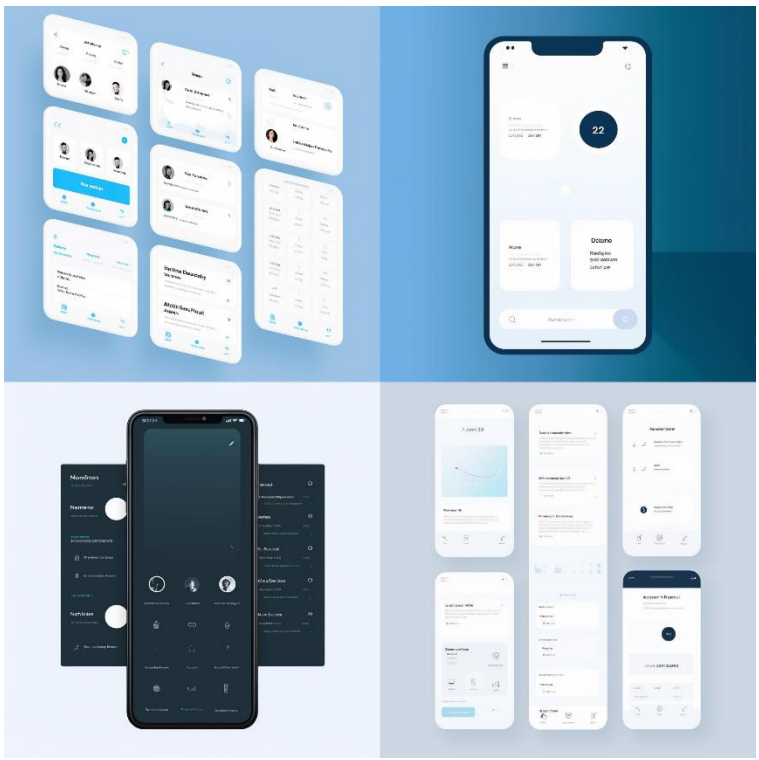


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --chaos 20 --v 5**

Generation 1:



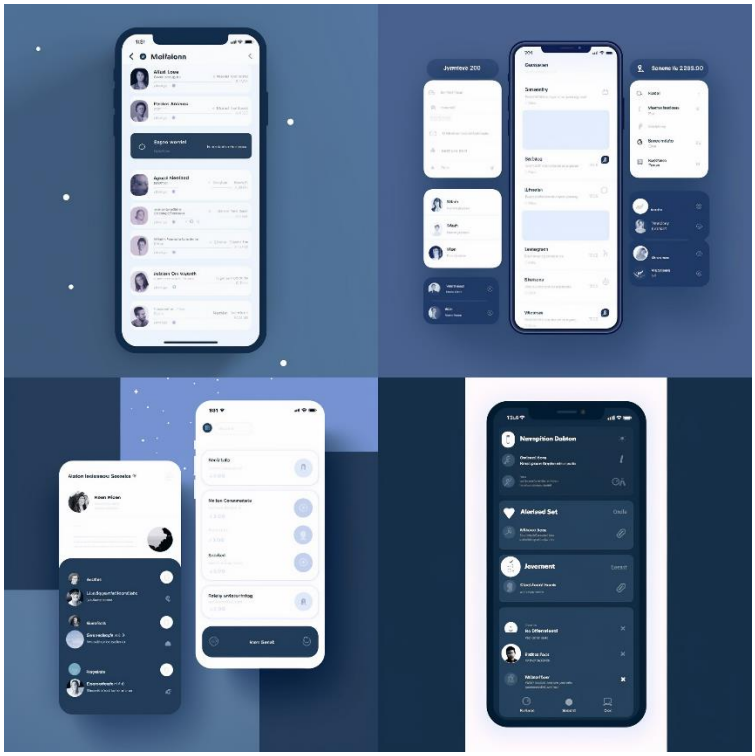
Generation 2:



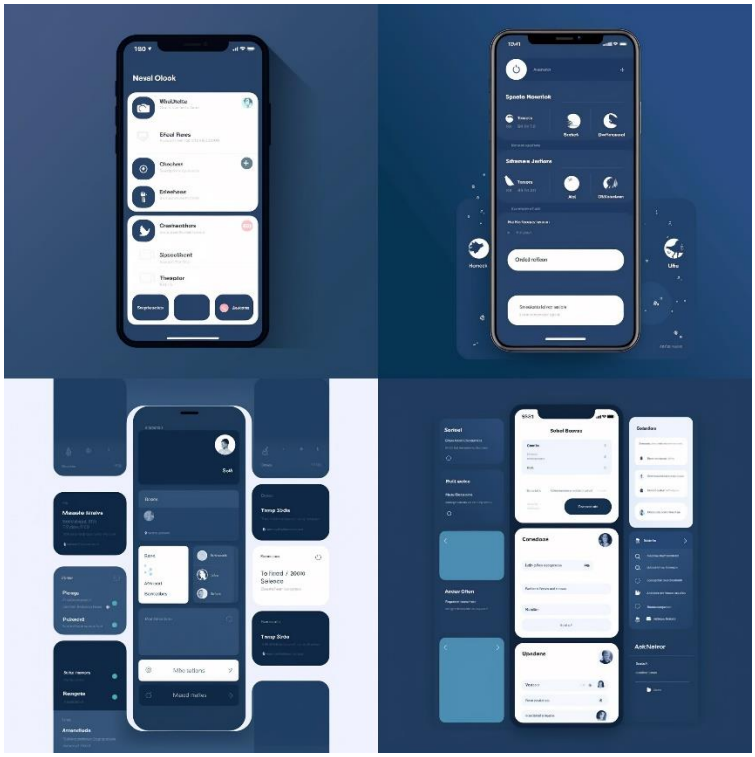
Testing the chaos parameter with a value of 2

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 2 --v 5**

Generation 1:

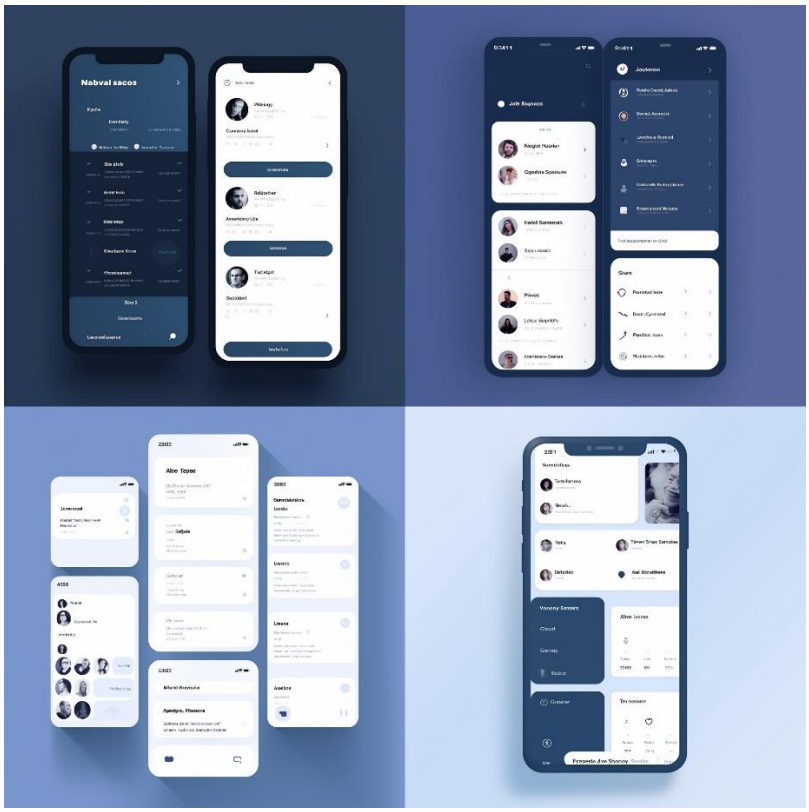


Generation 2:

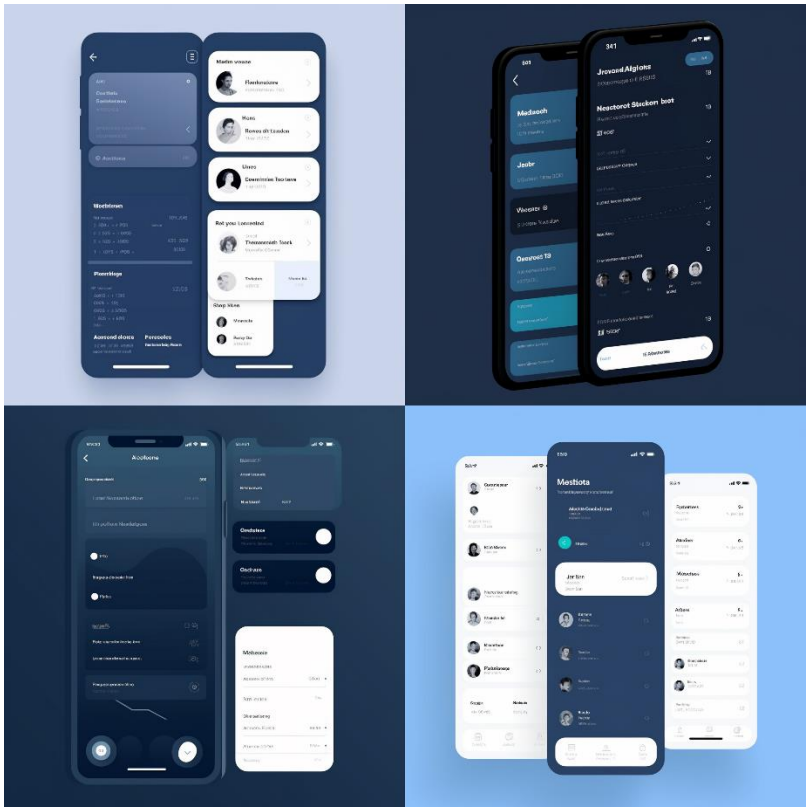


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 2 --v 5**

Generation 1:



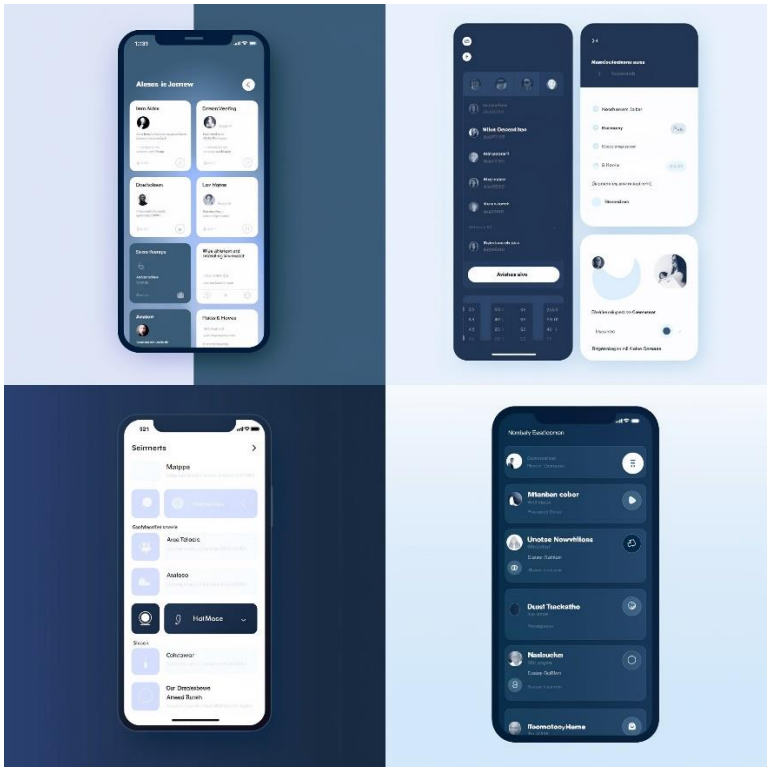
Generation 2:



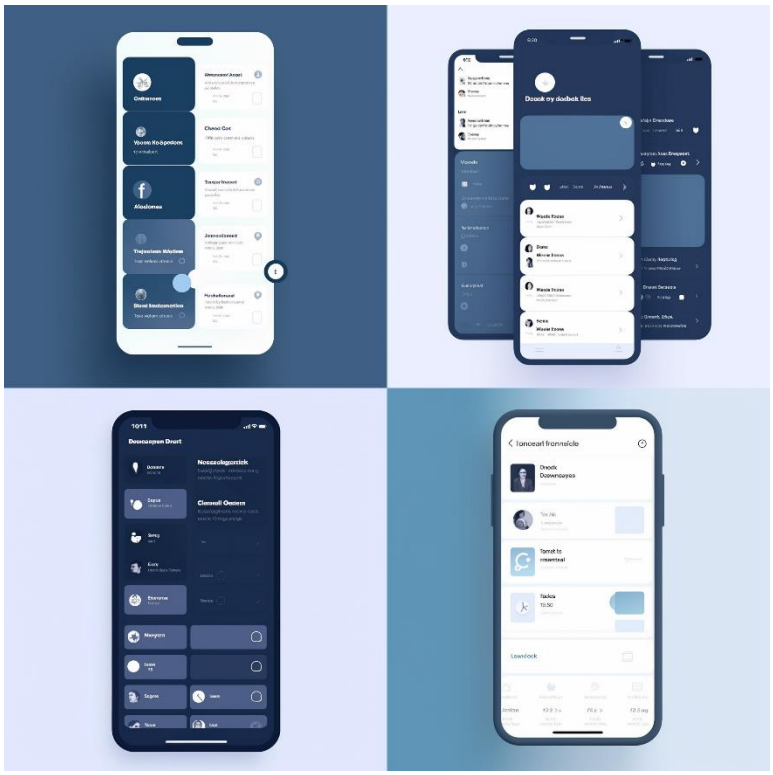
Testing the chaos parameter with a value of 0.5

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 0.5 --v 5**

Generation 1:

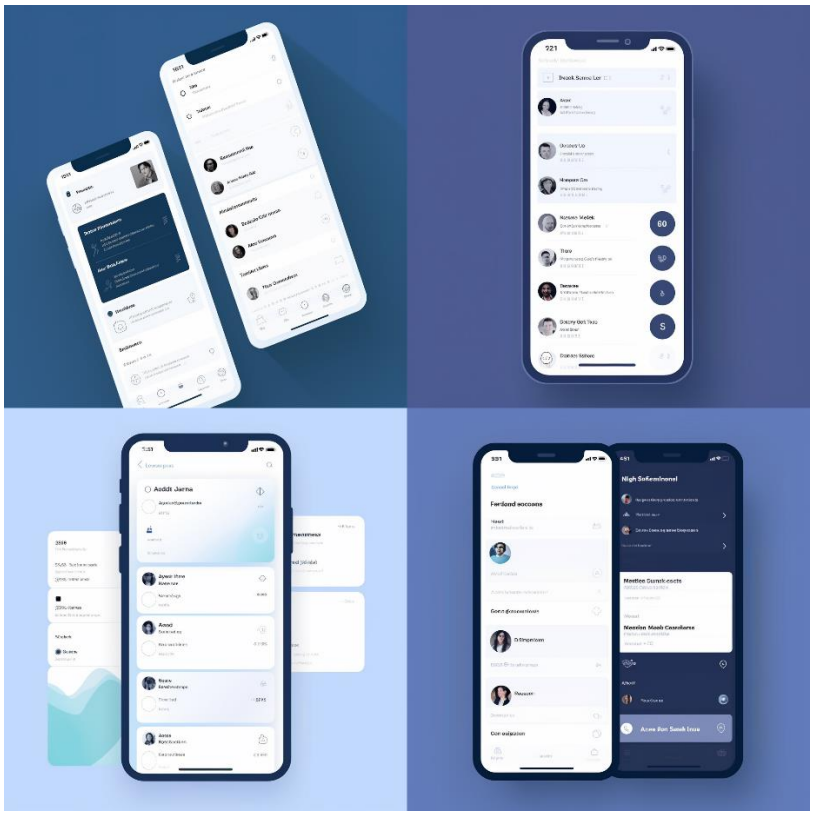


Generation 2:

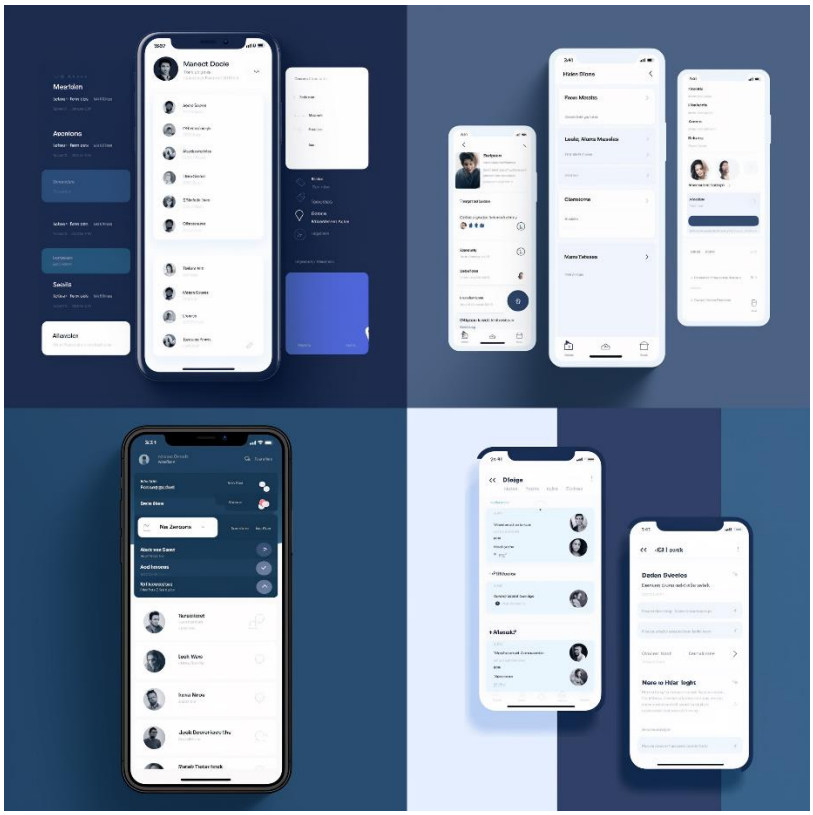


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --c 0.5 --v 5**

Generation 1:



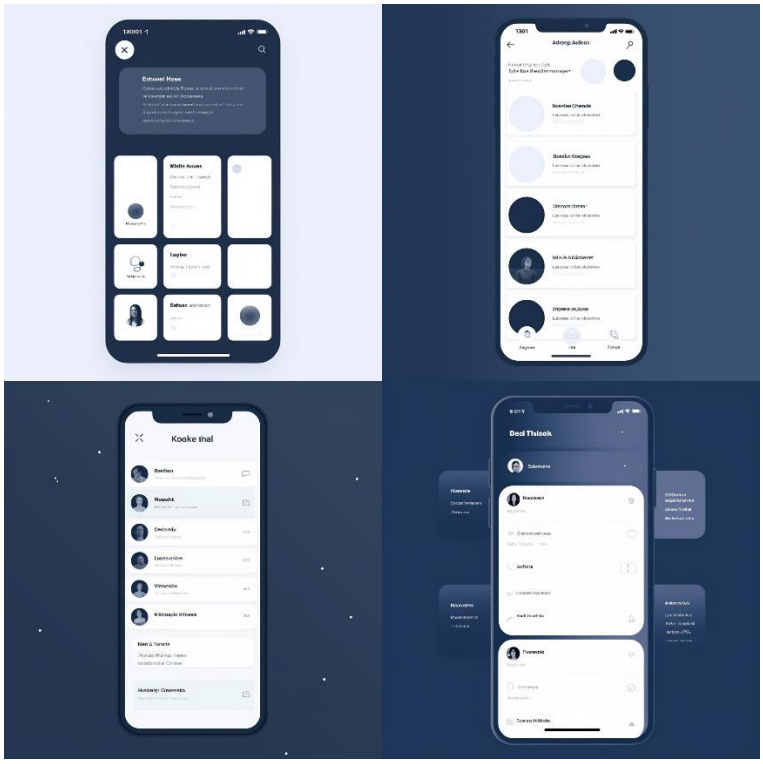
Generation 2:



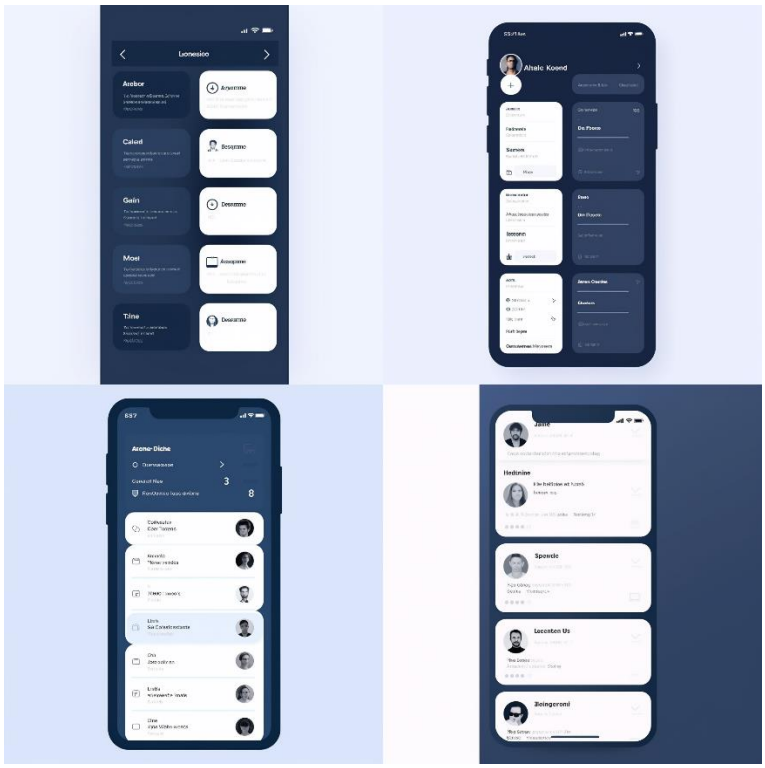
Testing the image weight parameter with a value of 2 and the chaos parameter with a value of 2

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --c 2 --v 5**

Generation 1:

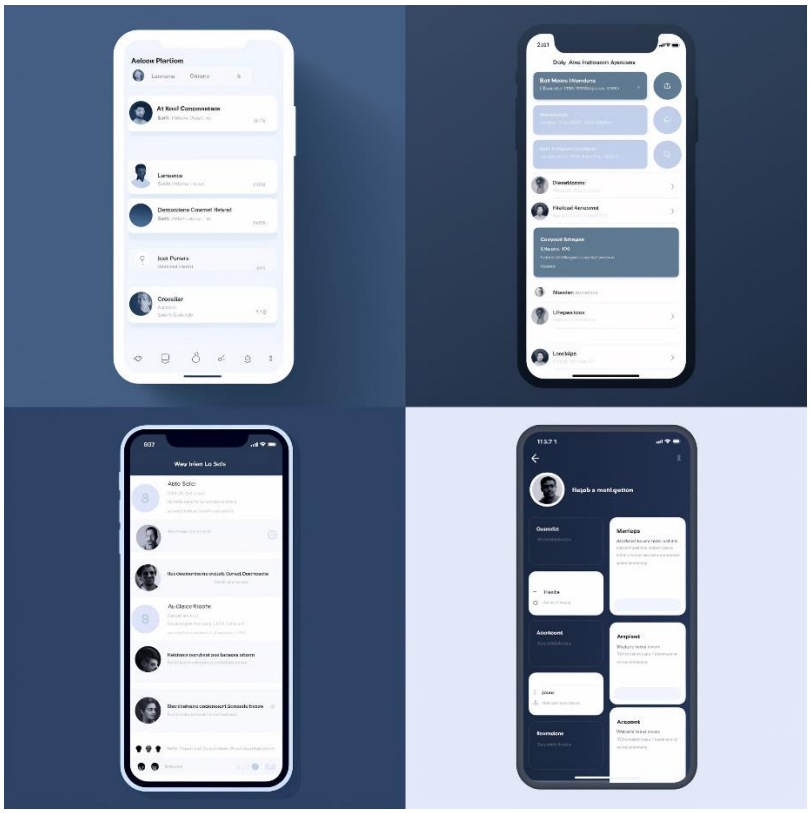


Generation 2:

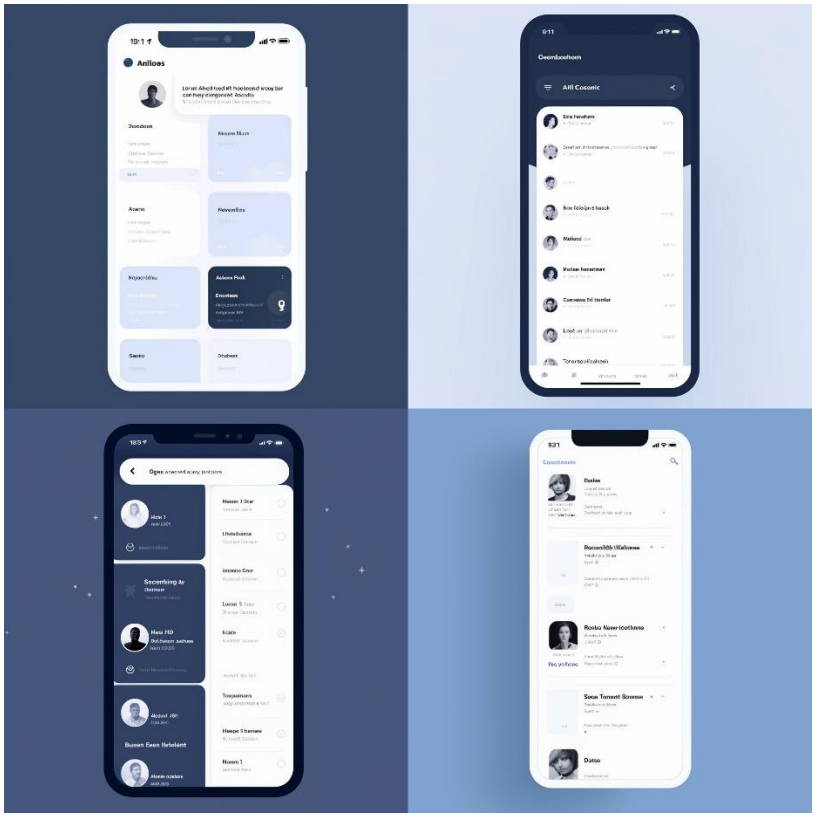


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --c 2 --v 5**

Generation 1:

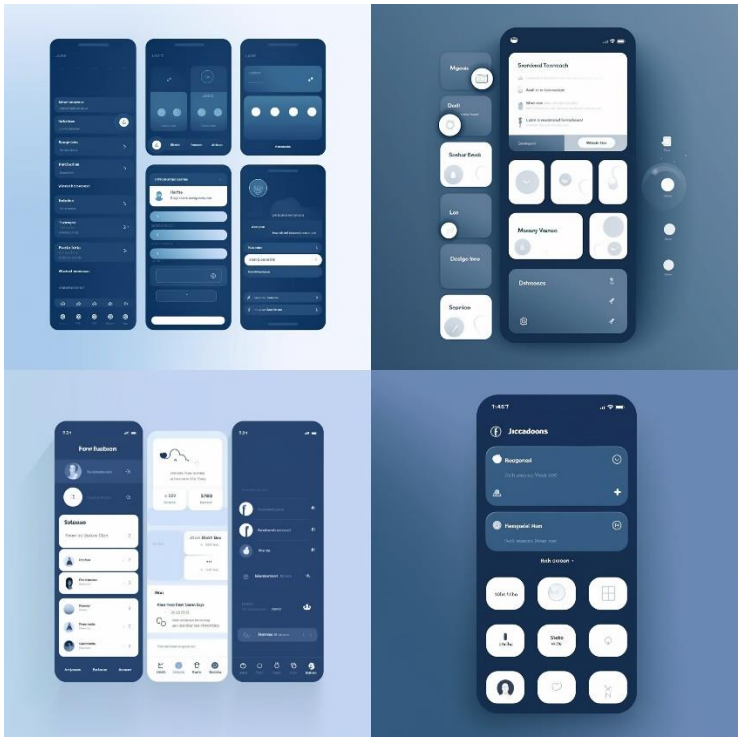


Generation 2:

