



# A Study of Midjourney-based Artificial Intelligence in Clothing Design Innovation

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**Abstract.** This research delves into the application of Midjourney AI technology in Clothing design and its specific impact on design efficiency and innovation. Using experimental design and questionnaire methods, this research compares and analyses the differences between applying the Midjourney technique and the traditional design process. The research found that Midjourney technology significantly improves design efficiency and reduces design cycles while promoting innovative thinking. The questionnaire results show that the vast majority of Clothing design professionals have a positive attitude towards the designs created using the technology. Despite the challenges of technology dependency and the convergence of traditional design methods, the use of Midjourney technology in Clothing design shows significant potential. It offers an innovative path for the industry.

**Keywords:** Artificial Intelligence, Clothing Design, Midjourney, Design Efficiency, Innovation, Market Applicability

## 1 INTRODUCTION

With the advent of the fourth industrial revolution, new technologies are reshaping every aspect of our lives, with Artificial Intelligence (AI) technology becoming a central driver of modern societal development [1][2]. AI, defined as the ability of computers to perform complex tasks by mimicking intelligent behavior, including information analysis, object and voice recognition, and data processing [3], relies on advanced software, scripts, algorithms, and robust computer systems [4]. It has a wide range of application areas, such as personalized advertising, speech recognition, and computer vision [5][6][7]. In the field of Clothing design, AI technology is triggering changes in the industry, such as trend prediction, design automation, and production process optimization [8]. In particular, AI image generation programs like Midjourney provide new perspectives on Clothing design by generating images from textual descriptions through deep learning and natural language processing [9]. This accelerates the generation of design sketches and expands the range of design styles and concepts to be explored, thus increasing design efficiency and innovation [10]. Despite the great potential that

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AI technologies hold for the Clothing design industry, there are still challenges in effectively integrating these technologies into existing design processes [11]. Designers and organizations are exploring using AI to enhance the creative process, improve efficiency, and better understand consumer needs. This process is not only about integrating technology but also involves a re-evaluation and possible transformation of traditional design methods.

The main objective of this research is to investigate the use of Midjourney AI technology in Clothing design and its impact on innovation and efficiency. Using experimental design, questionnaire, and data analysis methods, this research evaluates the effectiveness of the Midjourney technique in practice, its integration with the traditional design process, and the technique's role in improving design efficiency and innovation. Meanwhile, the satisfaction, market adaptability, and acceptance of design work experimenting with AI technologies by Clothing design professionals were researched, aiming to provide new insights into the research and industry practice of Clothing design and AI and to promote the development of the field. The research questions include 1. how to apply Midjourney AI technology in Clothing design effectively; 2. the impact of Midjourney technology on design efficiency; and 3. the satisfaction, marketability, and acceptance of professionals in designing works using AI technology.

## 2 METHOD

This research combines experimental and questionnaire methods to evaluate the effectiveness of Midjourney AI in Clothing design. Midjourney is a Python-based generative software system developed by a team led by David Holz [12] that creates digital images with high aesthetic value based on textual parameters, similar to tools such as DALL-E [13]. The objective of the research is to analyze the role of AI in the integration of the design process, the generation of innovative designs, and the improvement of efficiency, and to find out through a questionnaire how satisfied designers are with the AI design work and how well it fits in the market. Experiments were conducted to observe the application of Midjourney technology in the design process, and experimental conditions were controlled to ensure the accuracy of the results. Data were collected through questionnaires and quantitatively analyzed using SPSS to assess the impact of Midjourney on design efficiency, satisfaction, and market adaptation and to compare the differences in designer satisfaction and market adaptation between designers who used and did not use the Midjourney technology using the Mann-Whitney U Test (Mann-Whitney U Test).

The U value of the Mann-Whitney U test is calculated using the following formula:

$$U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \quad (1)$$

Where  $n_1$  and  $n_2$  are the sizes of the two independent samples, and  $R_1$  is the sum of ranks for the first sample.

To determine whether the U value is significant, the Z value is calculated using the following formula:

$$Z = \frac{U - \mu U}{\sigma U} \quad (2)$$

Where  $\mu U$  is the expected value of the  $U$  statistic, calculated as  $\mu U = \frac{n_1 \times n_2}{2}$ , and  $\sigma U$  is the standard deviation of the  $U$  statistic, calculated as

$$\sigma U = \sqrt{\frac{n_1 \times n_2 \times (n_1 + n_2 + 1)}{12}} \quad (3)$$

Then, the  $P$  value is determined from the  $Z$  value to assess statistical significance. The  $P$  value is derived from the standard regular distribution table, and for a two-tailed test, it is calculated as follows:

$$P = 2 \times \text{norm.cdf}(-|Z|) \quad (4)$$

### 3 EXPERIMENT

#### 3.1 Preparation before experiment

The research subjects were selected from the senior students majoring in Clothing Design and Engineering in the same college, four in total. These students have the necessary professional knowledge and skills in Clothing design. To ensure the randomness and controllability of the experiment, the students were randomly assigned to two groups of two people each. The task of the experiment was to design an autumn and winter jacket for female university students with the theme of "Urban Explorer," involving style, pattern, and material selection. The control group was equipped with traditional design tools (e.g., drawing boards, drawing software, etc.), while the experimental group was fitted with the Midjourney AI tool.