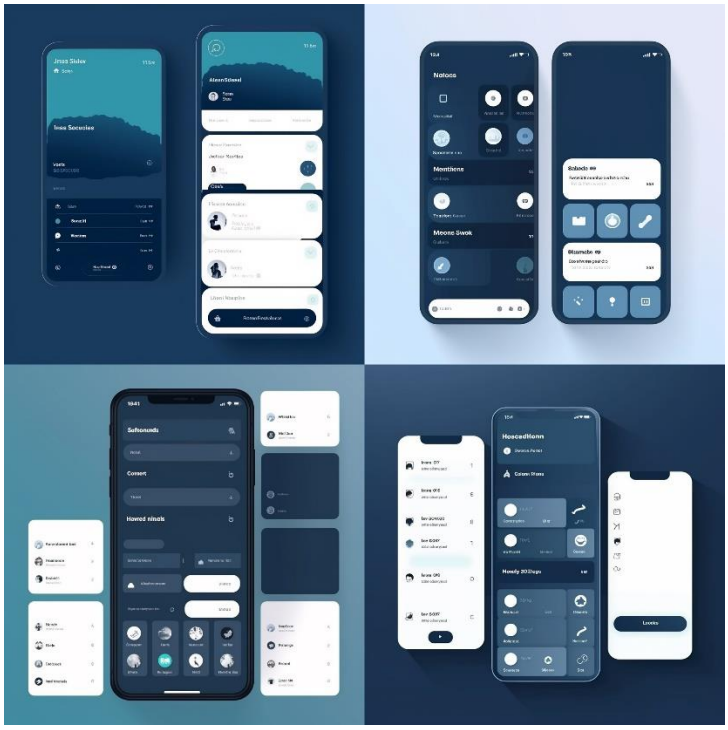


Testing the image weight parameter with a value of 2 and the chaos parameter with a va lue of 0.5
Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --c 2 --v 5**

Generation 1:

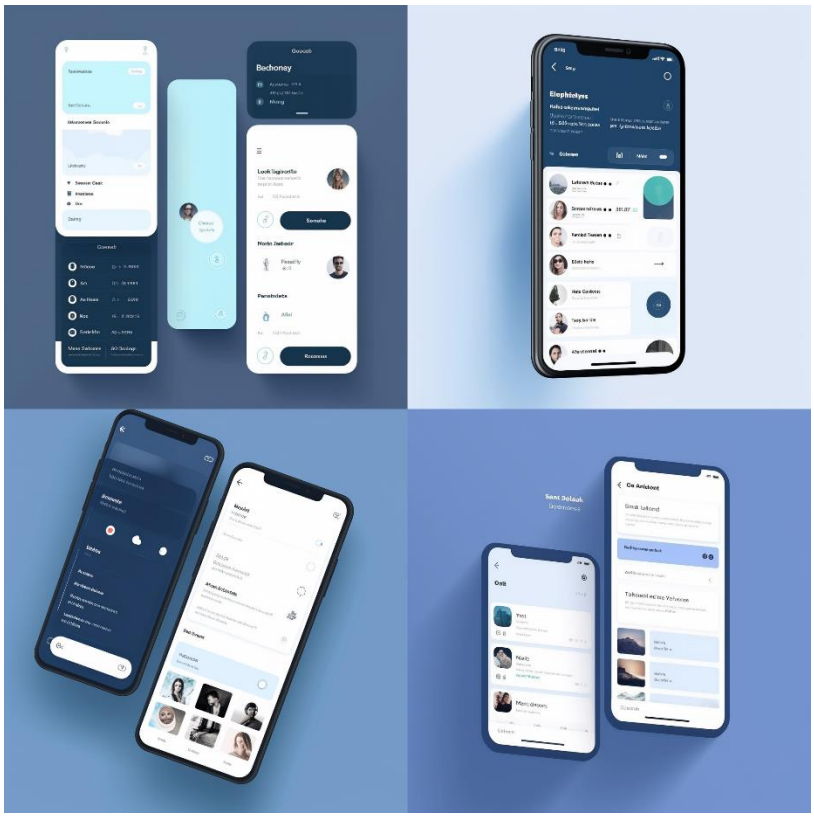


Generation 2:

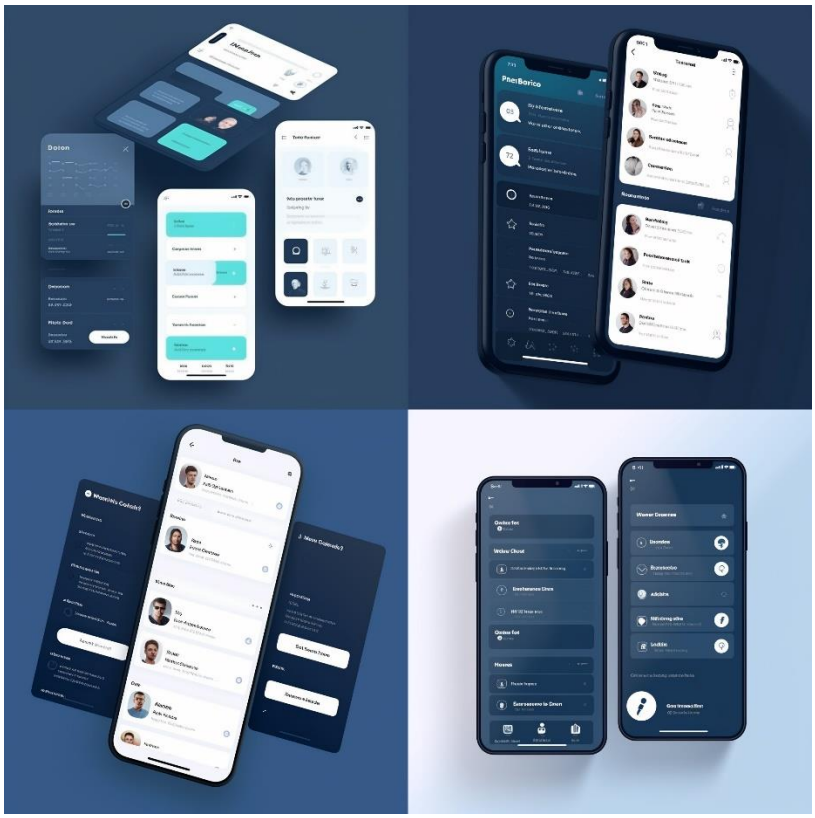


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --c 2 --v 5**

Generation 1:



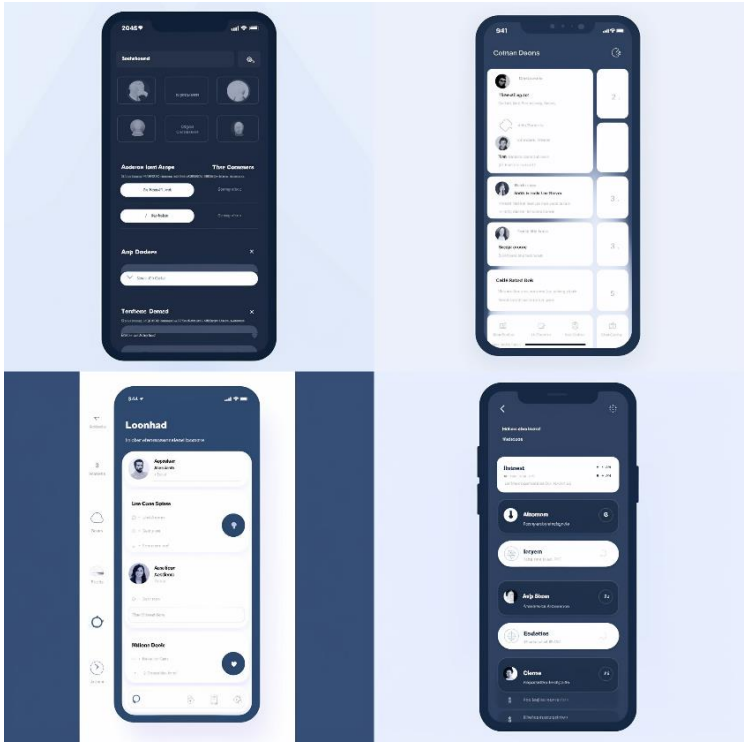
Generation 2:



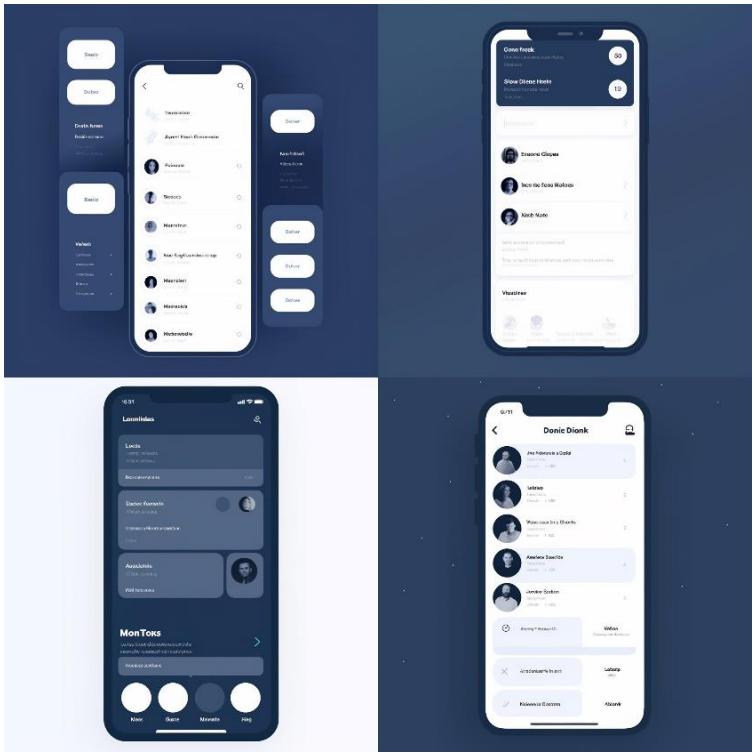
Testing the image weight parameter with a value of 2 and the chaos parameter with a value of 0.5

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --c 0.5 --v 5**

Generation 1:

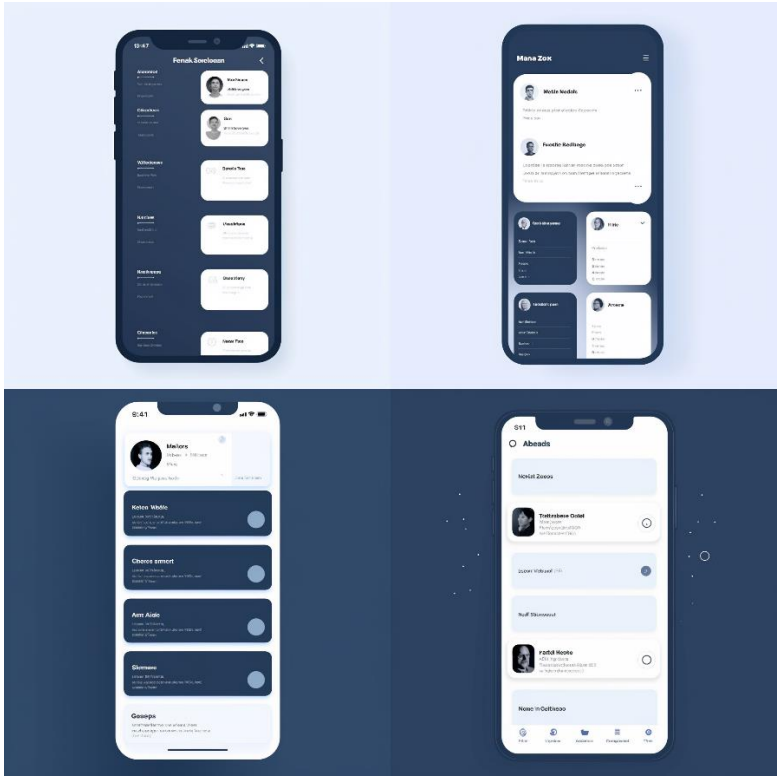


Generation 2:

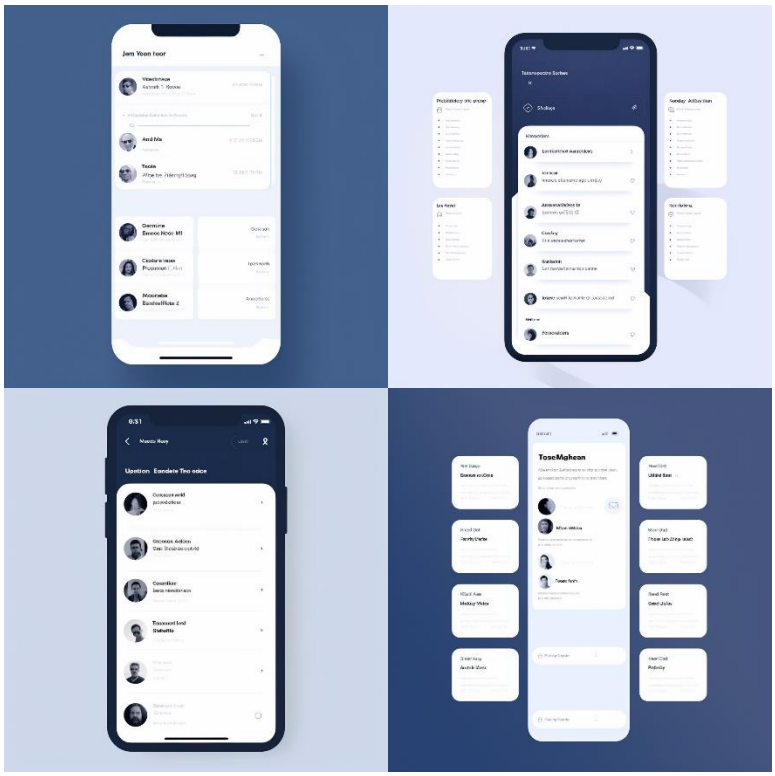


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 2 --c 0.5 --v 5**

Generation 1:



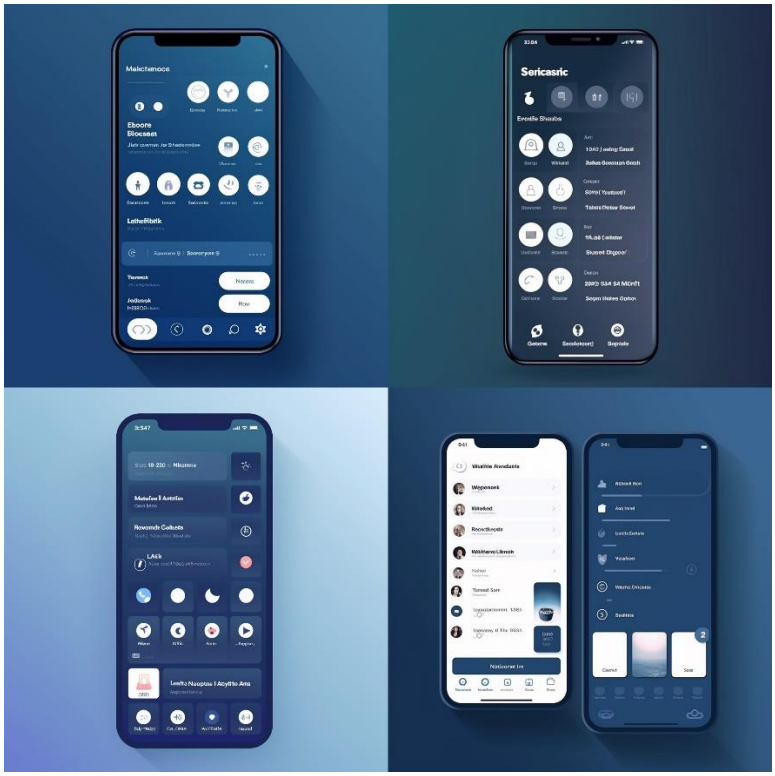
Generation 2:



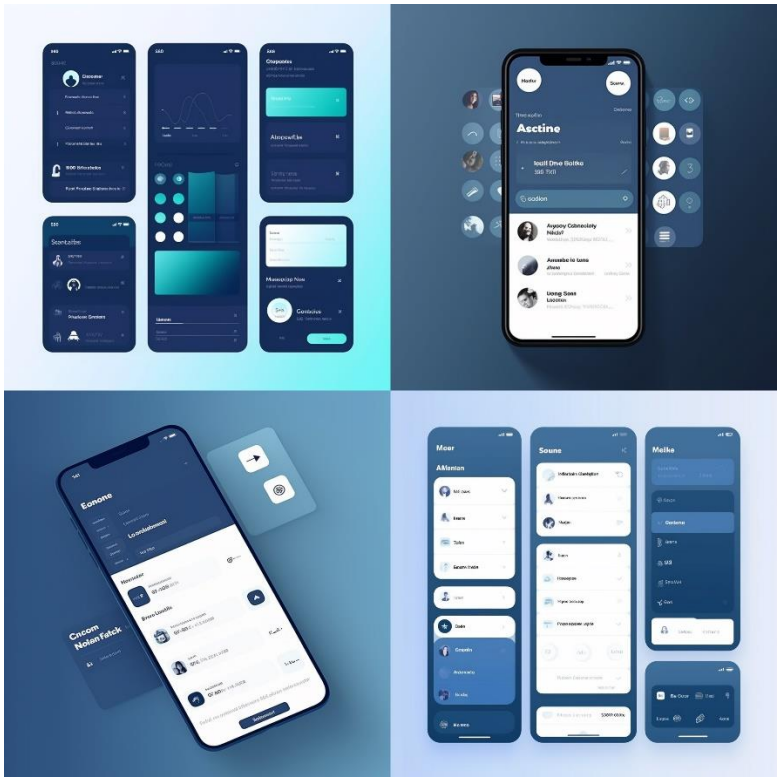
Testing the image weight parameter with a value of 2 and the chaos parameter with a value of 0.5

Prompt: **Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --c 0.5 --v 5**

Generation 1:

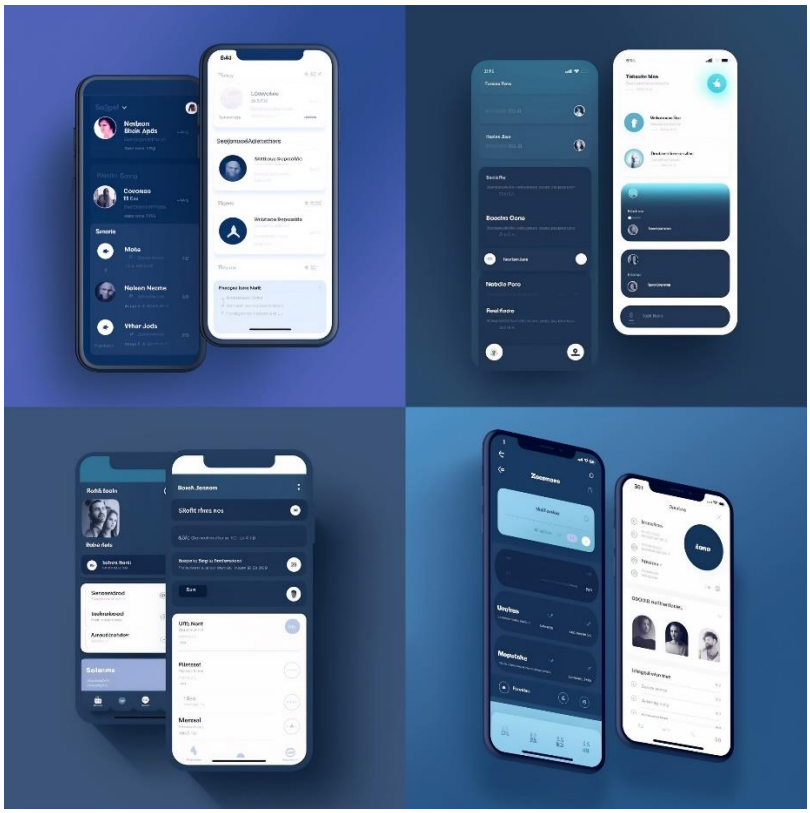


Generation 2:

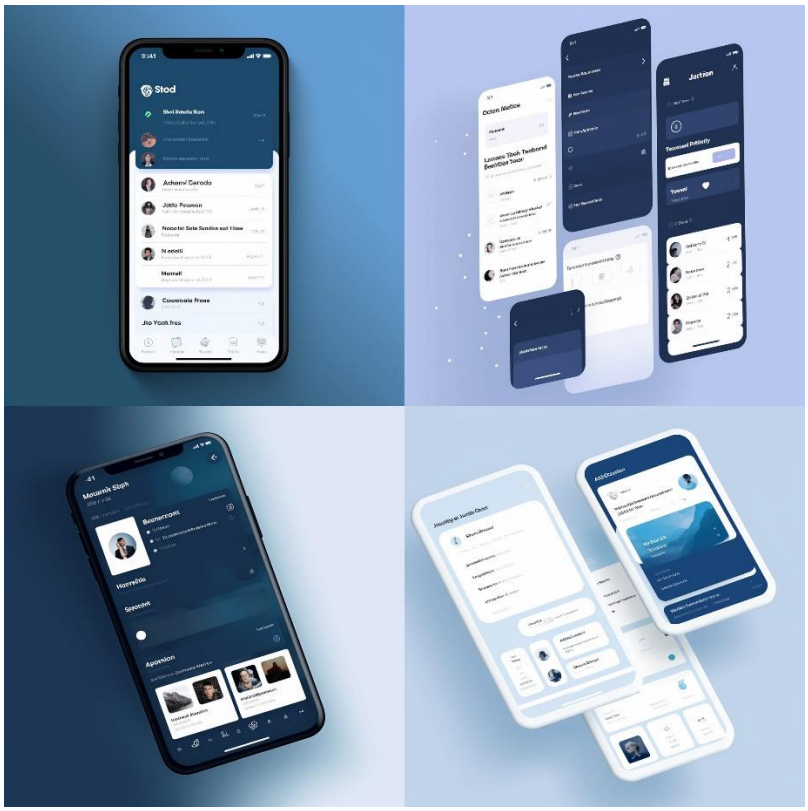


Prompt: **UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --iw 0.5 --c 0.5 --v 5**

Generation 1:



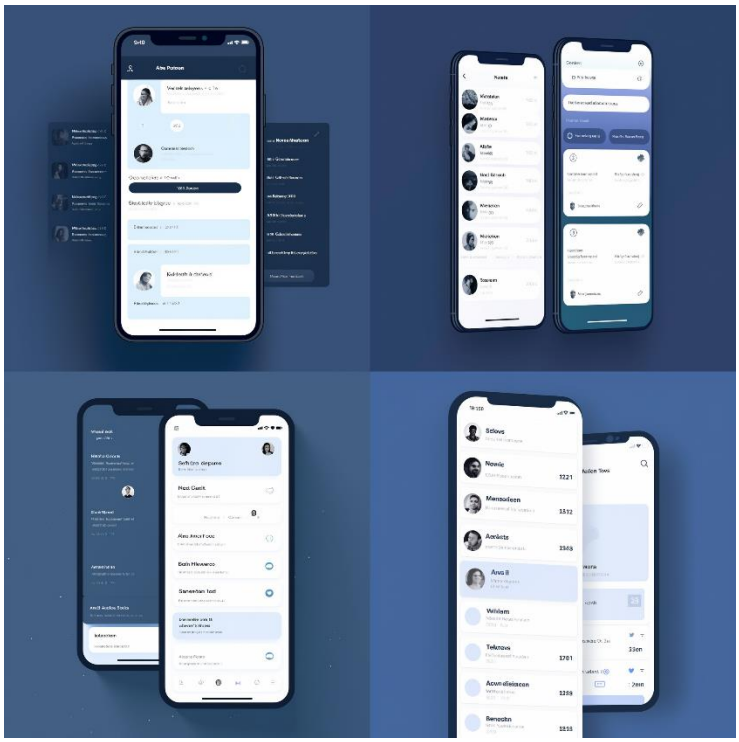
Generation 2:



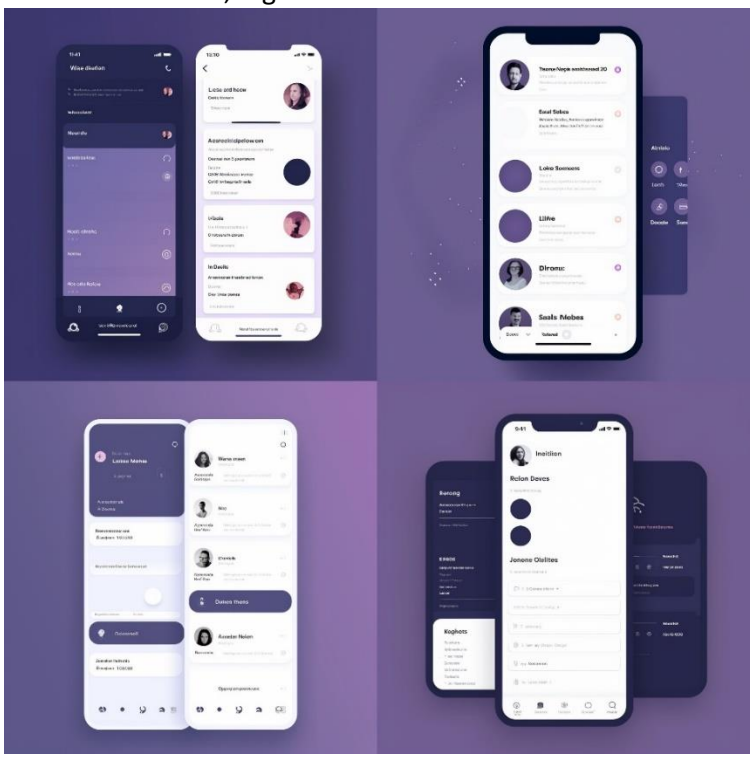
Evaluation Experiments: Testing the efficacy of the text-to-image model with UX design professionals

Interfaces generated by P1

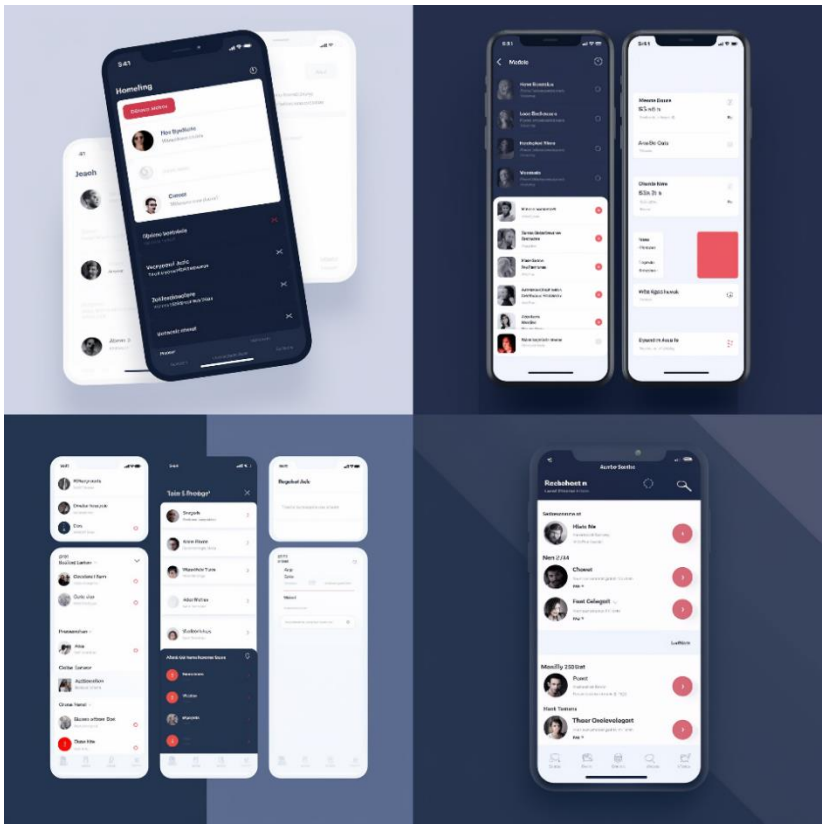
Prompt: **<wireframe>** UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5



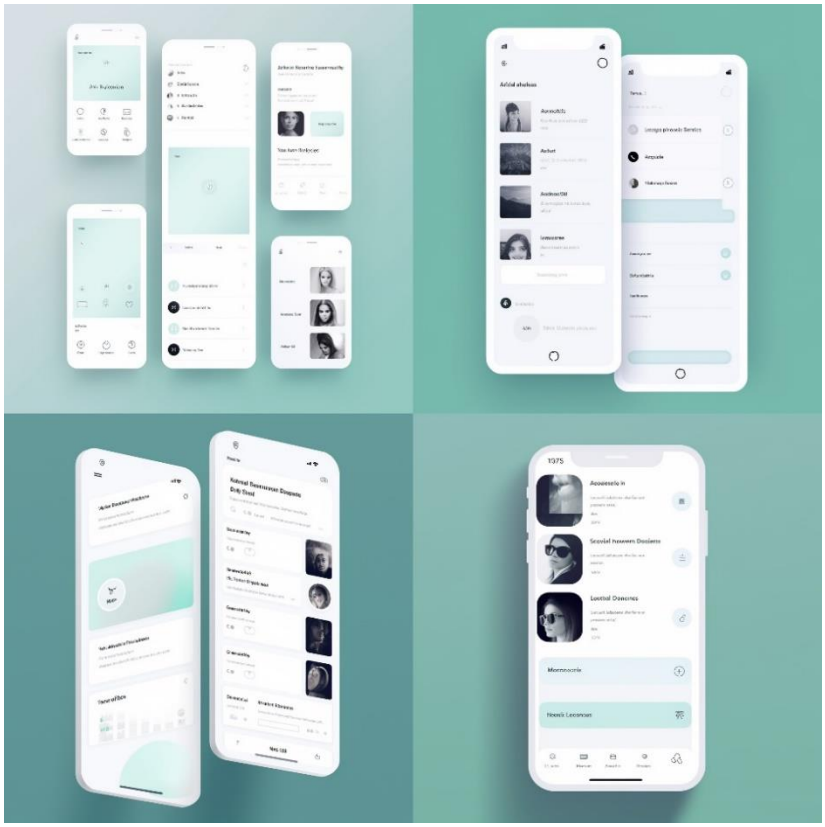
Prompt: **<wireframe>** UI design of a social media app, Modern, Classy, Minimalistic, Purple Color Palette on Dribble, High Resolution --v 5



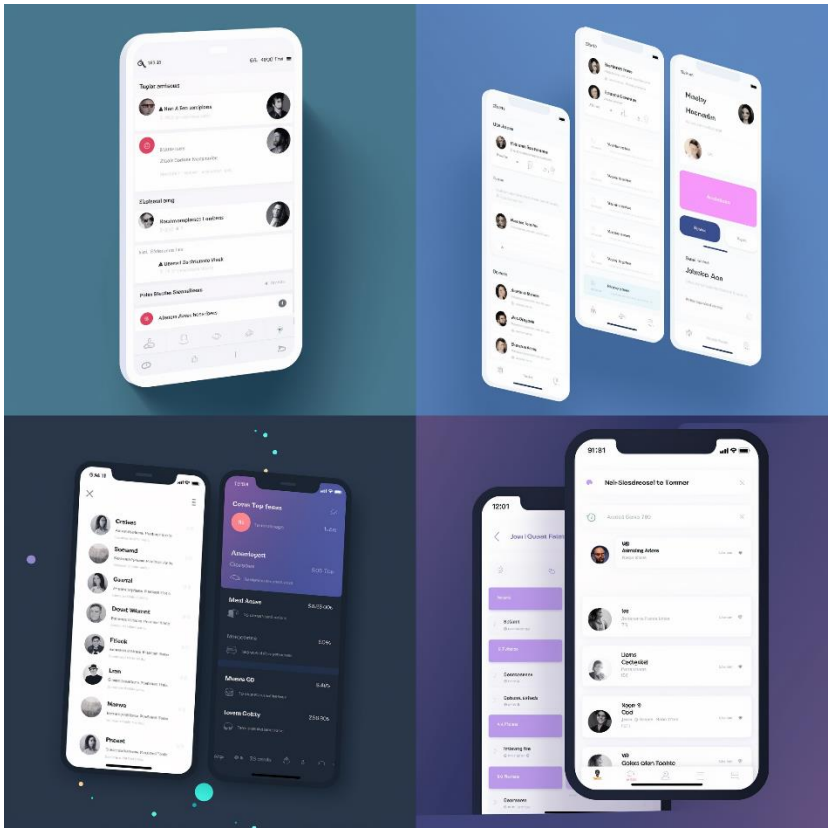
Prompt: **<wireframe>** UI design of a social media app, Classy, Minimalistic, Elegant, Navy Blue and red color palette, High Resolution --v 5



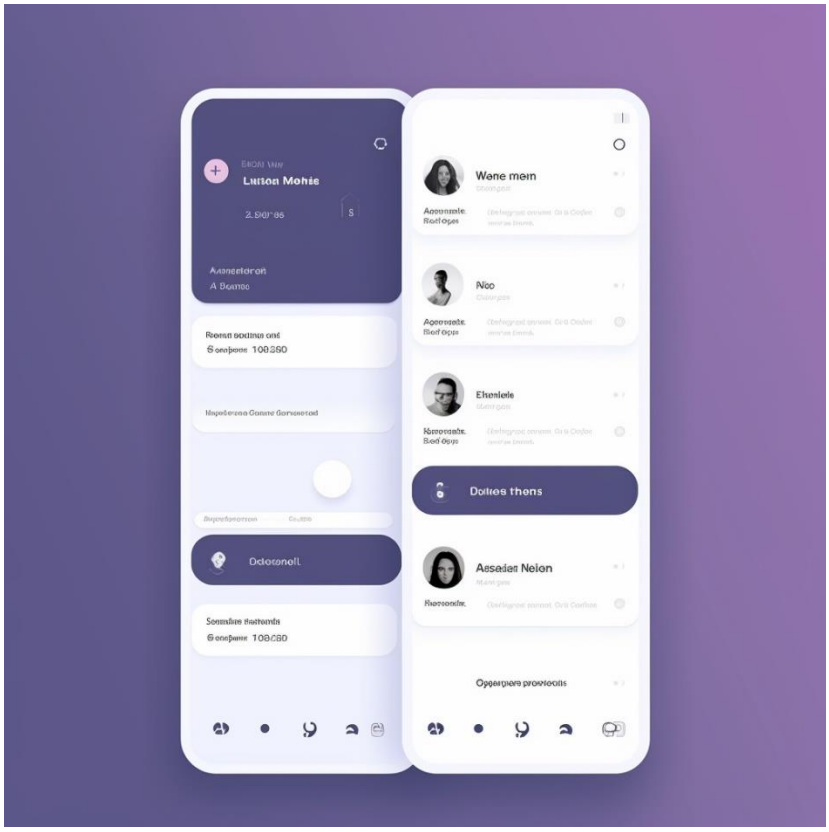
Prompt: **<wireframe>** UI Design of a social media app , Modern, Classy, Minimalistic, Dreamy mint Color, High Resolution --v 5



Prompt: **<wireframe>** UI Design of a social media app --v 5

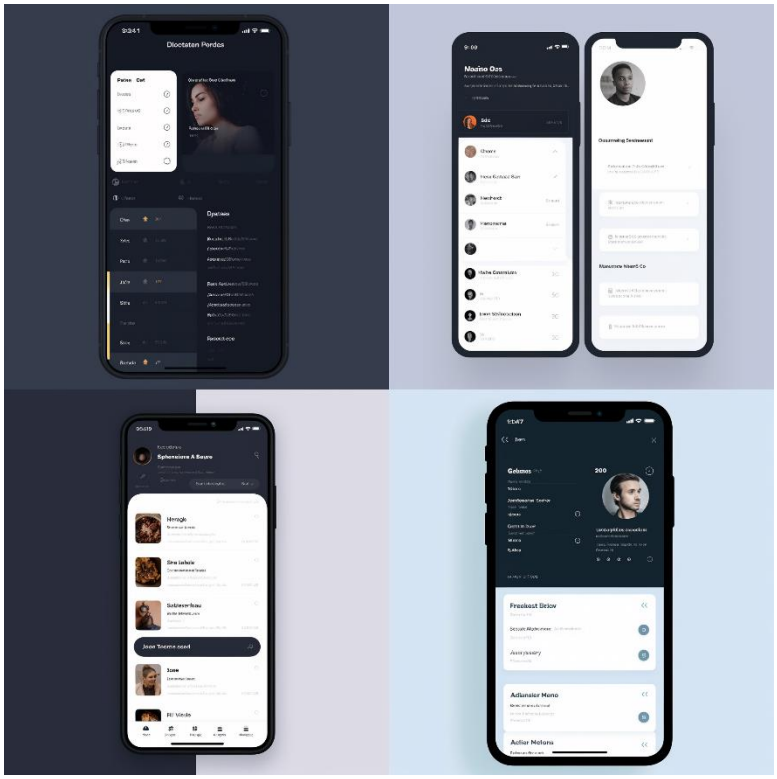


Prompt: **<wireframe>** UI design of a social media app, Modern, Classy, Minimalistic, Purple Color Palette on Dribble, High Resolution --v 5

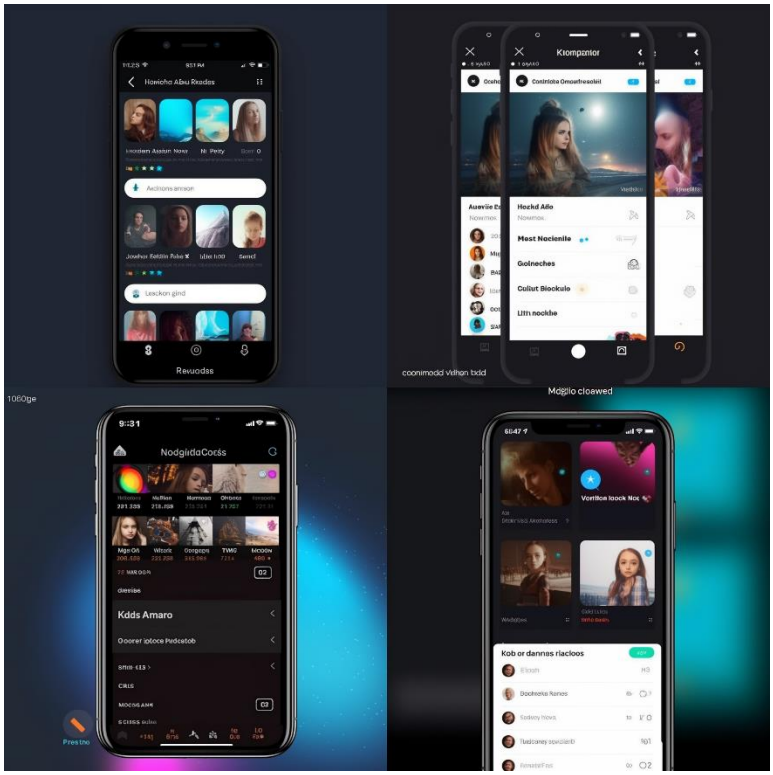


Interfaces generated by P2

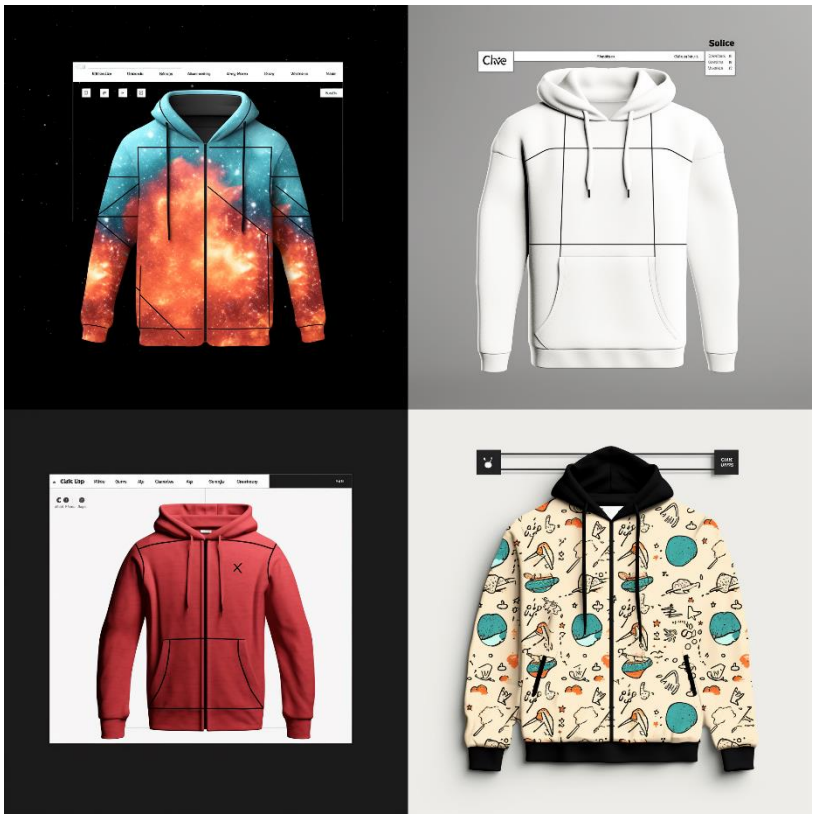
Prompt: **<wireframe> UI design menu at top left and profile picture right --v 5**



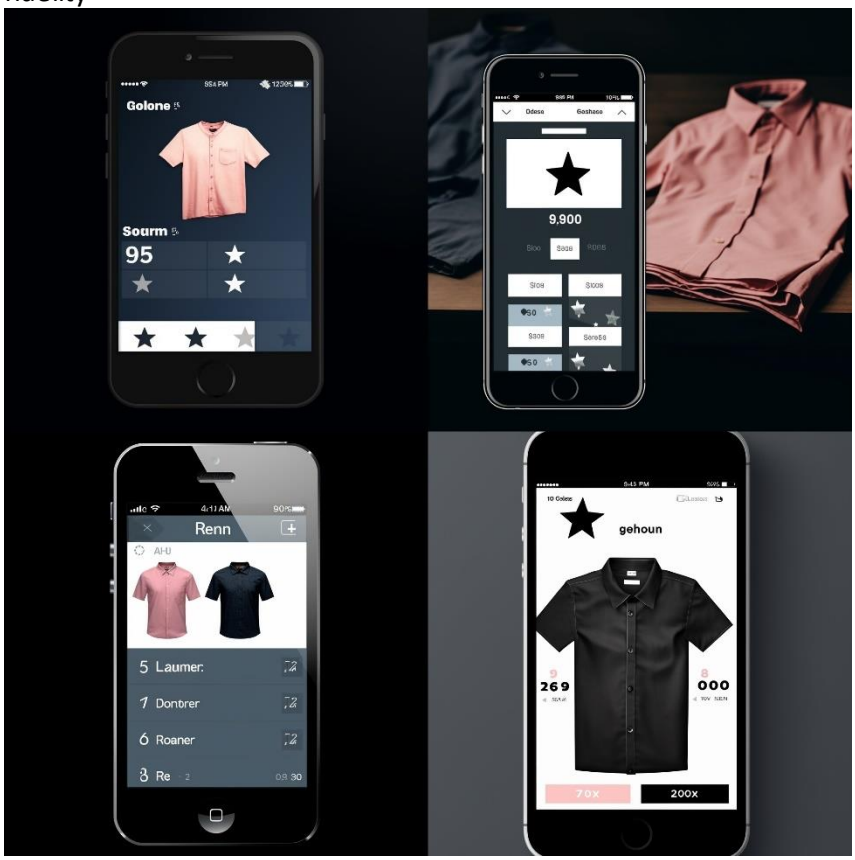
Prompt: **<Participant's randomly picked hi-fi mobile chat interface>** Create a high fidelity user-interface with Inter as font family where there are four cards promoting videos and has social messaging app



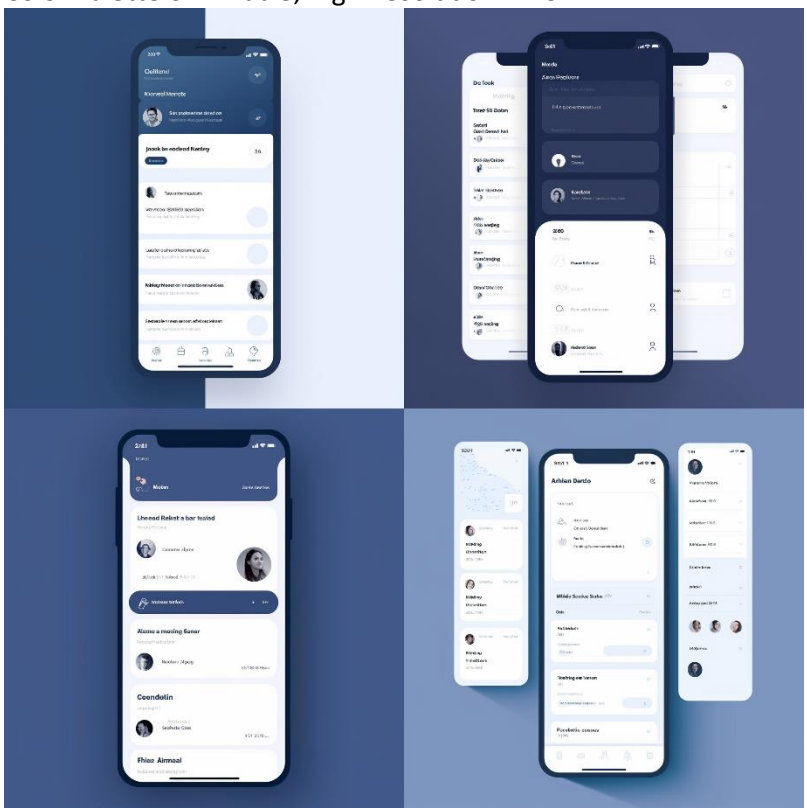
Prompt: **<Participant's own second wireframe>** create a user-interface for a e-commerce webshop product detail page fleece hoodie multiple sizes



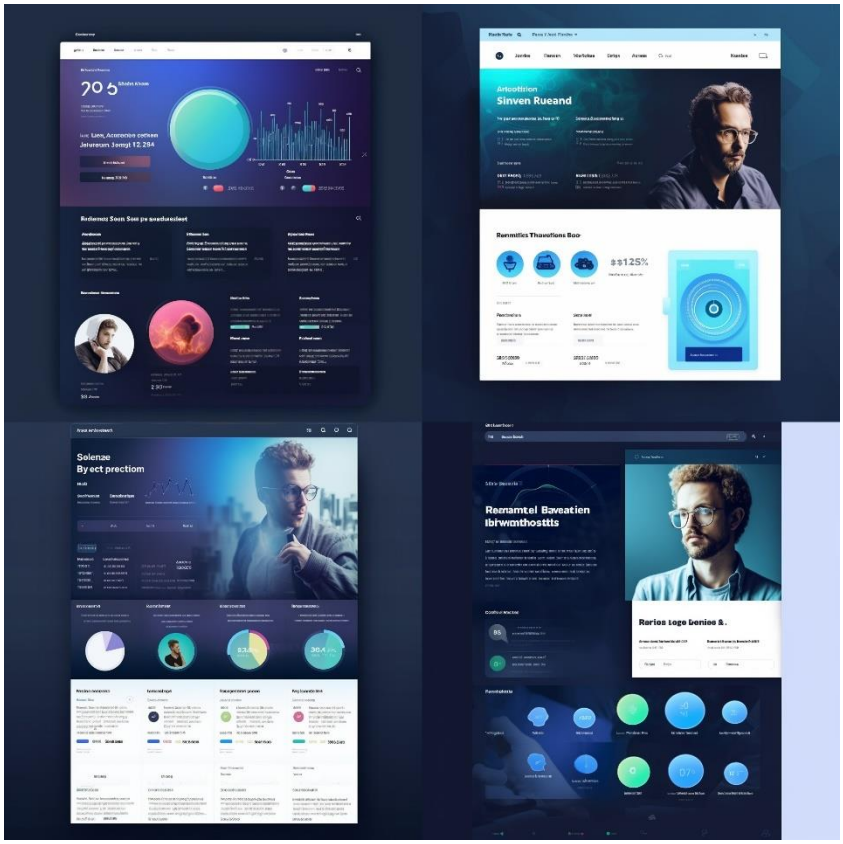
Prompt: **<Participant's own third wireframe>** create an app e-commerce shirts buying G-Star high-fidelity



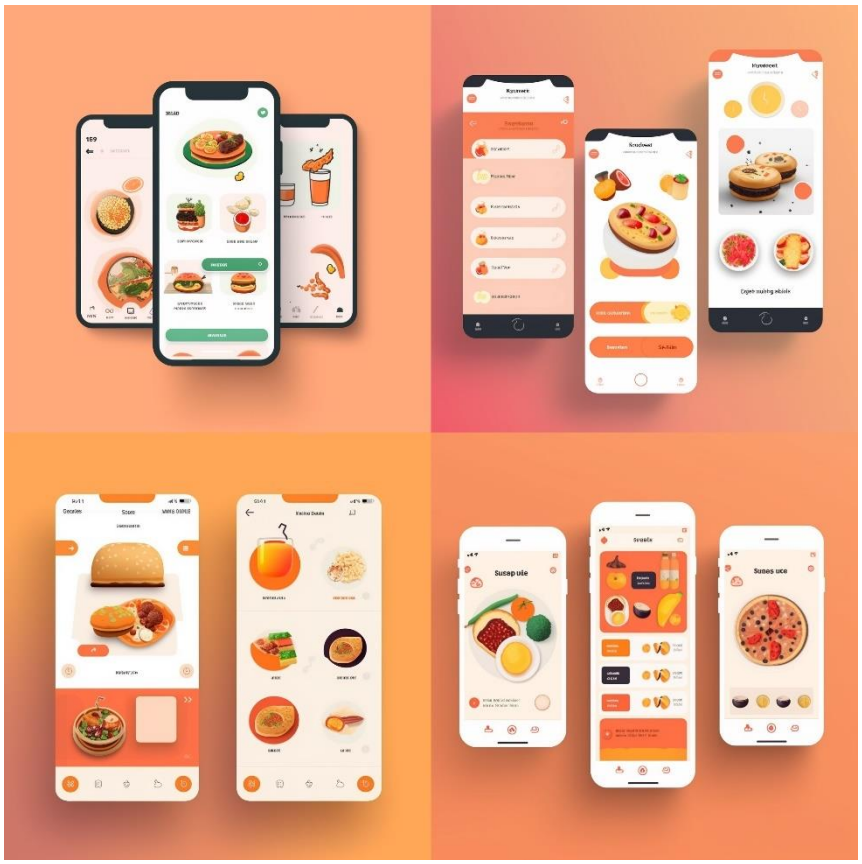
Prompt: **<wireframe>** UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5



Prompt: **<Participant's randomly picked hi-fi desktop blog interface>** create a user interface website for blogs high-fidelity professional blue color palette

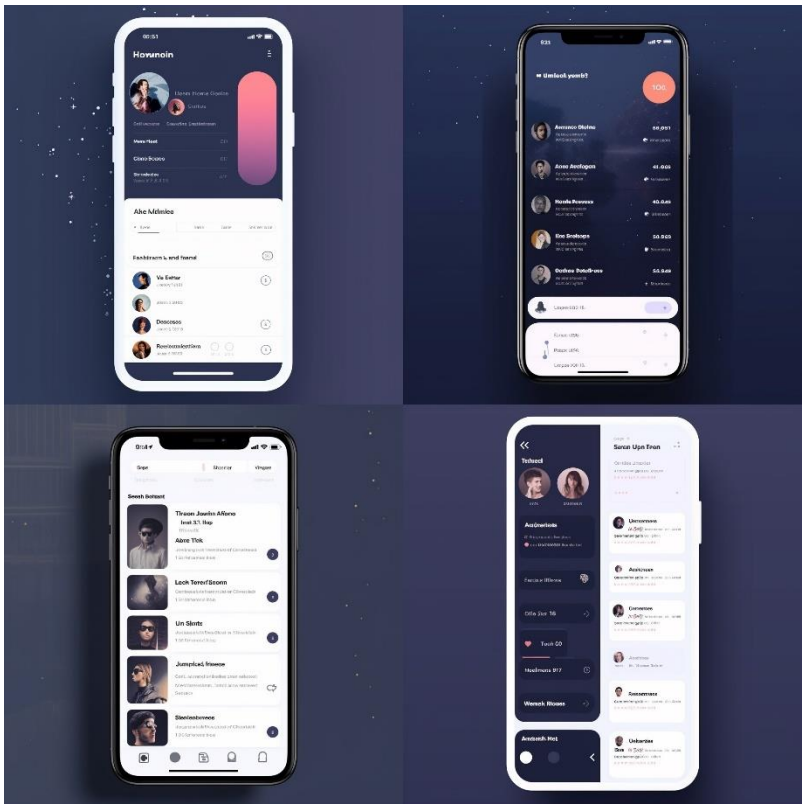


Prompt: **<none>** & **<Participant's randomly picked hi-fi mobile interface> create** a food app with minimalistic design flat illustrations clean high resolution --v 5

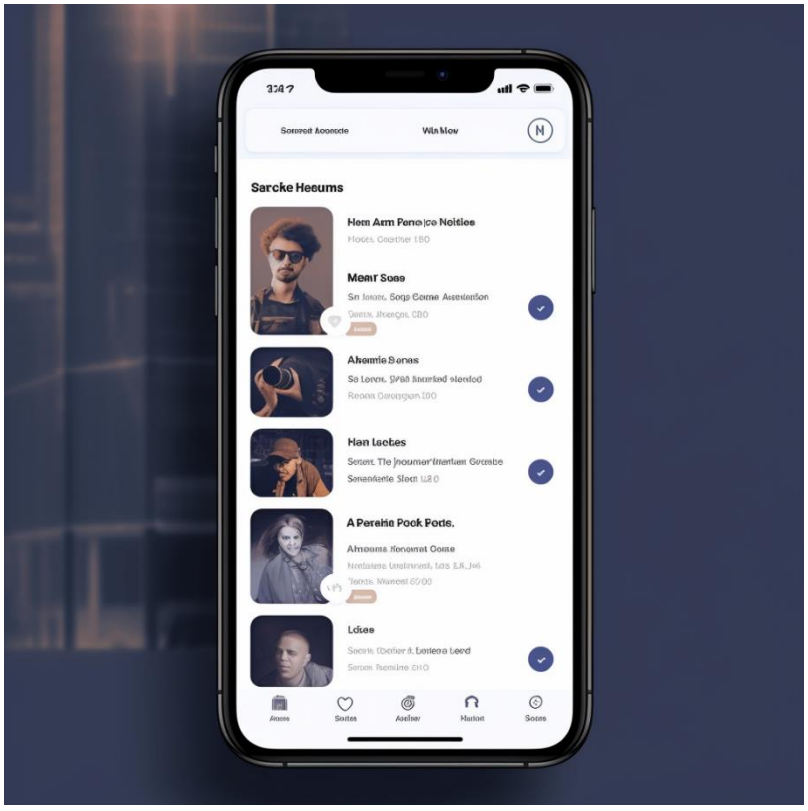


Interfaces generated by P3

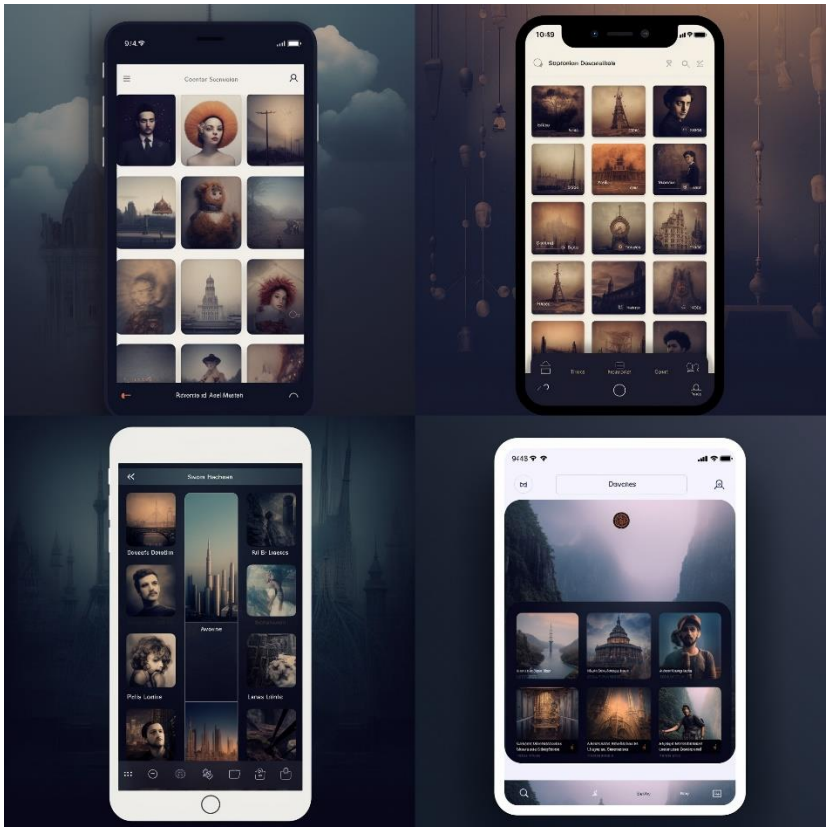
Prompt: **<wireframe>** modern social media application



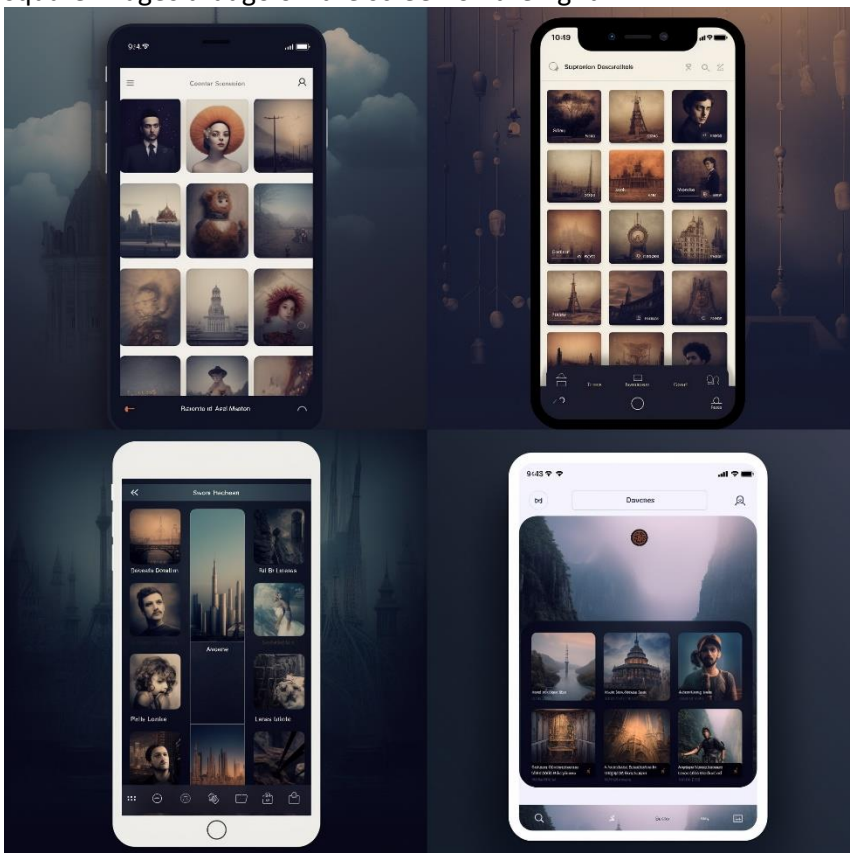
Variant 4 chosen:



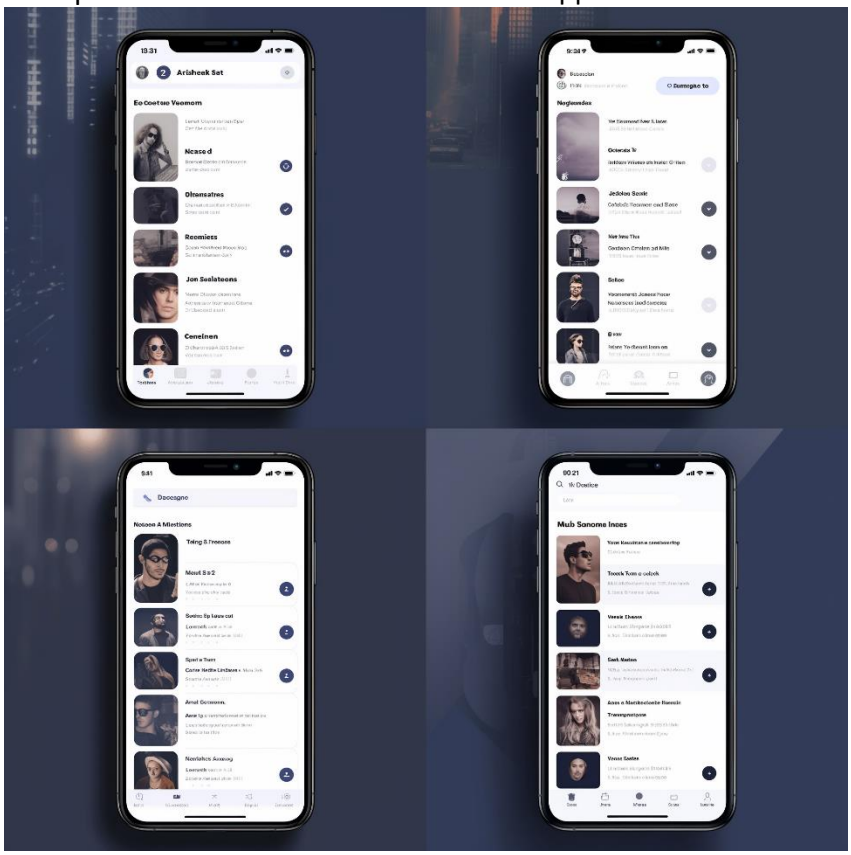
Prompt: **<Generated Interface Variant>** add a sliding carousel of square images at the top of the screen.



Prompt: **<Generated Interface Variant>** keep the design and lay-out the same, but add one row of square images that go off the screen on the right

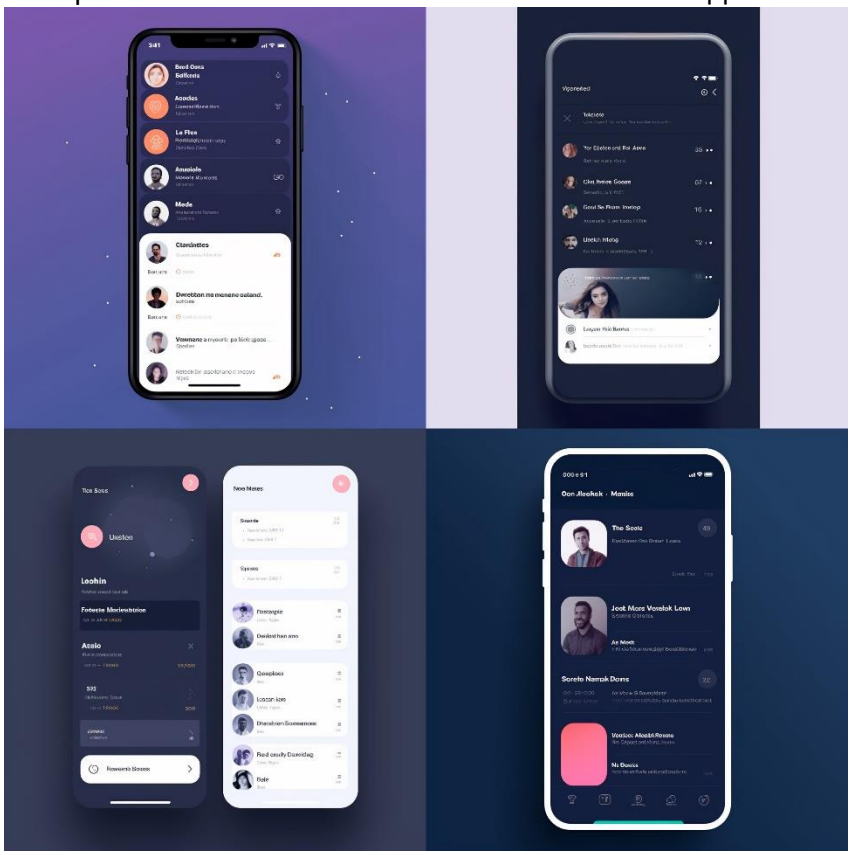


Prompt: **<wireframe>** modern social media application

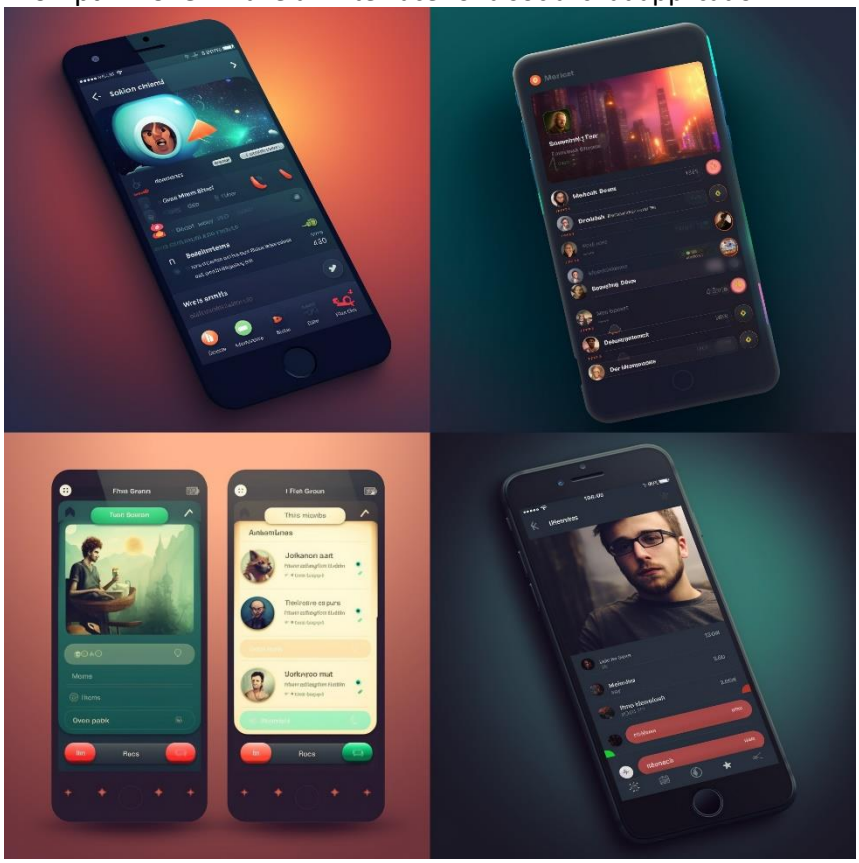


Prompt: **<Generated Interface Variant>** make the images a circle

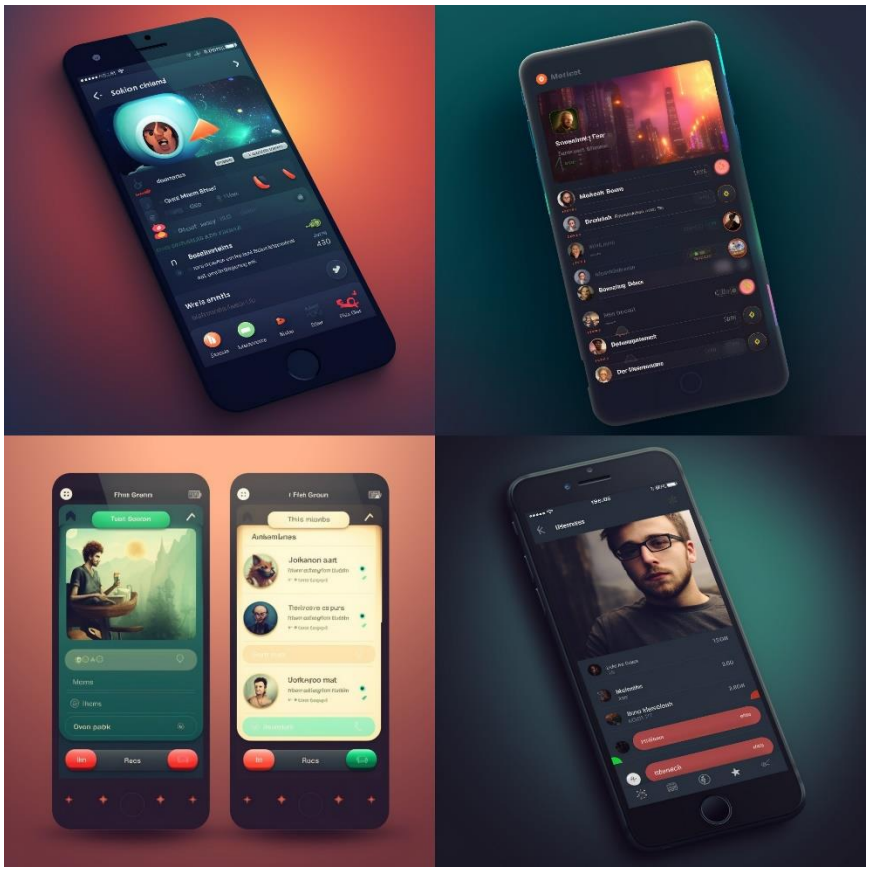
Prompt: **<wireframe>** modern minimalistic social media application with chat function

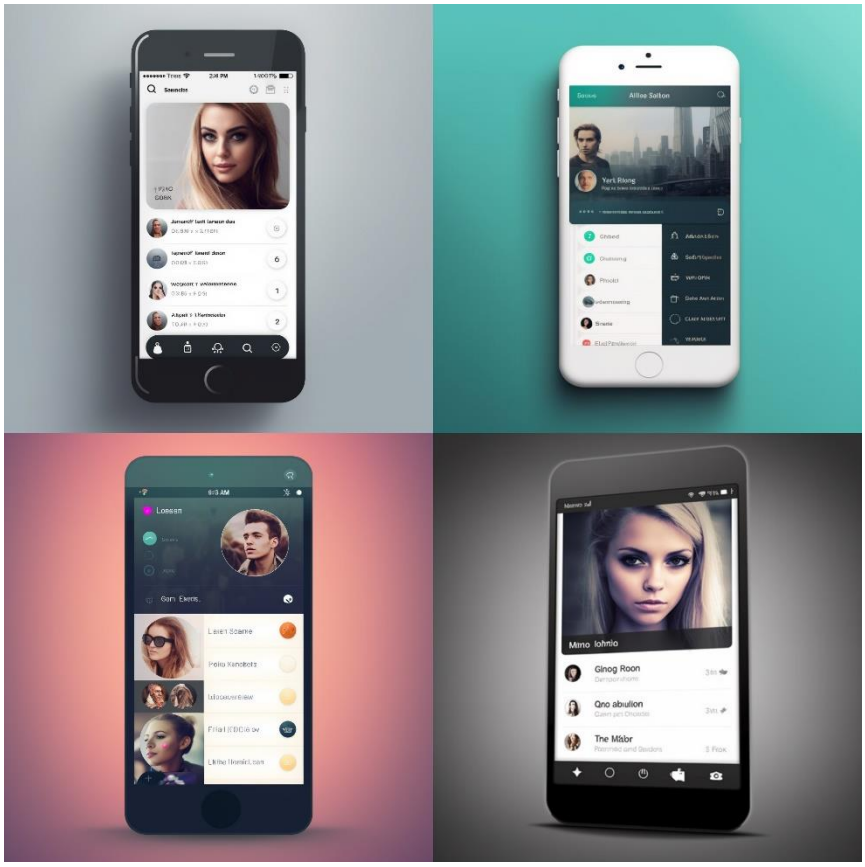


Prompt: **<none>** make an interface for a social chat application



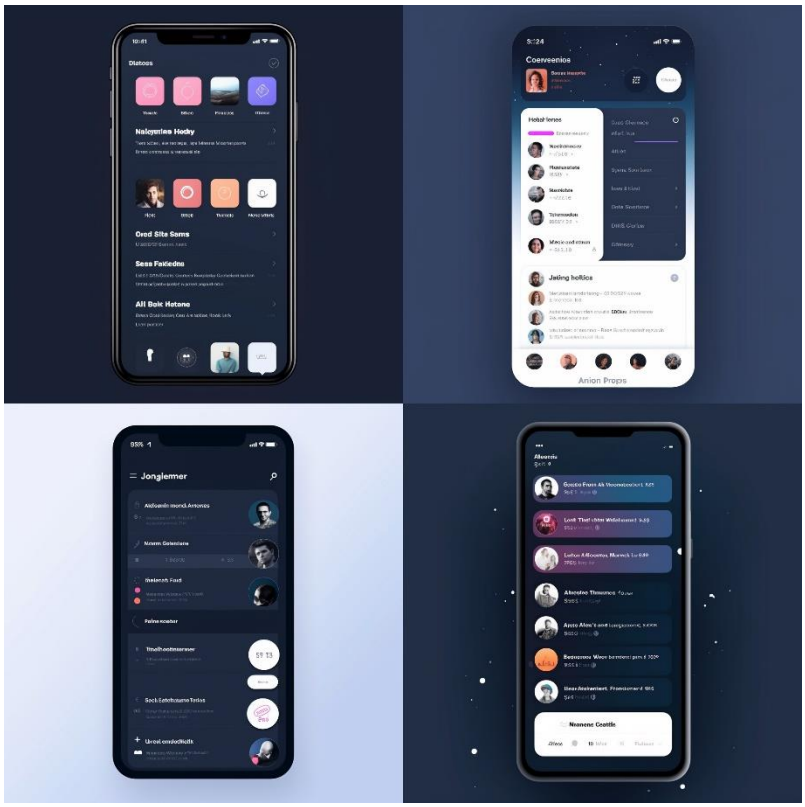
Prompt: **<none>** make a modern and minimalistic interface for a social chatt application



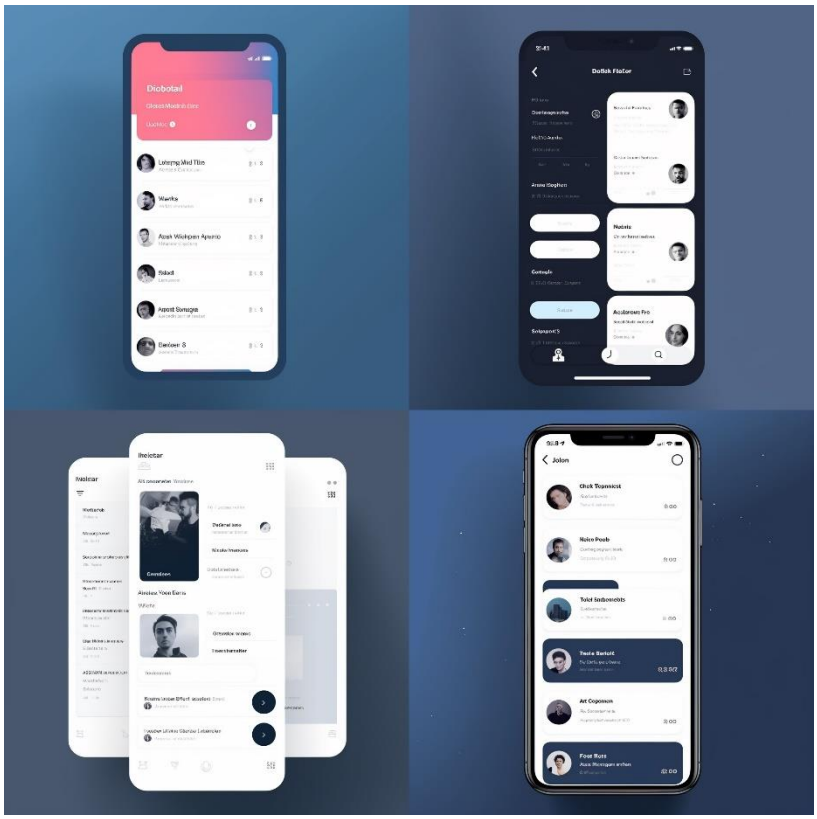


Interfaces generated by P4

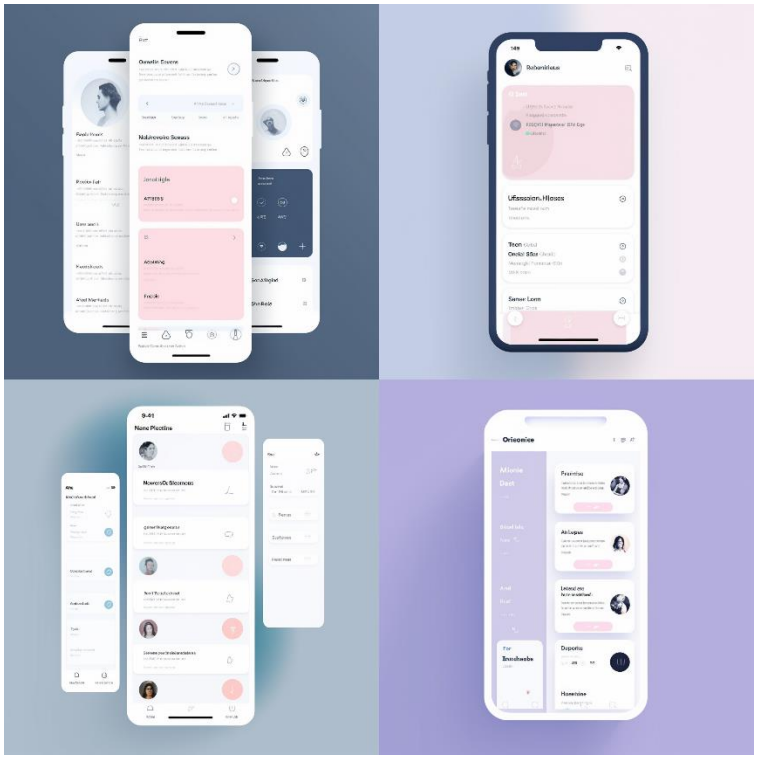
Prompt: **<wireframe>** Social media app UI, Modern



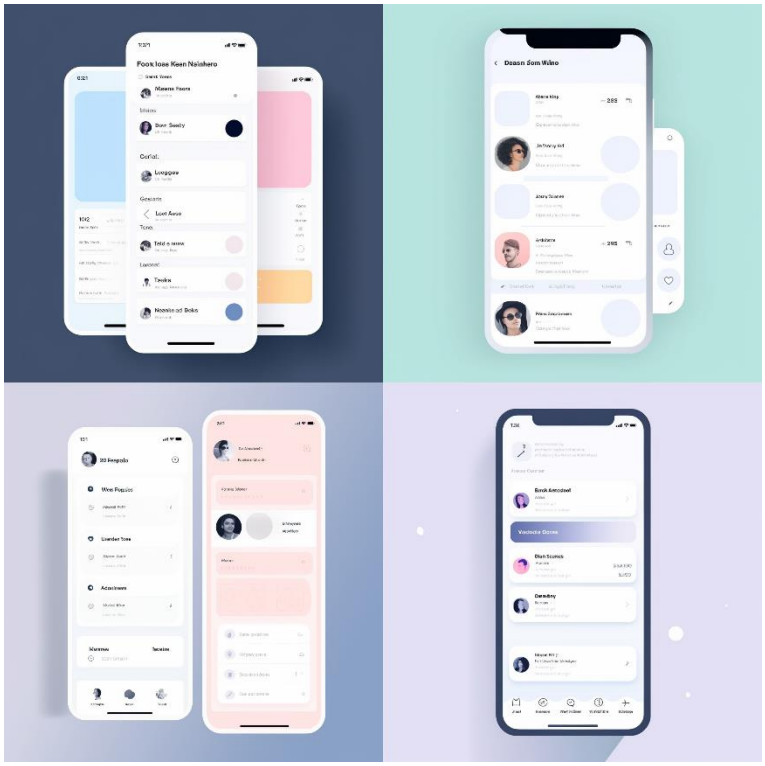
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic --v 5



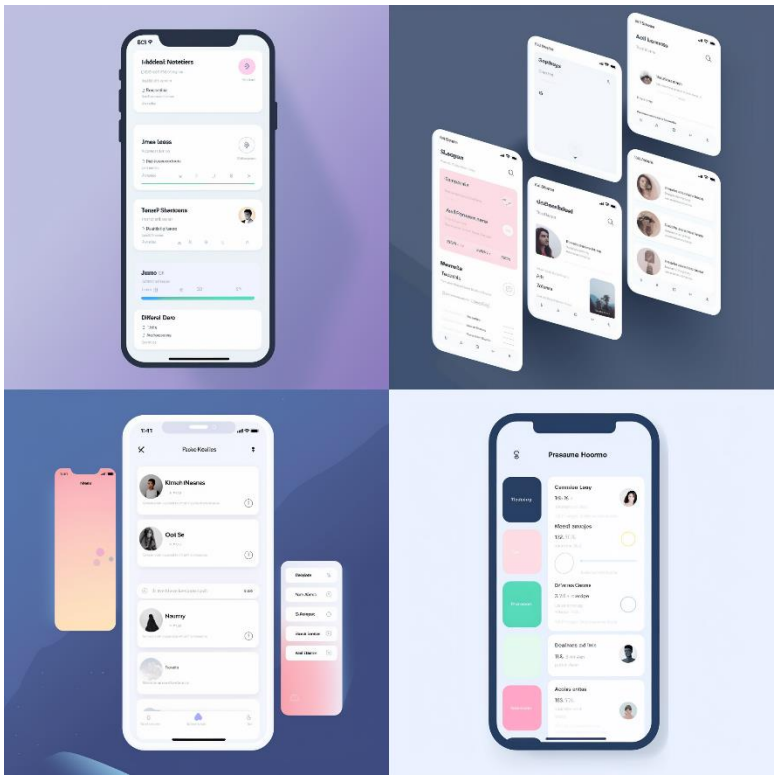
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours --v 5



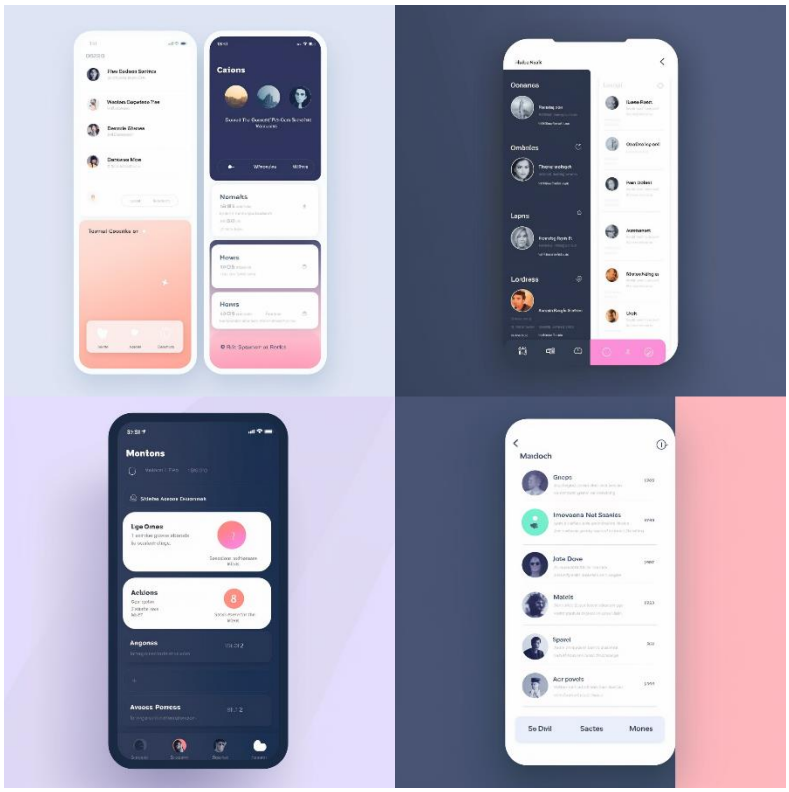
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the important message function, use a dribble design --v 5



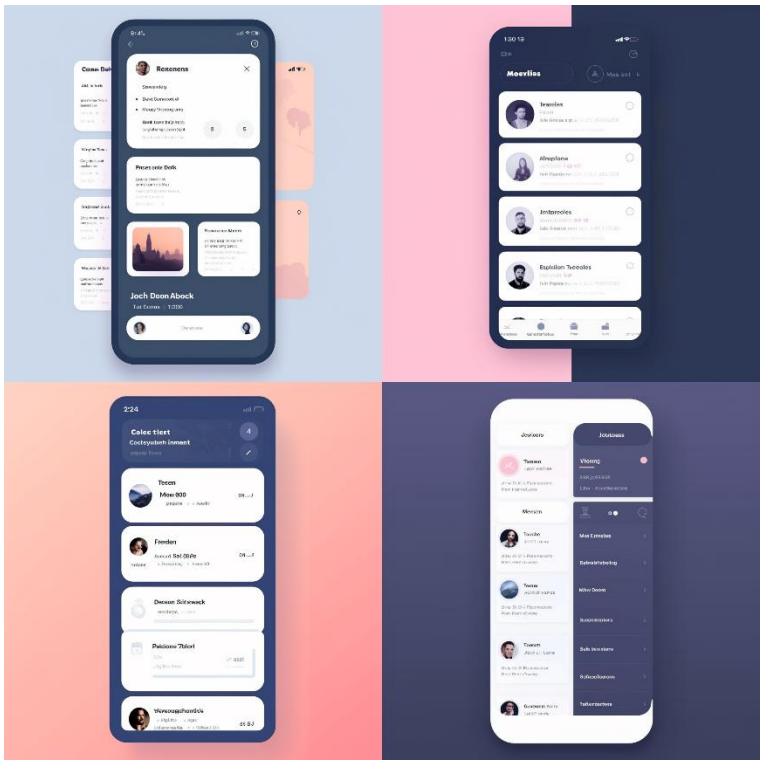
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the important message function, use a dribble design, make a clear information hierarchy, use your Ux knowledge --v 5



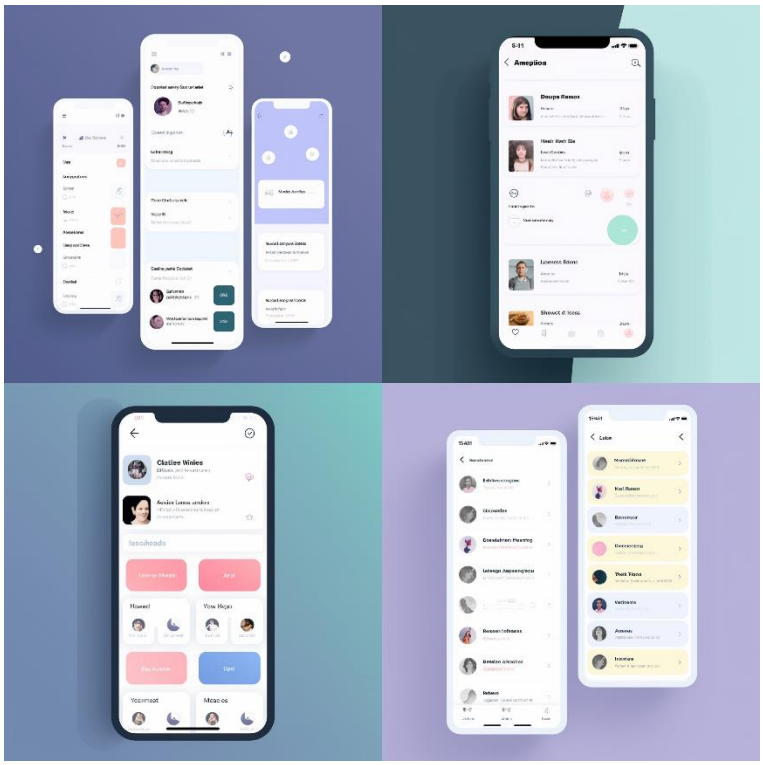
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, also make a profile--v 5



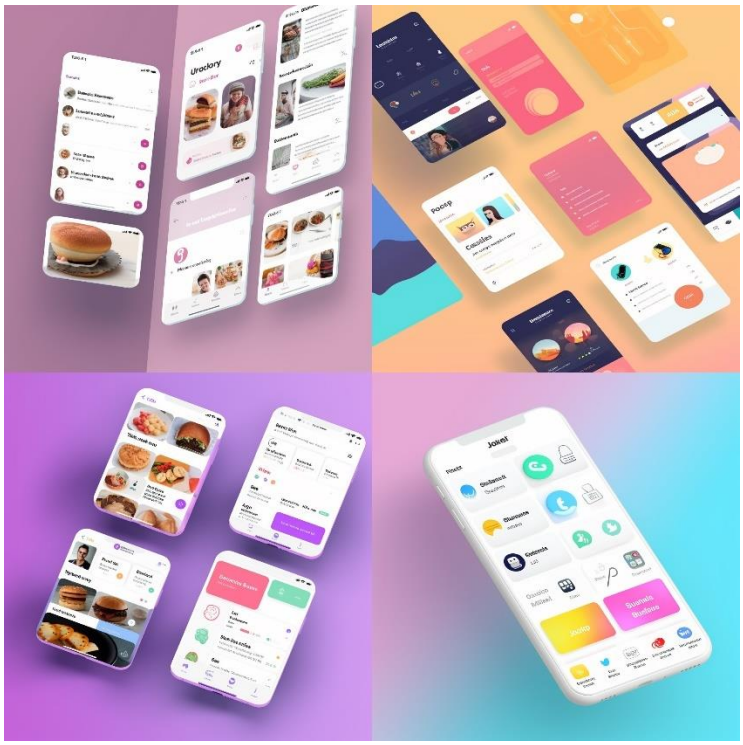
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, High Resolution, modern--v 5



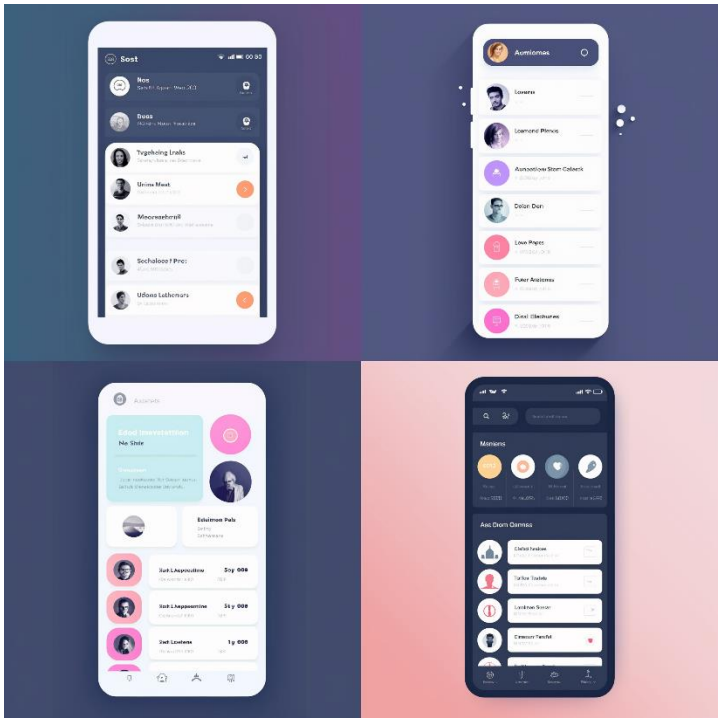
Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, make a grid, make an Hamburger menu, High Resolution, modern, use emojis --v 5



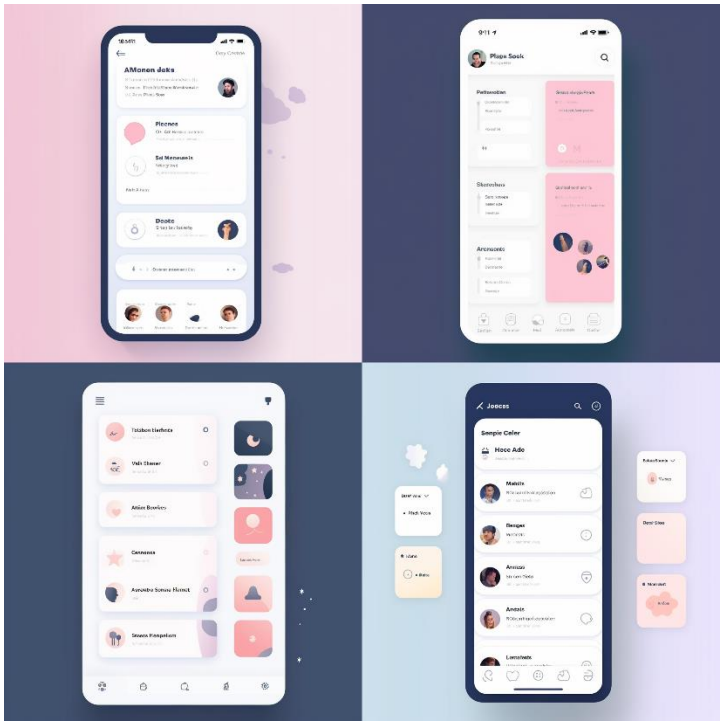
Prompt: **<none>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, make a grid, make an Hamburger menu, High Resolution, modern, use emojis --v 5



Prompt: **<none>** & **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation, make a grid, make an mobile menu, modern, use emojis

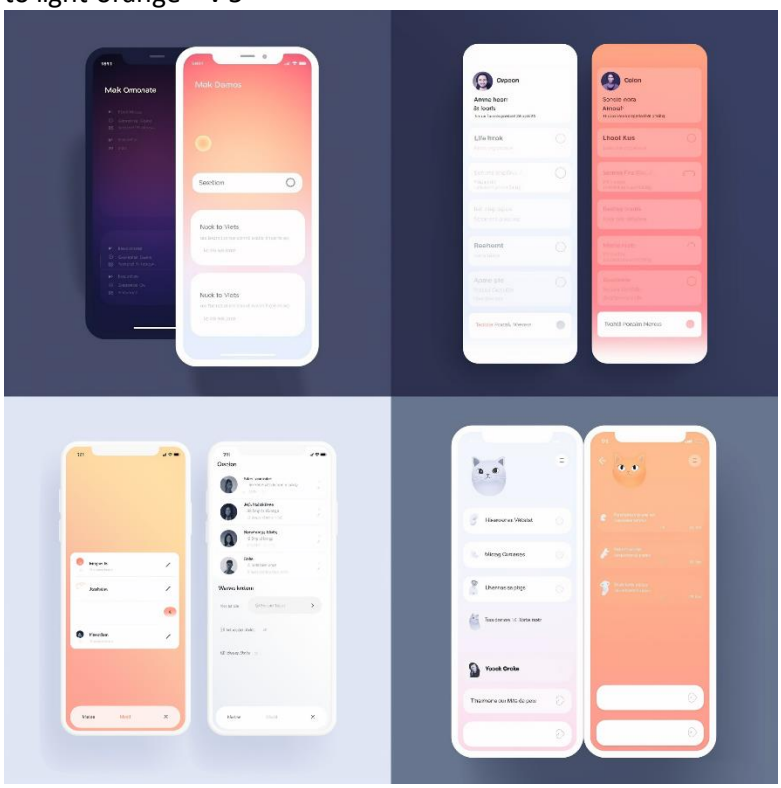


Prompt: **<wireframe>** Social media app UI, user friendly, Minimalistic design and features, use pastel colours, only use the message function, use a dribble design, use your Ux knowledge, Make sure the unread messages are highlighted, make a navigation in the bottom, make a grid, make an mobile menu on the top, modern, use emojis

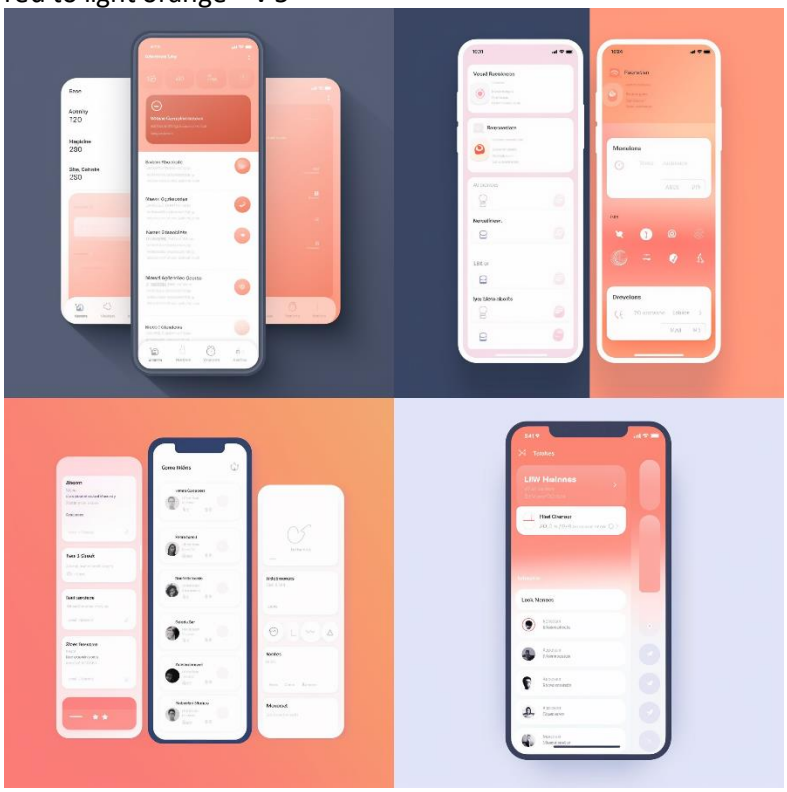


Interfaces generated by P5

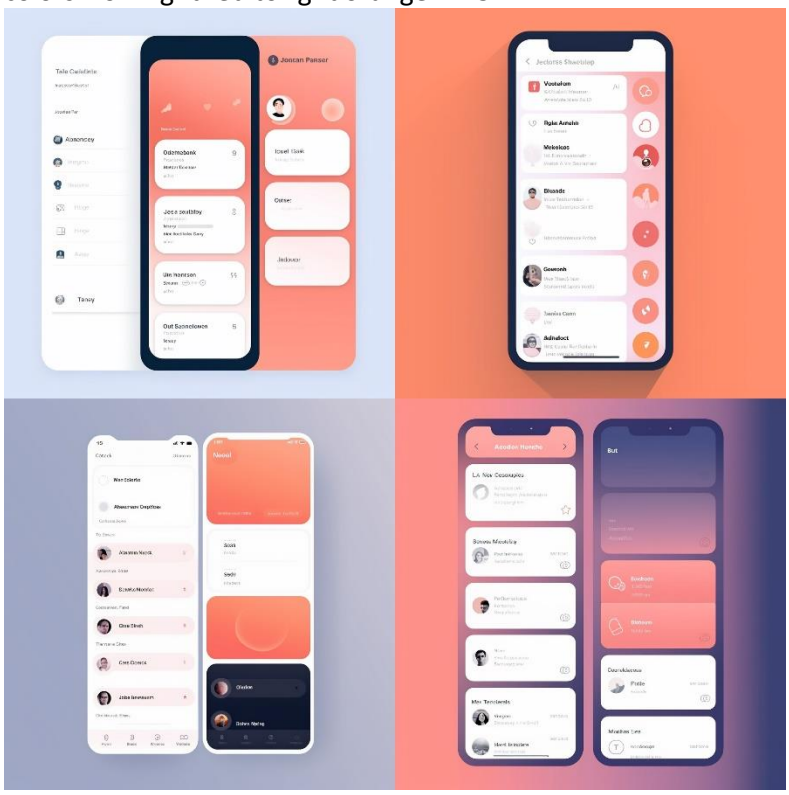
Prompt: **<wireframe>** Chat overview UI for Mobile, Minialistic design, gradient colors from light red to light orange --v 5



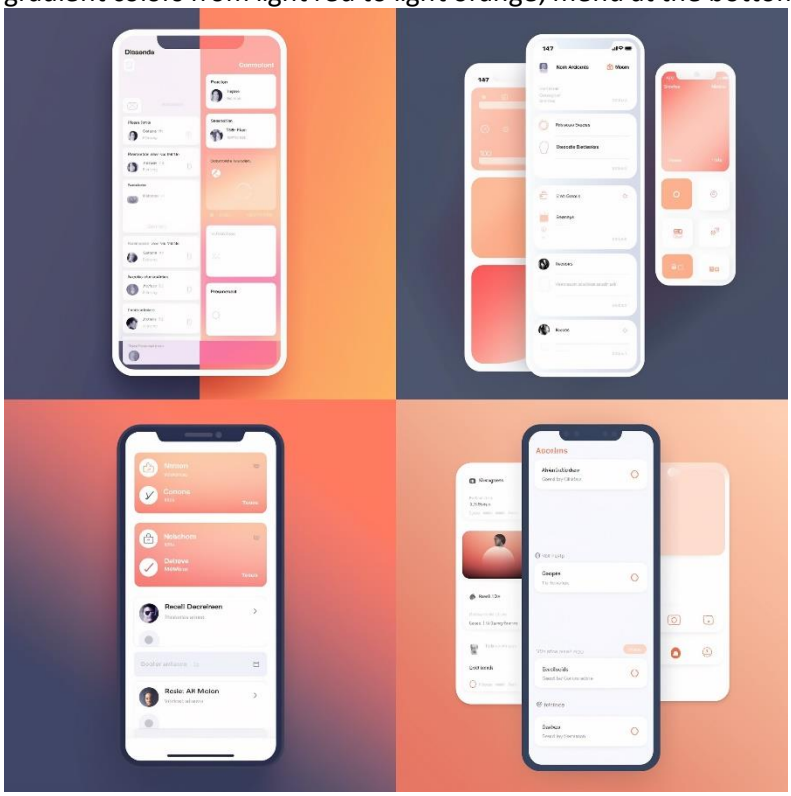
Prompt: **<wireframe>** Social Media App UI for Mobile, Minialistic design, gradient colors from light red to light orange --v 5



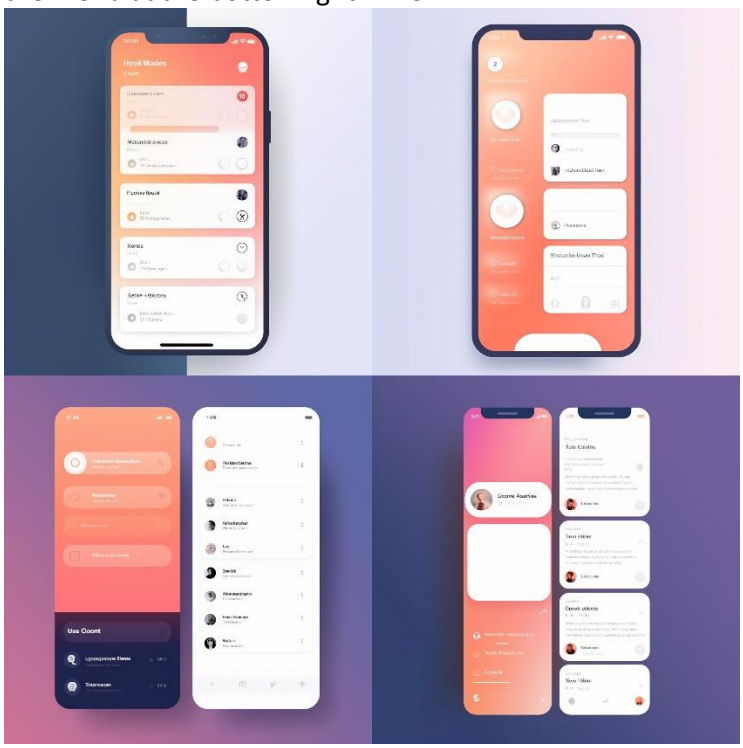
Prompt: **<wireframe>** Social Media App UI for Mobile, Minialistic design with accents of gradient colors from light red to light orange --v 5



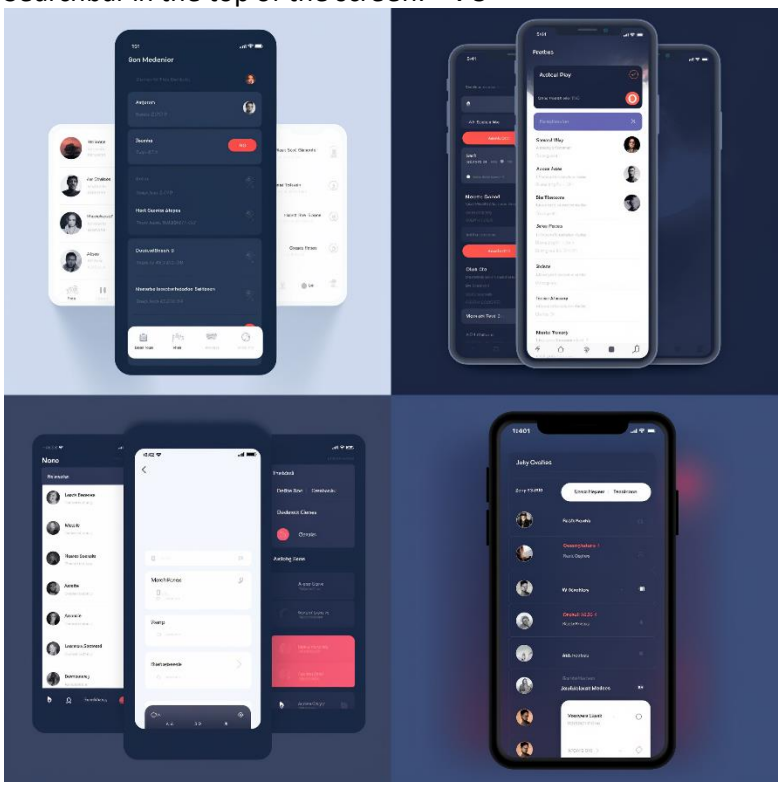
Prompt: **<wireframe>** Social Media App UI for Mobile, Outstandig 3Ddesign with border accents of gradient colors from light red to light orange, menu at the bottomright. --v 5



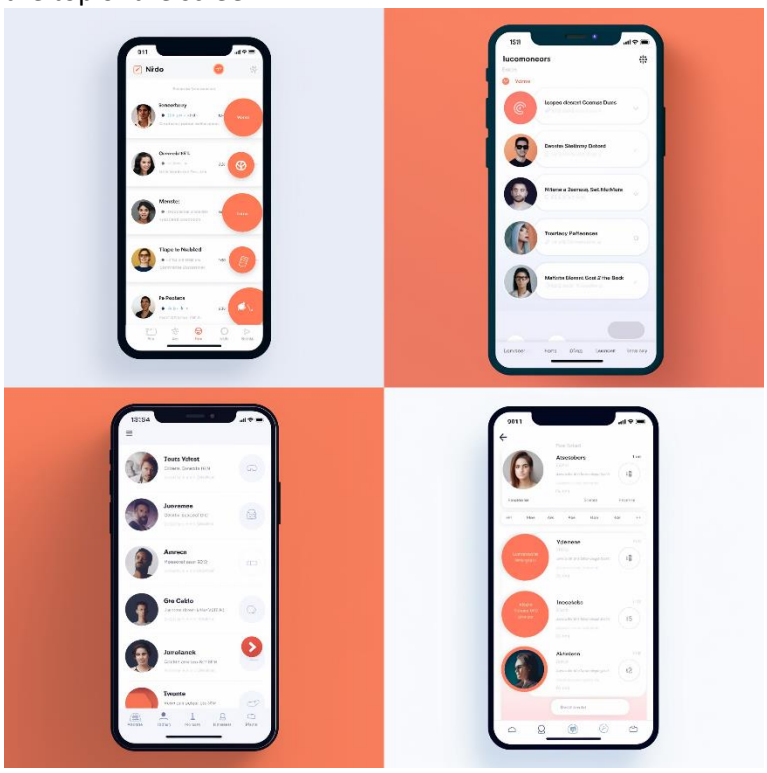
Prompt: **<wireframe>** Social Media App UI for Mobile, Outstandig 3Ddesign, with borders accents of gradient colors from light red to light orange, the border only exist on UI elements, round button of the menu at the bottomright. --v 5



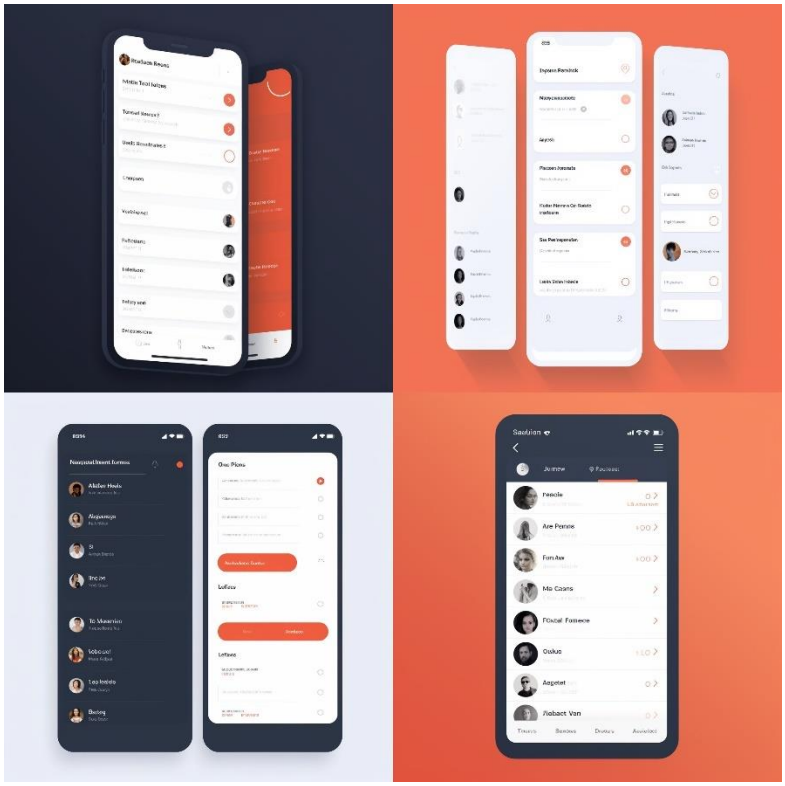
Prompt: **<wireframe>** Social Media App UI for Mobile, the ui elements of the design are having a border with color from the accents of glight red to light orange in a gradient. The most important elements/icons are dark blue. The profile pictures are on the left of the chat overview elements. The menu is on the bottom of the screen. With the selected menu item is the color red/orange. Searchbar in the top of the screen. --v 5



Prompt: **<wireframe>** A Social Media App UI for Mobile. Chat elements with profile pictures on the left. Status of the chats are red, orange, or green and are small circles. Accents colors of the UI are red/orange. The background is white. The menu is at the bottom of the screen. The searchbar is at the top of the screen.

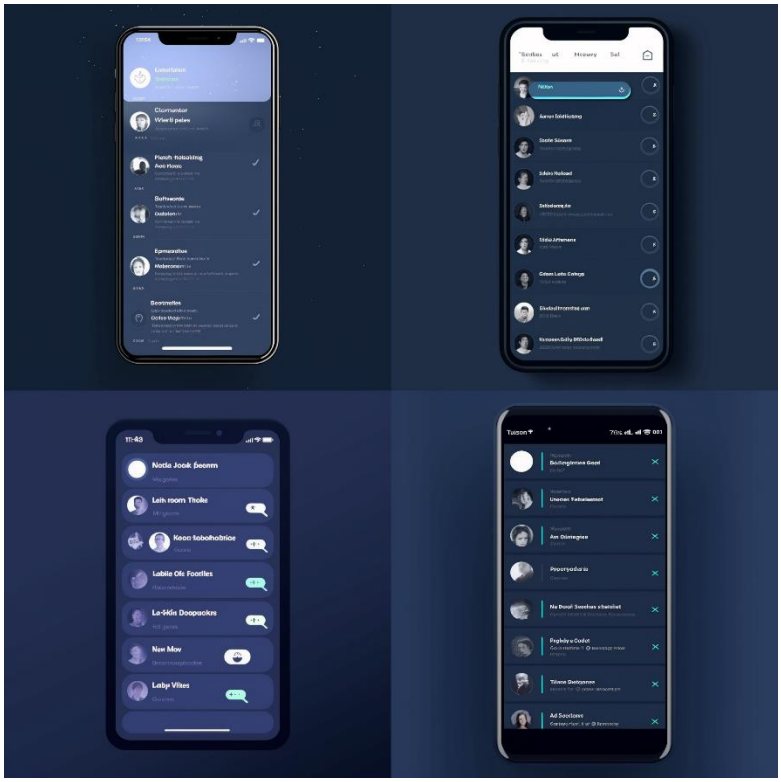


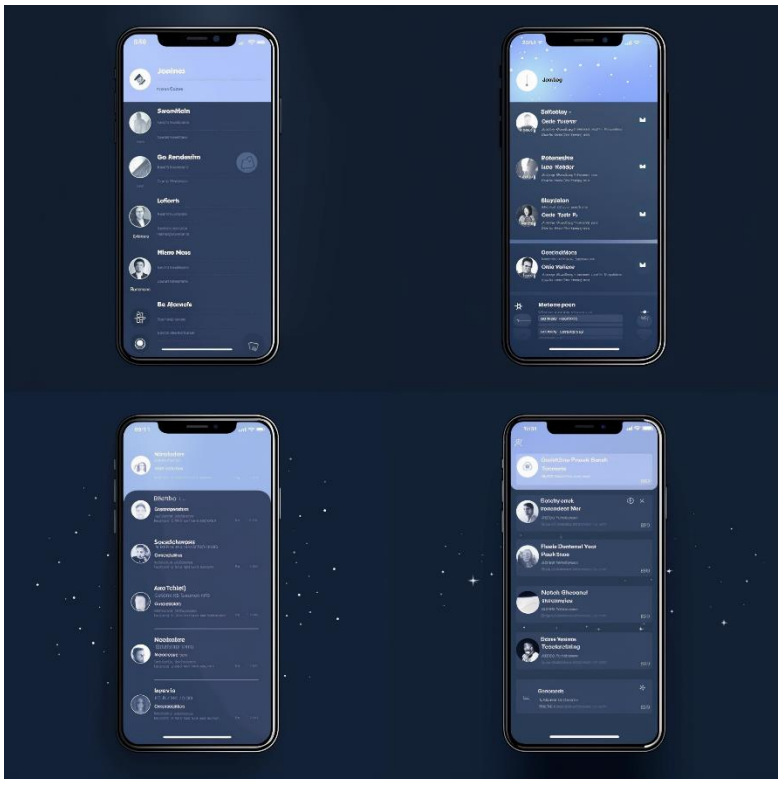
Prompt: **<wireframe>** A Social Media App UI for Mobile. Chat functions with red/orange elements --v 5



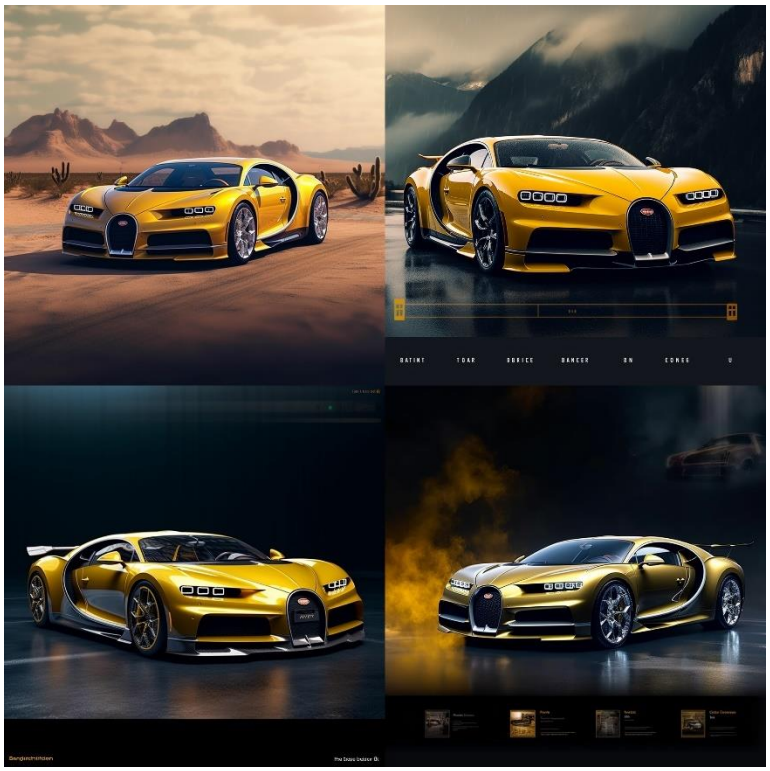
Interfaces generated by P6

<wireframe> Create a mobile app design with a list of 5 chats, with 'stories' on top of the screen. Style the icons in the menu bar. Use a navy blue theme with blue highlights, photorealistic, 4K, mock-up



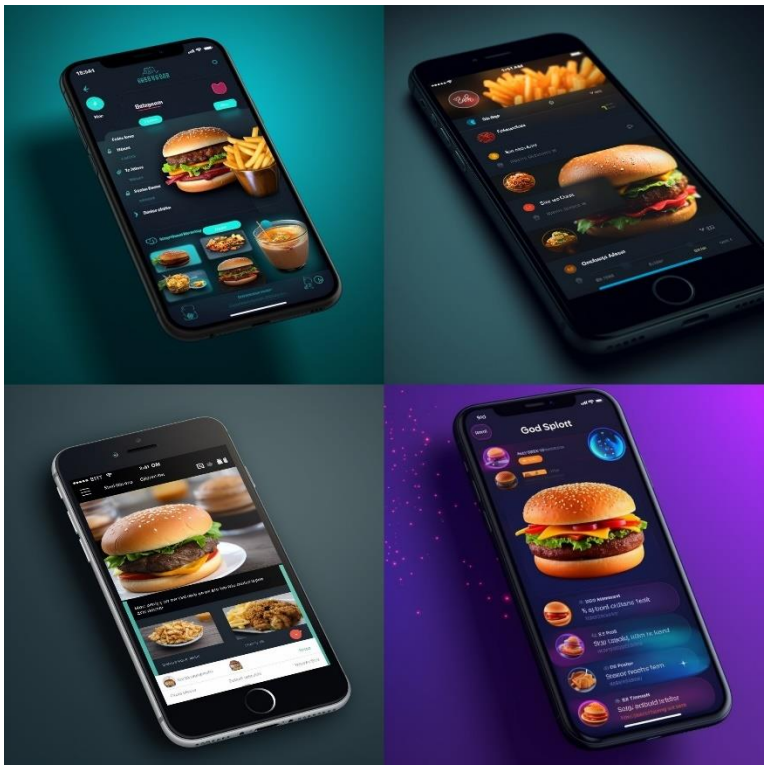


<none> Desktop website for a yellow bugatti chiron with large imagery, add details in buttons and background effects in the same yellow tint. Use a top screen nav-bar and a large catchy title, 4K, photorealistic, dark-themed

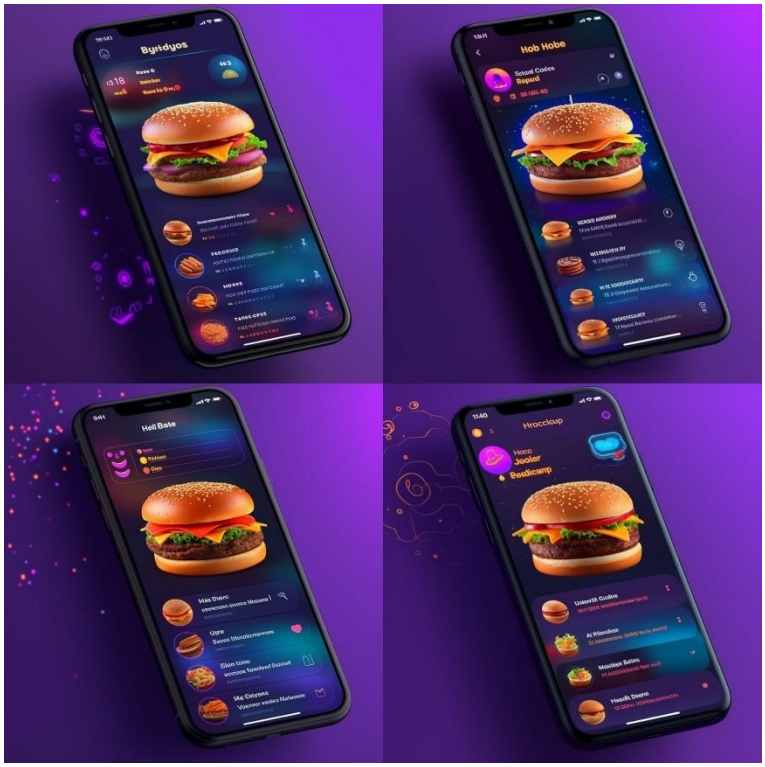


<none> Desktop website with a top screen nav-bar and a large catchy title, advertising a yellow bugatti chiron with large imagery, 4K, photorealistic, dark-themed

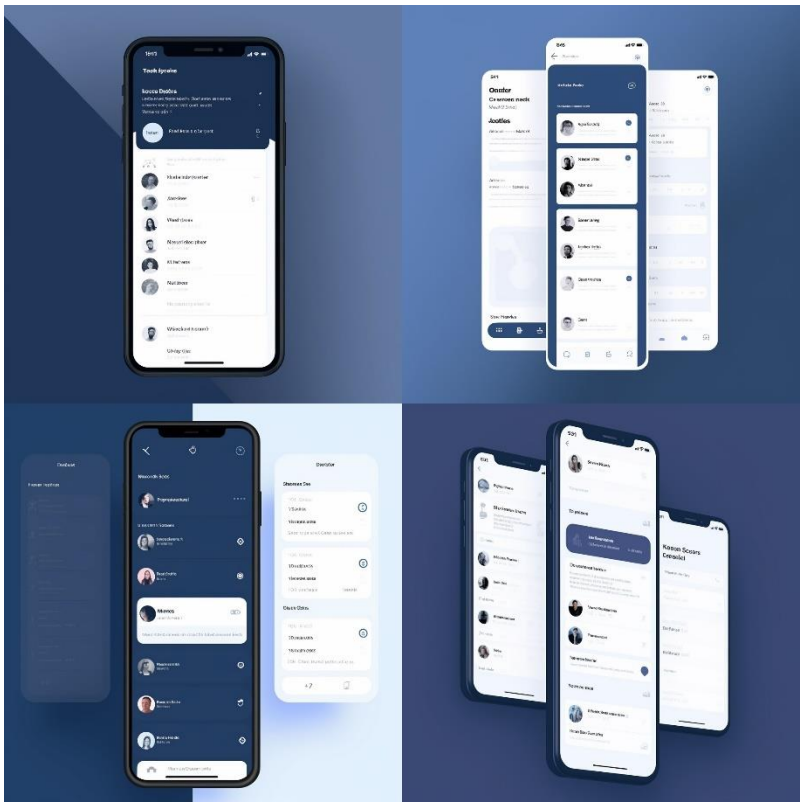
<none> create a visual design for a chat app. Use a burger-menu in the top-left corner, a profile badge in the top-right, a horizontal scroll with stories uploaded by users, and a nav-bar at the bottom of the page with the following icons; home, search, activity and settings. mock-up, 4k, photorealistic, light-theme, minimalistic



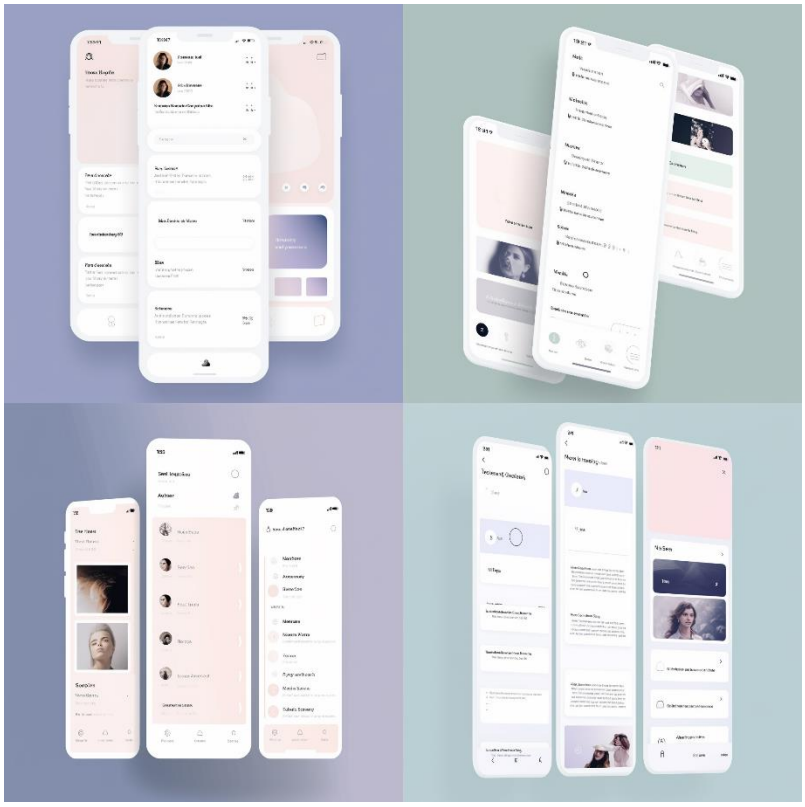
Variation 4 chosen:



<wireframe> UI design of a social media app, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5

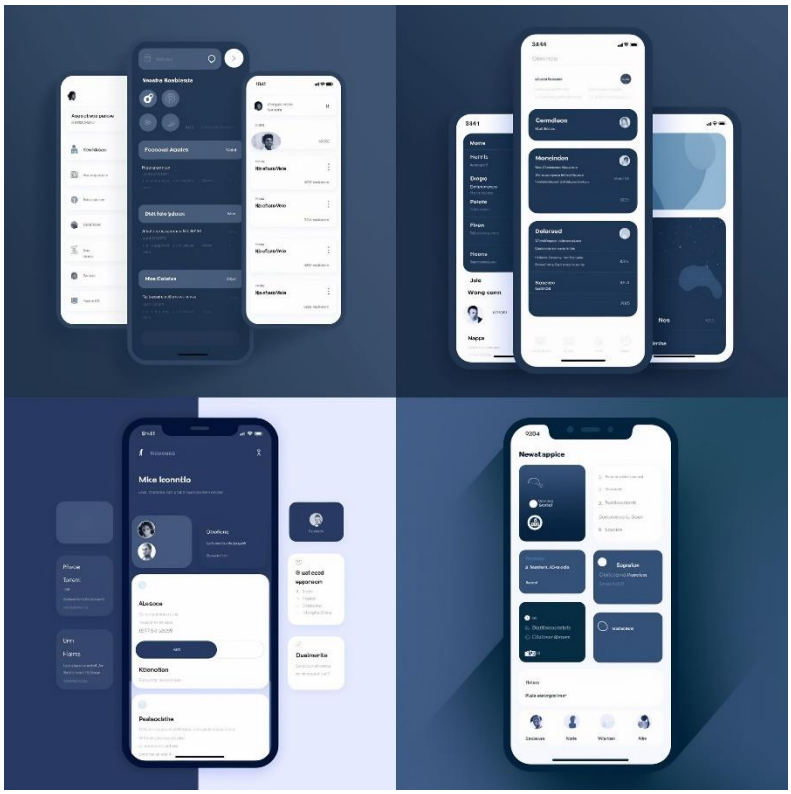


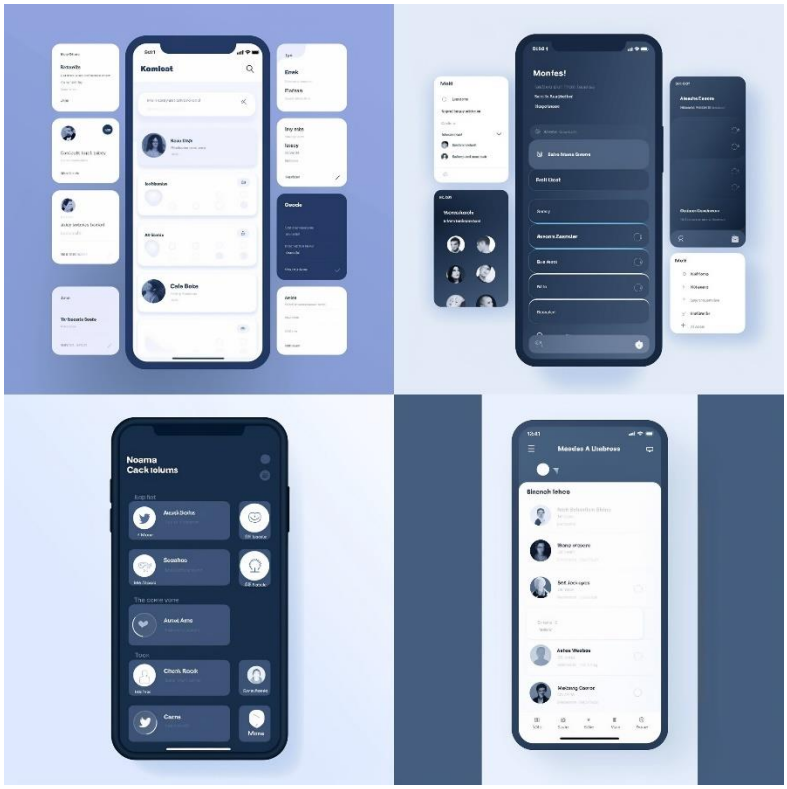
<wireframe> UI Design of a social media app , Modern, Classy, Minimalistic, Dreamy Pastel Color, High Resolution --v 5

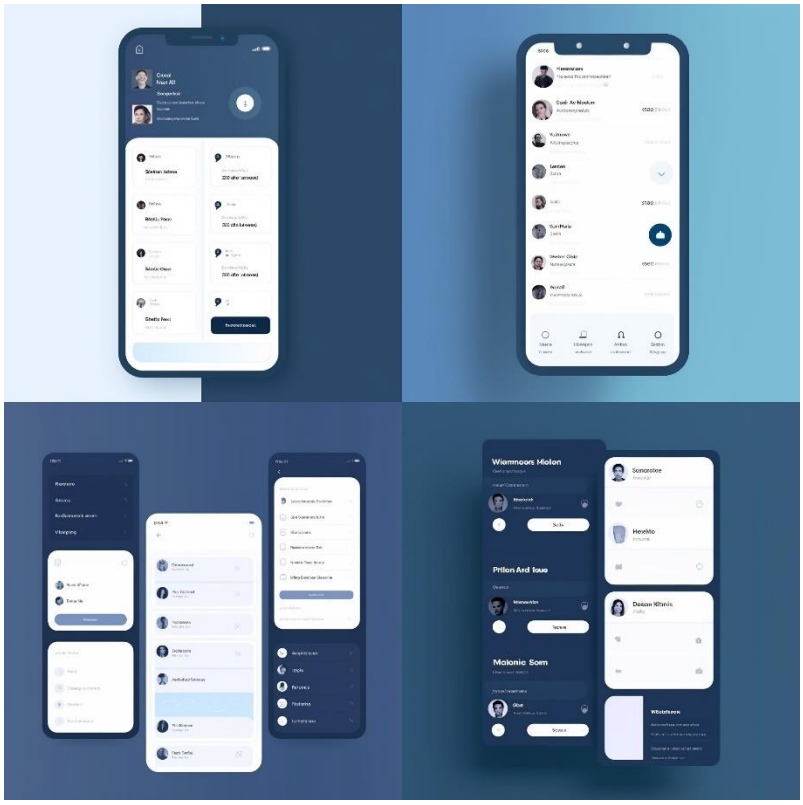


Interfaces generated by P7

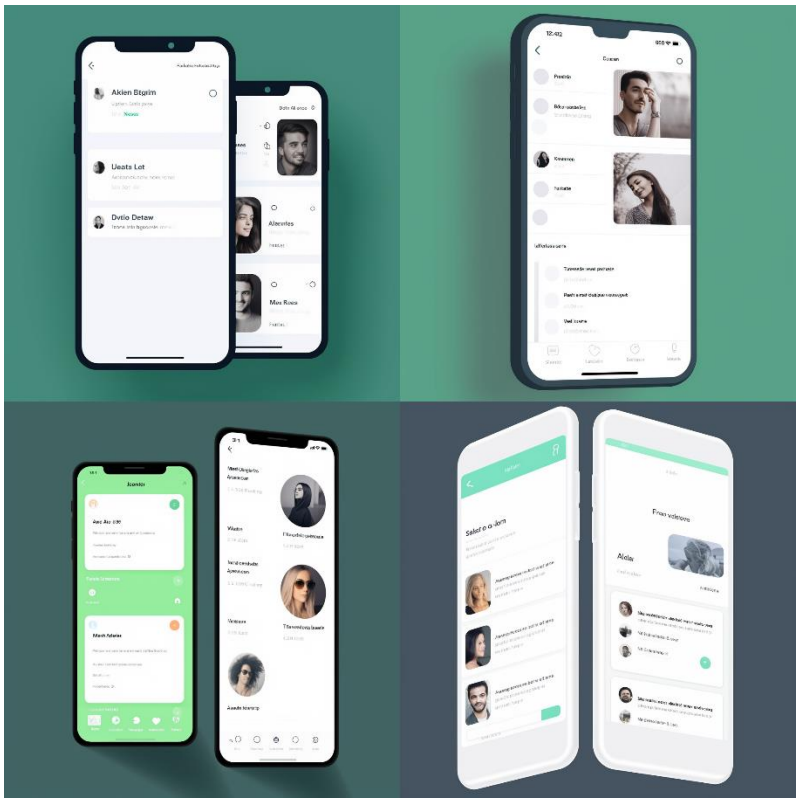
<wireframe> Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5

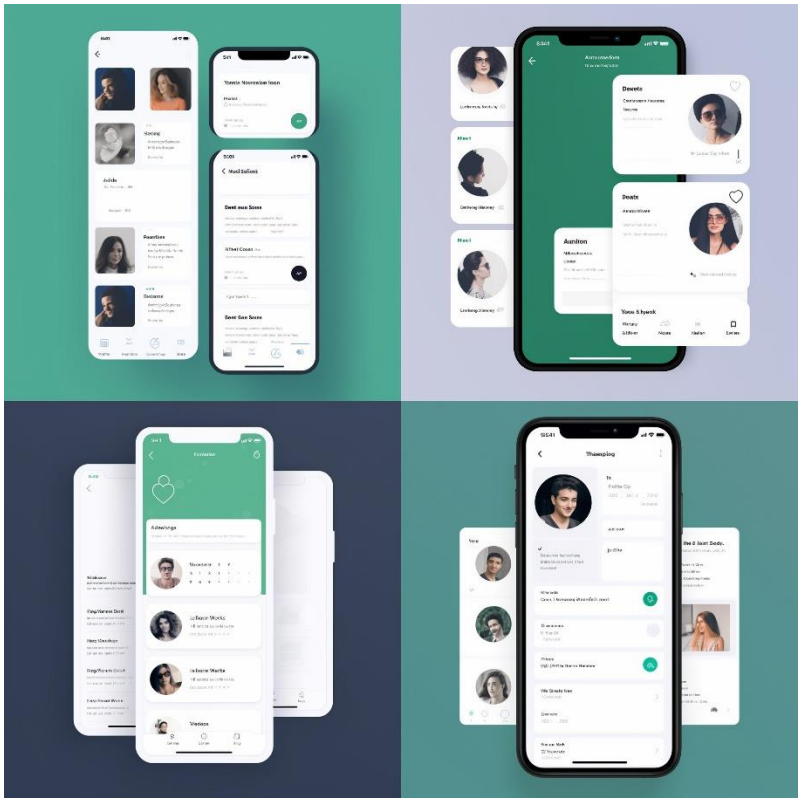




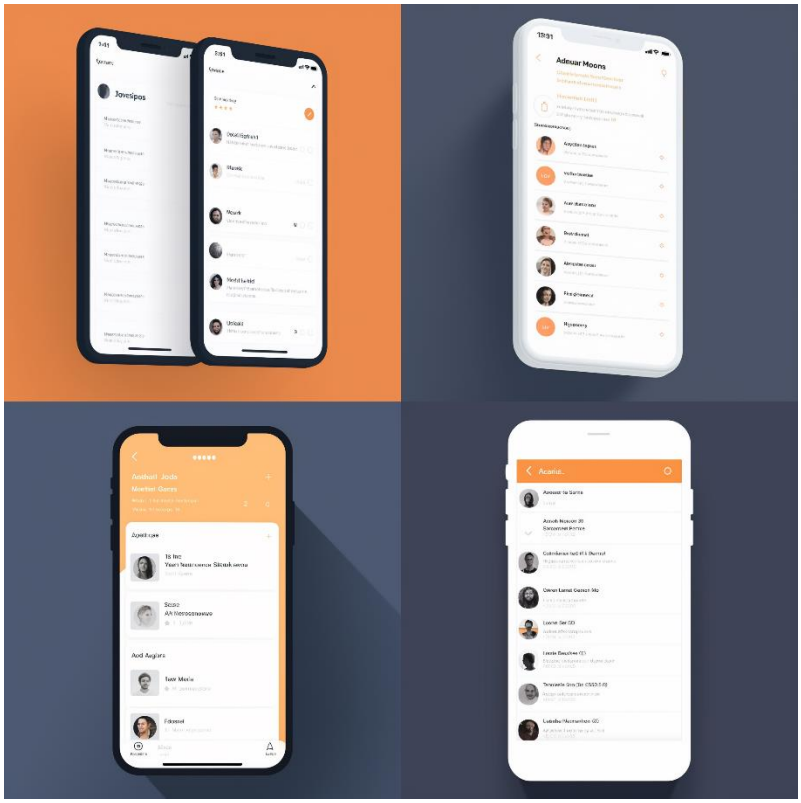


<wireframe> Social media app with a focus on dating with a green color palette, High resolution, focus on visuals --v 5

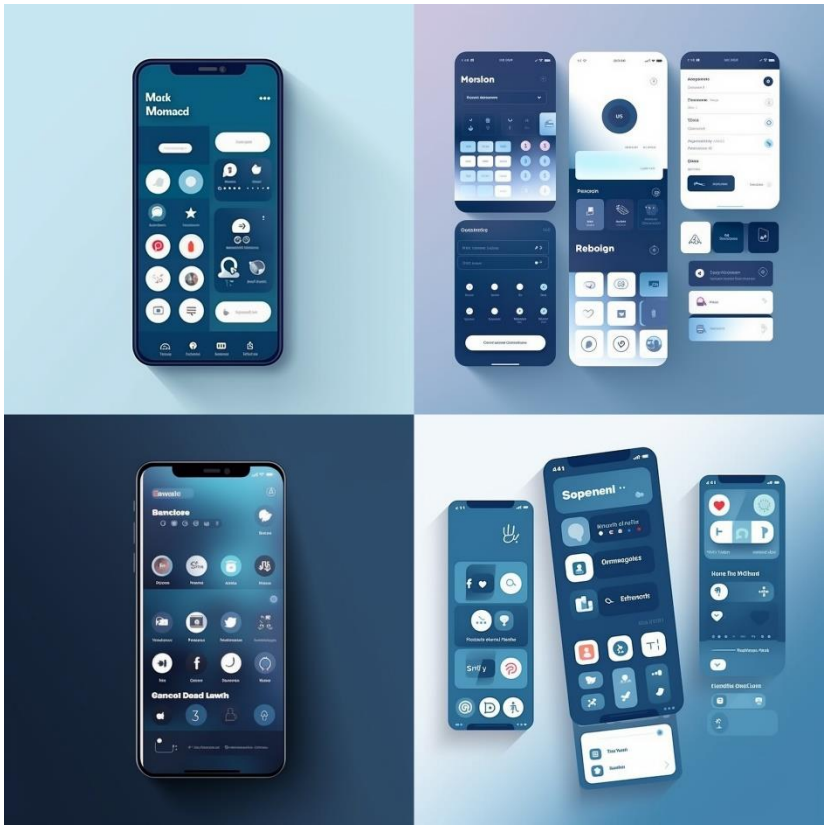




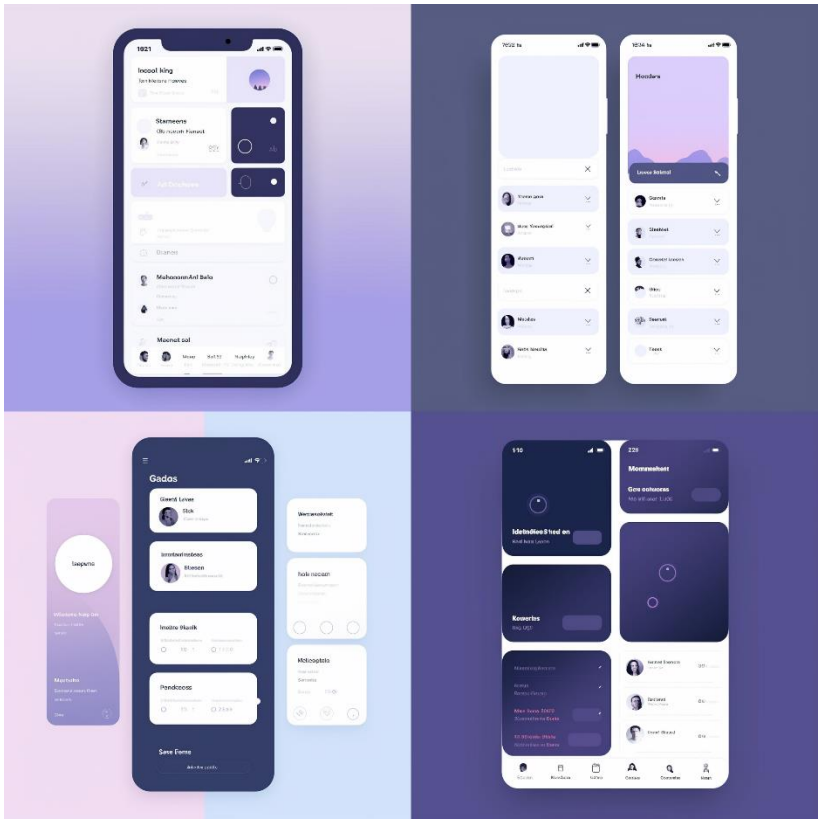
<wireframe> Messaging app UI, with a minimalistic approach using a orange color palette --v 5



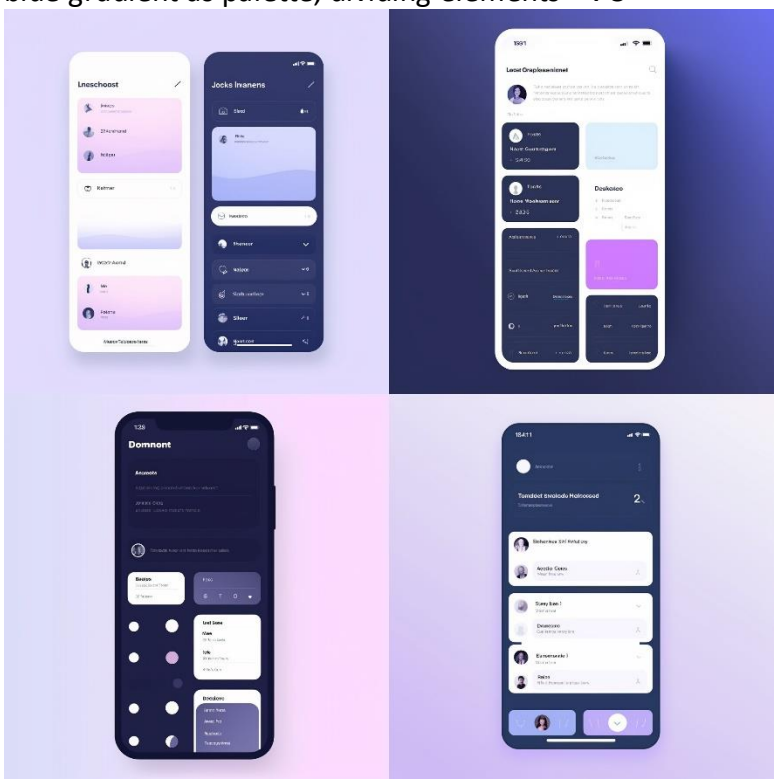
<none> Social media app UI, Modern, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5



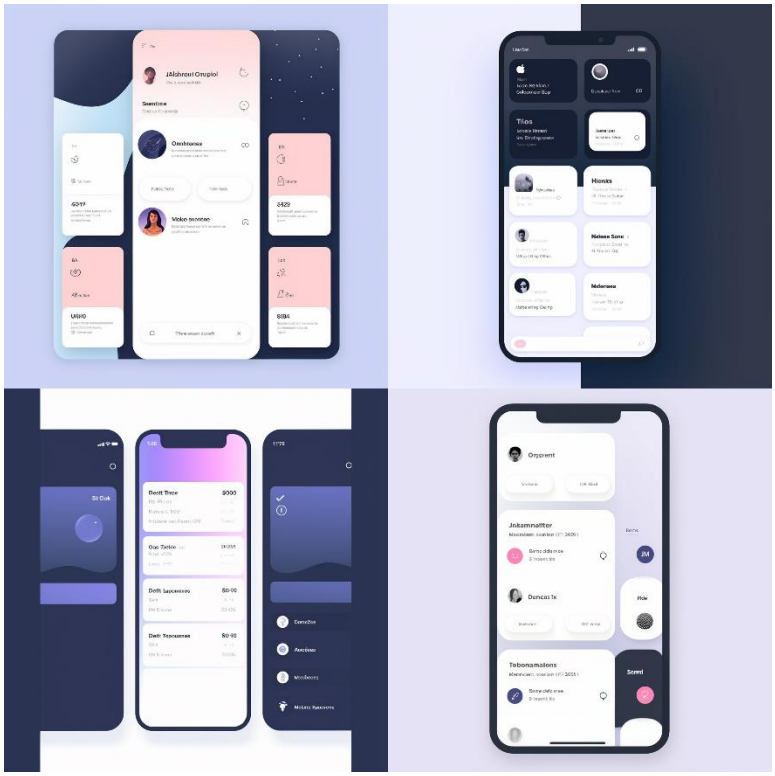
<wireframe> Social media app UI interface, minimalistic, supports stories with a purple and blue gradient as palette, dividing elements --v 5



<wireframe> Social media app UI interface, minimalistic, supports stories with a purple and blue gradient as palette, dividing elements --v 5

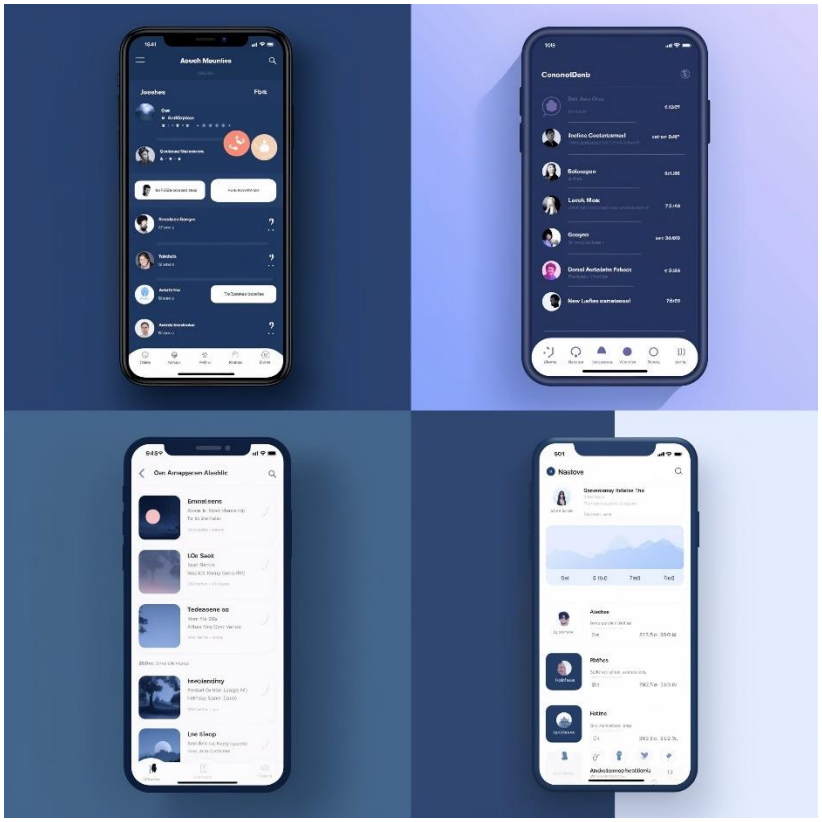


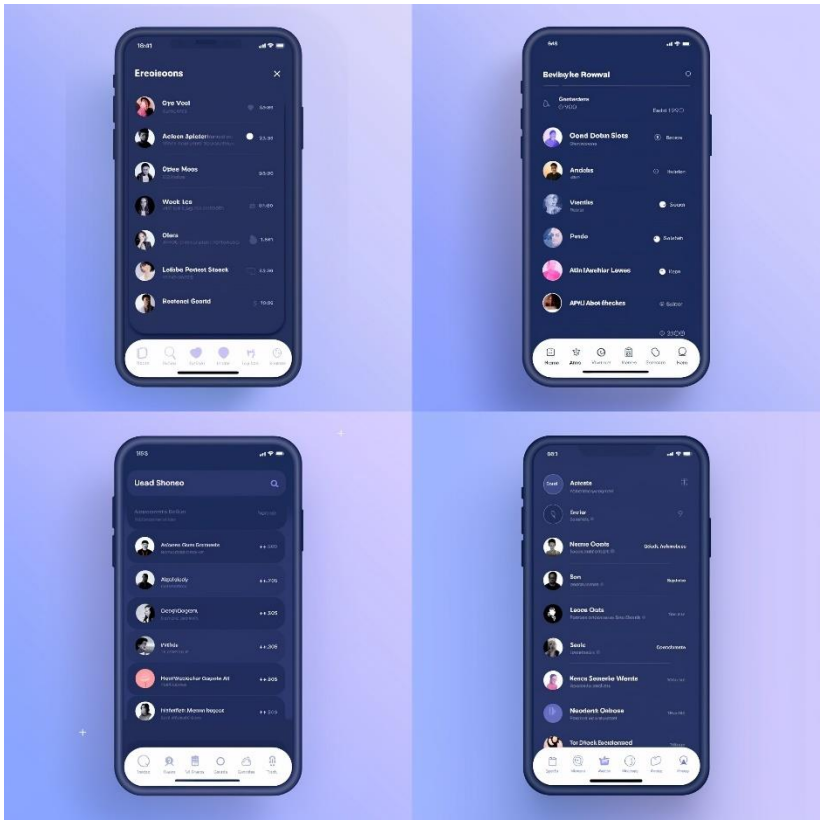
<wireframe> Social media app UI interface, minimalistic, supports stories gradient, dividing elements --v 5



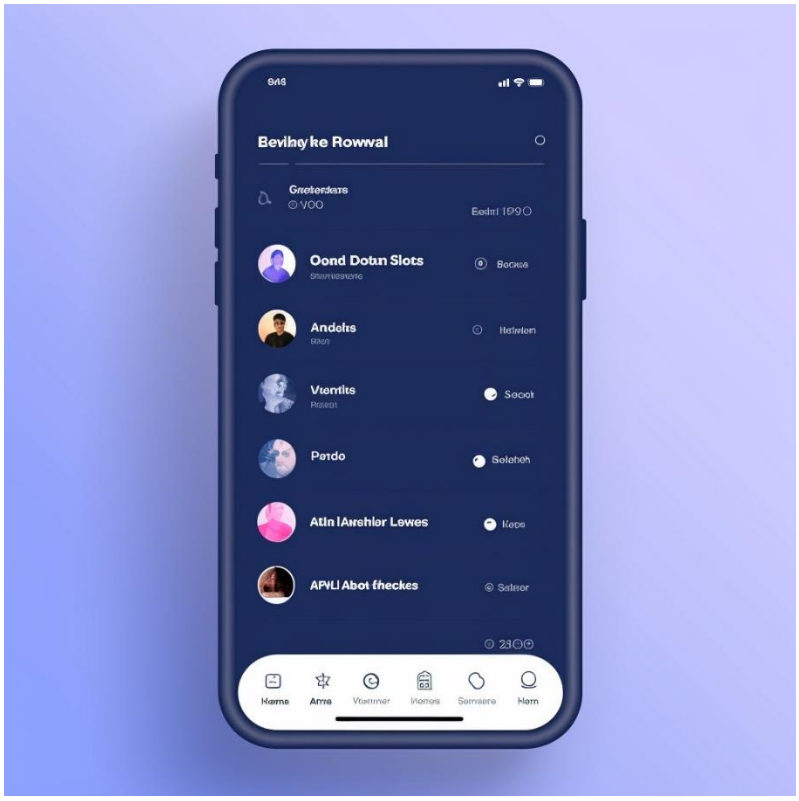
Interfaces generated by P8

Prompt: **<wireframe>** Social media app UI, Modern, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution

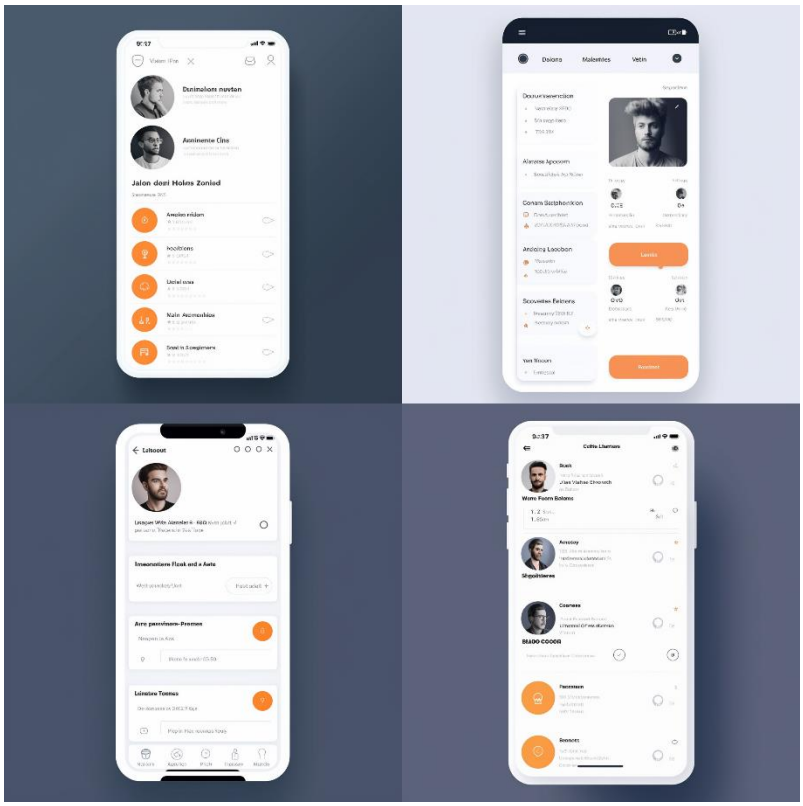


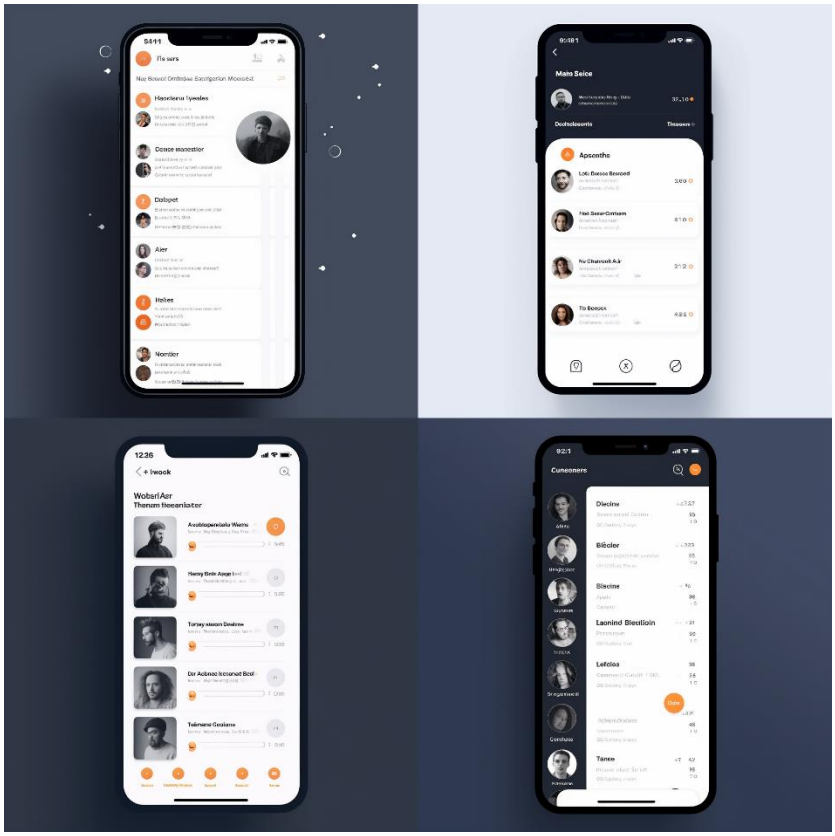


Variation 2 selected:

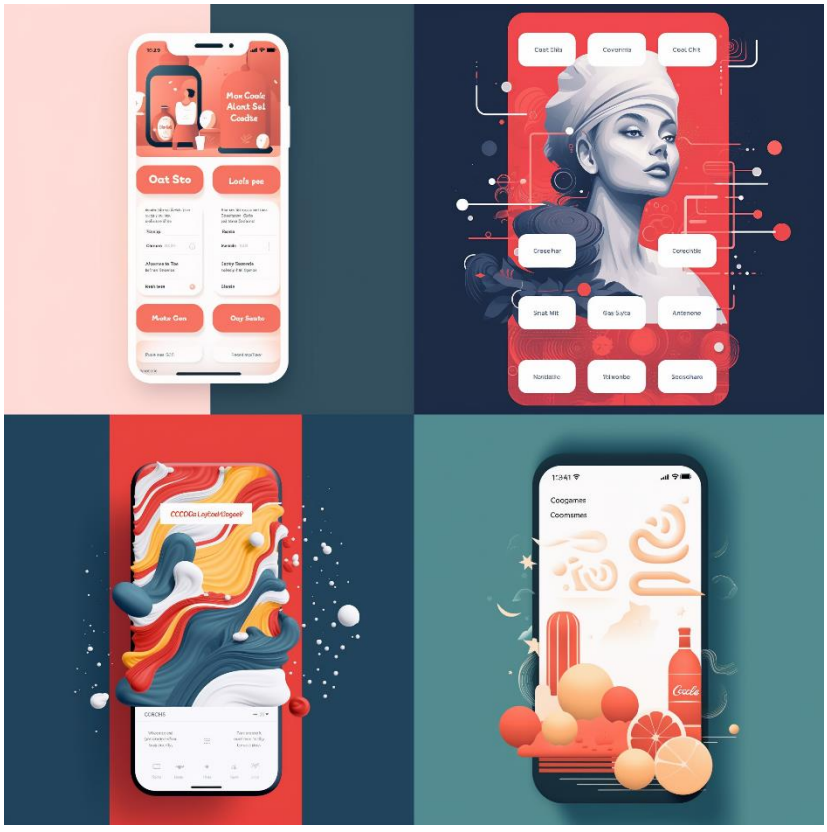


Prompt: **<wireframe>** bottom menu white, modern, social media app, people, trending dribbble orange white color scheme, hamburger navigation, profile picture



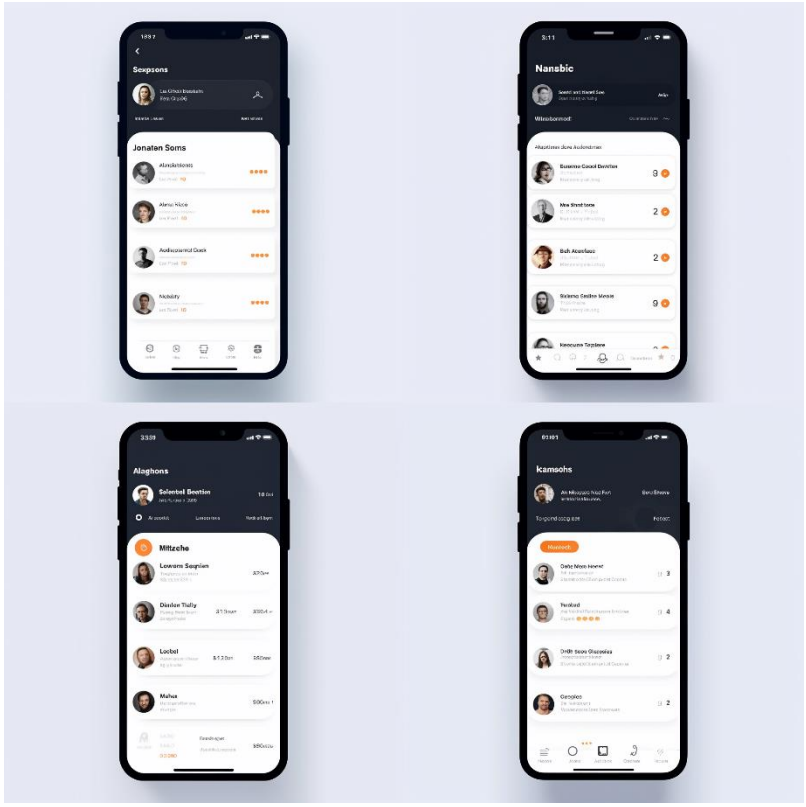


Prompt: **<wireframe>** Coca Cola color scheme, Social Media app to connect with people, fun, likes, dislikes, stories

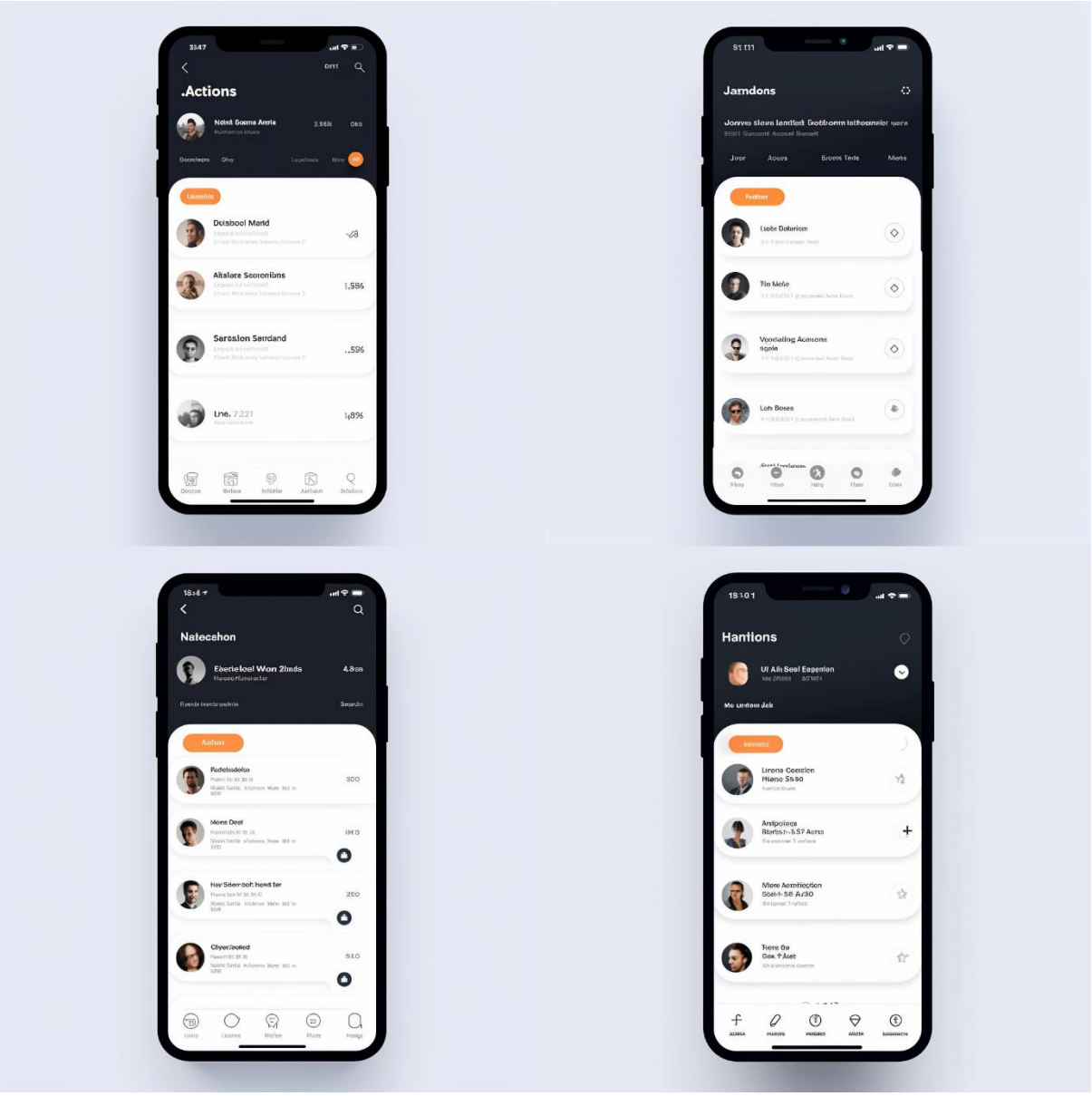


Prompt: **<wireframe>** hexcolor #7F9172

Prompt: **<wireframe>** bottom menu white, modern, social media app, people, trending dribbble orange white black color scheme

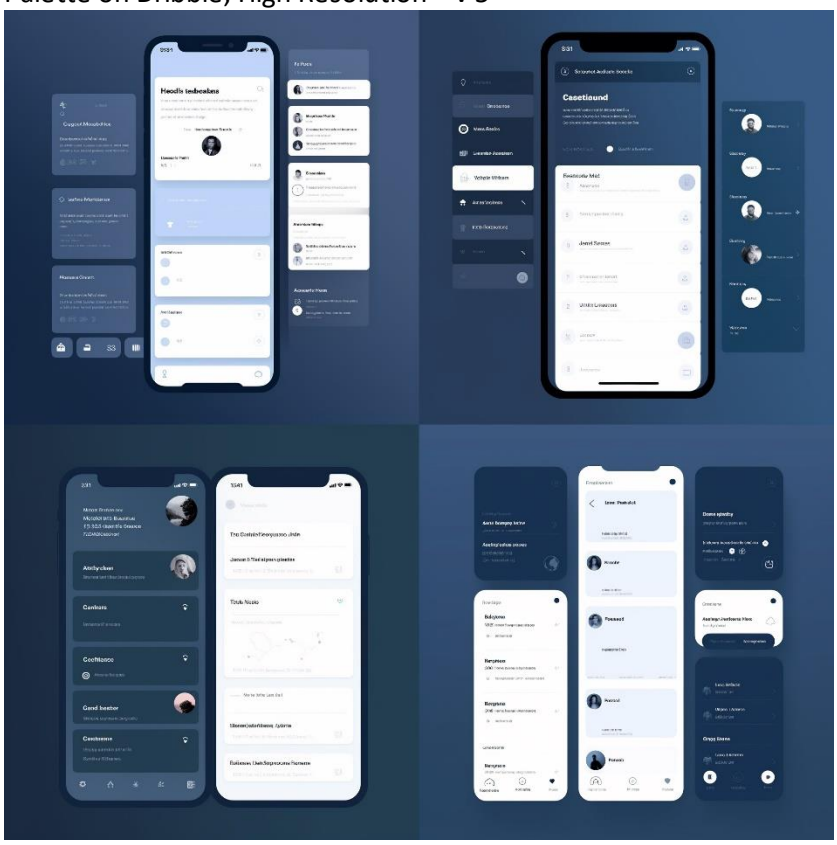


Regenerating from variation 4:

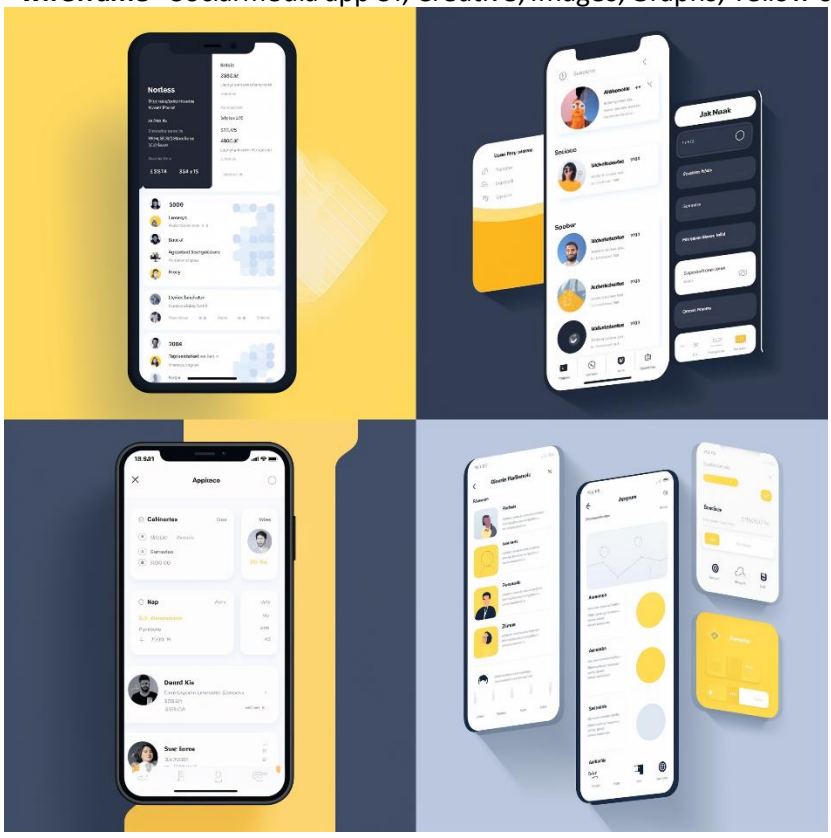


Interfaces generated by P9

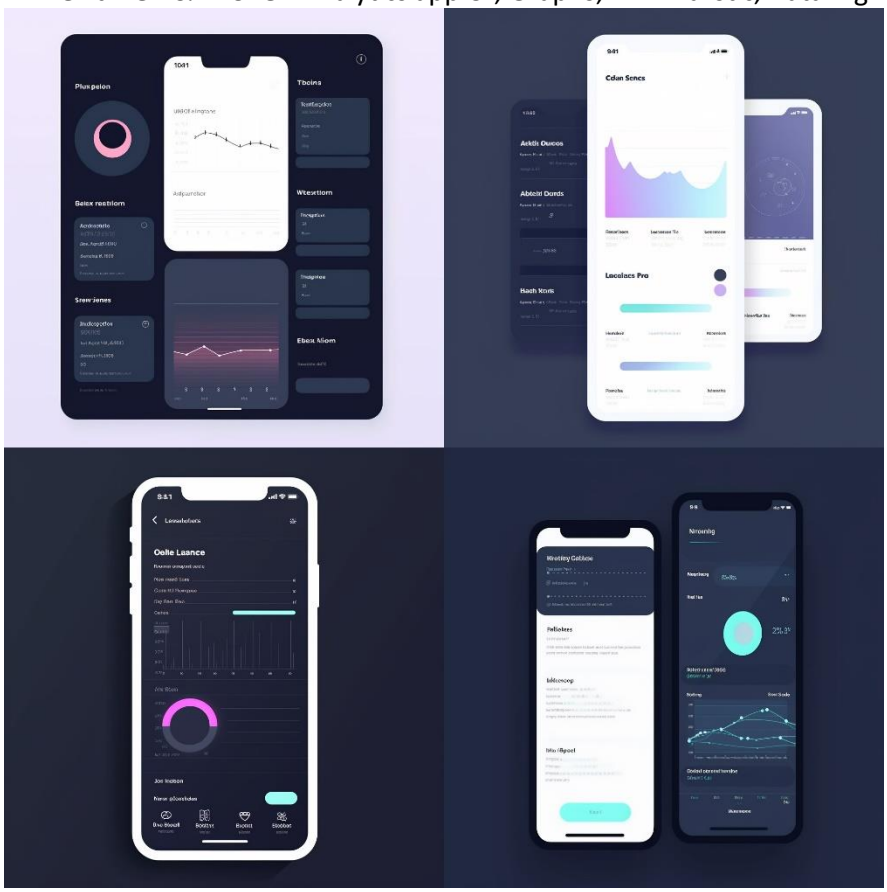
Prompt: **<wireframe>** Social media app UI, Industrial, Classy, Minimalistic, Trending Blue Color Palette on Dribble, High Resolution --v 5

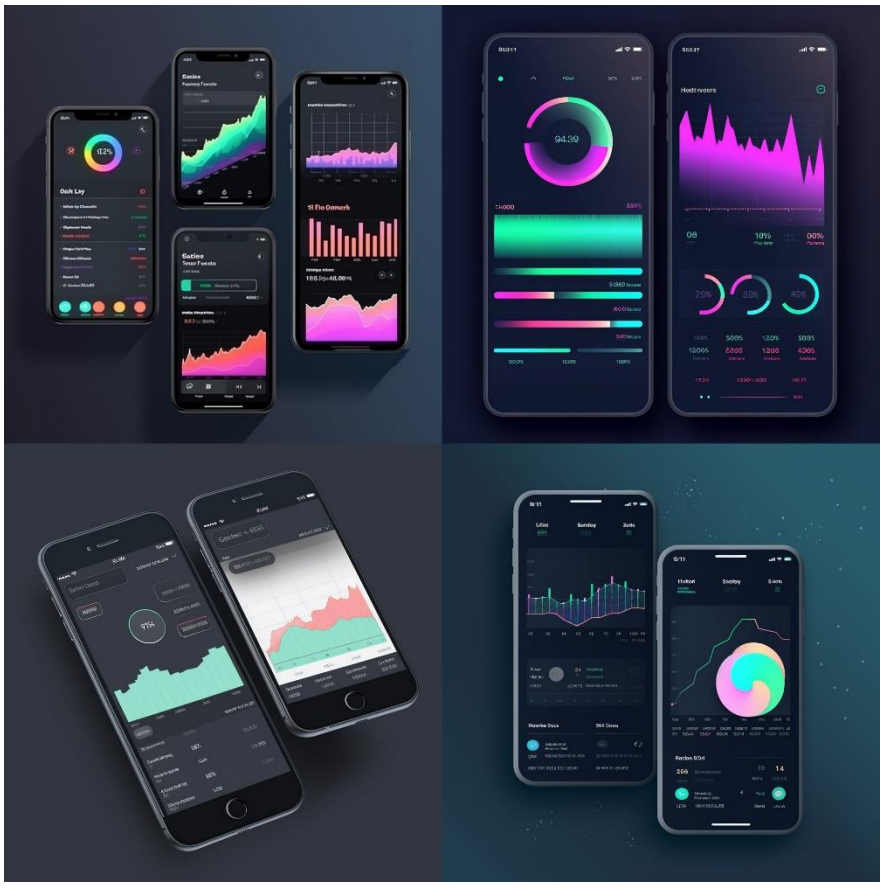


<wireframe> Social media app UI, Creative, Images, Graphs, Yellow on Dribble, High Resolution --v 5

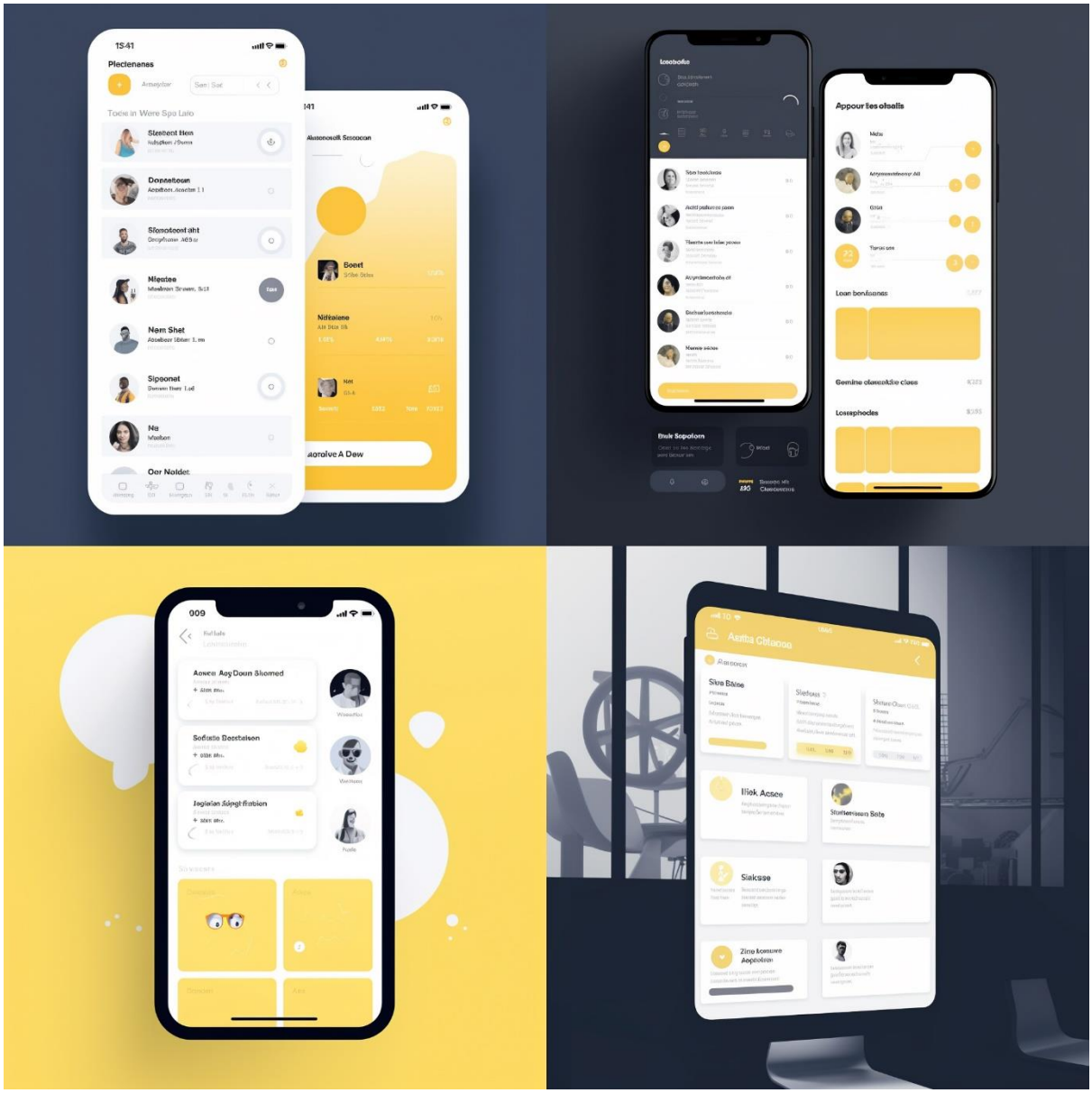


<wireframe> & **<none>** Analytics app UI, Graphs, Minimalistic, Data High Resolution --v 5



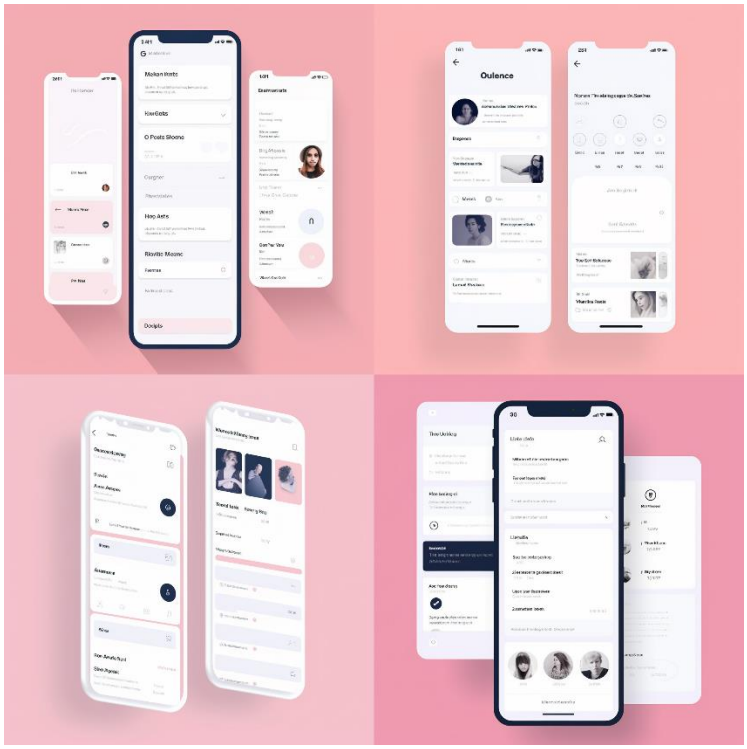


<wireframe> Social media app UI, Desktop, Creative, Images, Graphs, Yellow on Dribble, High Resolution --v 5

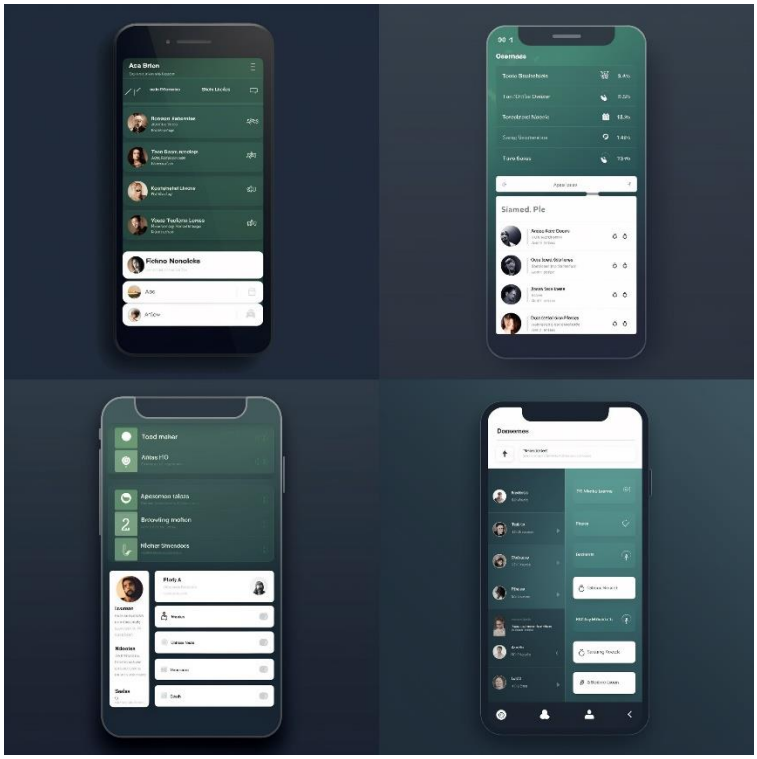


Interfaces generated by P10

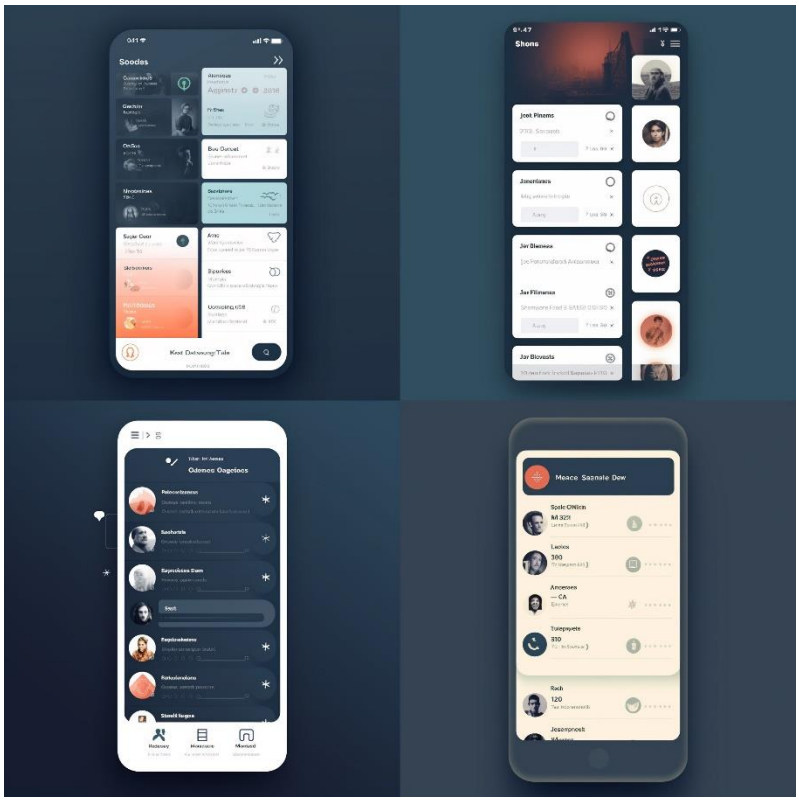
<wireframe> Social media app UI, Modern, Classy, Minimalistic, Trending Pink Color Palette on Dribbble, High Resolution --v 5



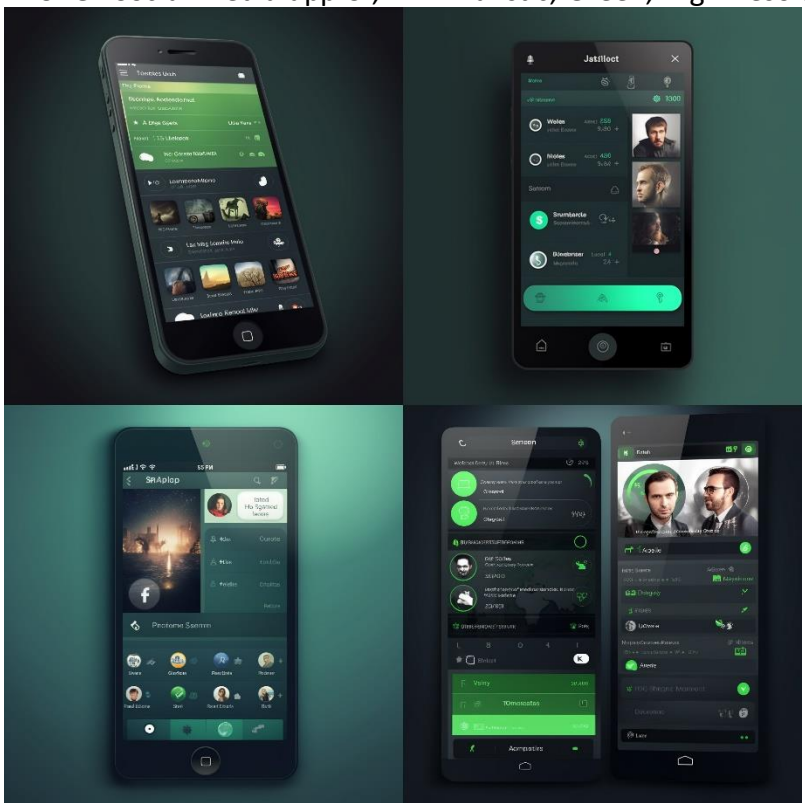
<none> Social media app UI, Old school, Minimalistic, Green, High Resolution v 5

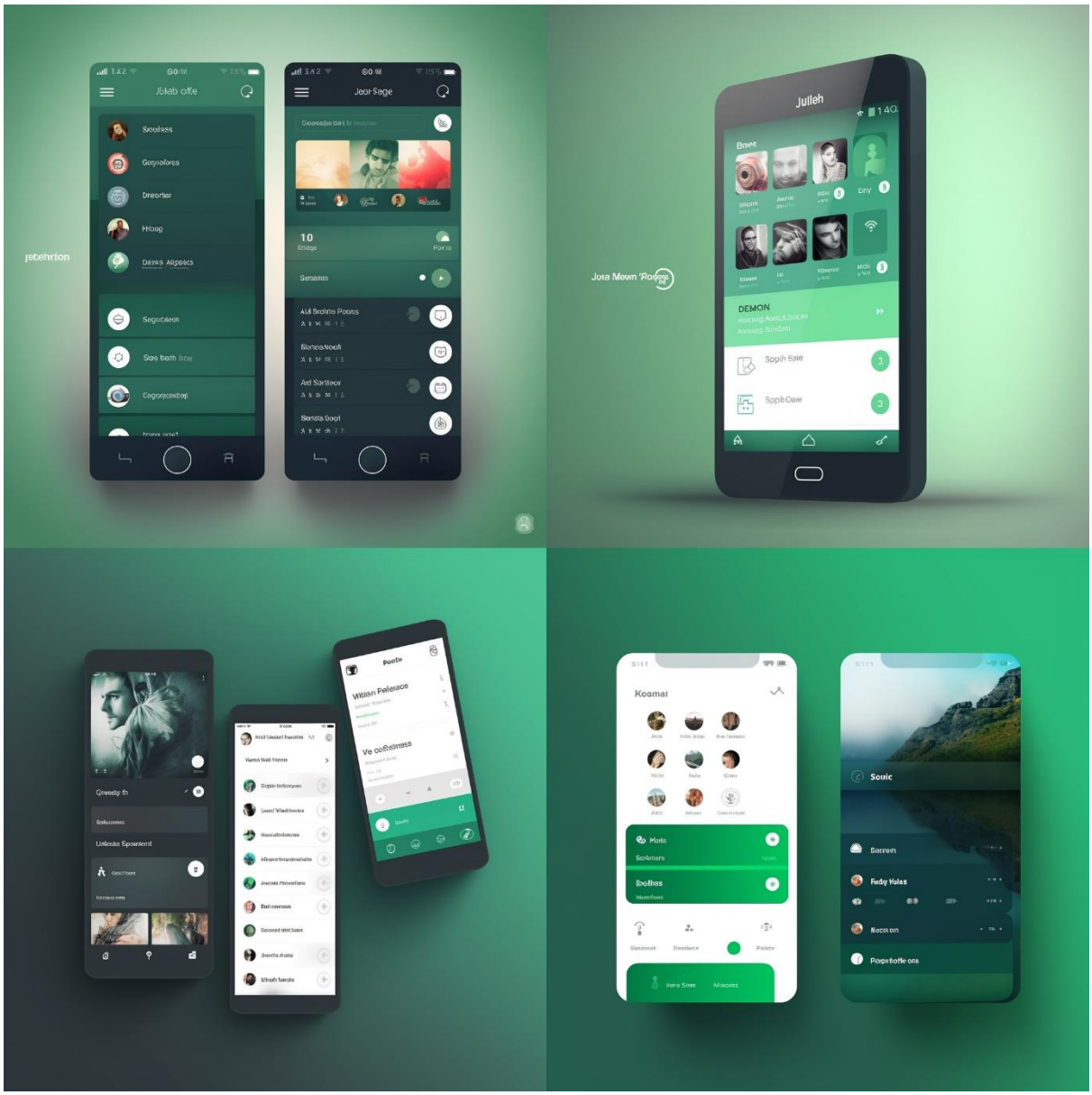


<none> Social media app Ui, High Resolution, Old school v 5



<none> Social media app UI, Minimalistic, Green, High Resolution v 5




Julleh
DEMON
Koomal