#### 3.2 Experimental Procedure

Design efficiency was quantified by timing the design from when it was initiated and recording the total time to complete the design for each group. The design process of the two groups of students was monitored throughout (Fig. 1), with a particular focus on the experimental group's specific application of Midjourney AI technology for Clothing design.



Fig. 1. Record of the experimental process



Experimenter 2-Design Work 2 (Using Midjourney)

Experimenter 1-Design Work 1 (Using Midjourney)



Experimenter 3-Design Work 3 (Not using Midjourney)



Experimenter 4-Design Work 4 (Not using Midjourney)

Fig. 2. Drawing of the final design work

### 3.3 End of experiment and data collection

The final designs of the two groups were collected at the end of the experiment (Fig. 2), and a questionnaire survey was conducted among Clothing design professionals to collect data on the satisfaction and Market Applicability of the designs of the two groups. Subsequently, the collected data were collated, including the survey results on design duration, satisfaction, and Market Applicability, and statistical methods were applied to analyze the differences between the two groups in terms of each indicator. Based on the results of the statistical analyses, the specific impact of Midjourney AI technology on the Clothing design process and outcomes is explored in depth, including its potential advantages and limitations in enhancing design efficiency, satisfaction, and market suitability.

## 4 DISCUSSION

### 4.1 Analysis of Experimental Results

#### 4.1.1 Application of Midjourney Artificial Intelligence Technology in the Clothing Design Process

In comparing the Clothing design process with and without the Midjourney AI technology, this research found that the AI technology significantly improved design efficiency and innovation. Experimenters who did not use Midjourney technology, such as Experimenters 3 and 4, followed the traditional design process (Figure 3): analyzing the task, collecting inspiration (e.g., searching through Baidu, Little Red Book app, and Bing, POP Web Platform), drafting the design, and completing the design through multiple rounds of revisions, relying on personal judgment and hand-drawing, which is a time-consuming process and relies on personal inspiration. as Experimenters 1 and 2 shown in Figure 4, experienced the immediate benefits of the AI technology. Experimenters 1 and 2 quickly collected inspiration diagrams by entering design-related keywords, a step that drastically reduced collection time. After confirming the inspiration diagrams, Midjourney was used to generate swiftly multiple design solutions in combination with textual descriptions, and the final solution was determined through iterative optimization. This process is more efficient and enhances creativity by enabling the rapid visualization of multiple design concepts. Comparing the design process in Figures 3 and 4 demonstrates that the process using Midjourney is more concise and efficient, suggesting that the application of AI technology in Clothing design has significantly optimized the design process, making it more efficient and flexible.

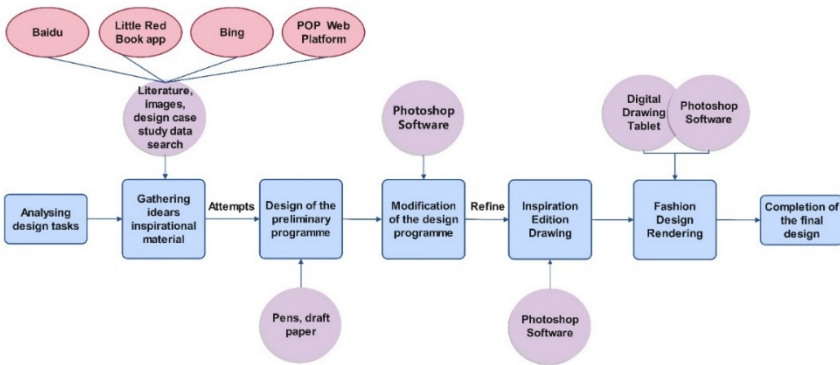


Fig. 3. Design flow without using Midjourney AI technology

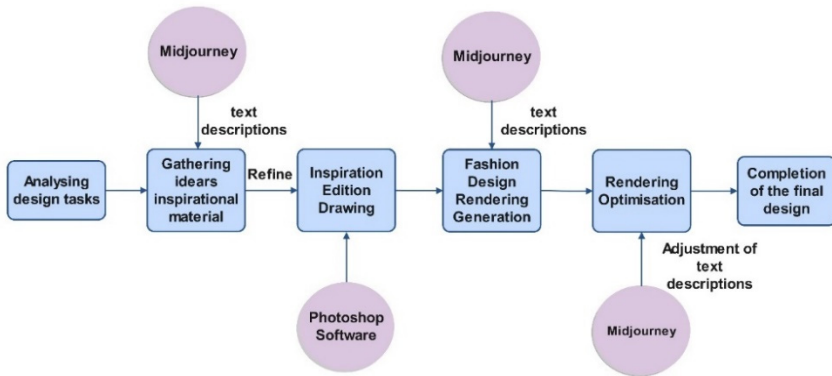


Fig. 4. Design flow using Midjourney AI technology

**4.1.2 Impact of Midjourney AI technology on design efficiency**

The impact of Midjourney AI technology on Clothing design efficiency was analyzed by recording a comparison of the time taken by four experimenters to complete the same design task. The results show <Table 1> that the experimenters using the Midjourney technology took an average of 3 hours, 32 minutes, and 45 seconds to complete the task, which is a significant improvement in design efficiency compared to the experimenters who did not use the technology, who took an average of 5 hours, 16 minutes and 30 seconds. Midjourney reduces the time from initial ideas to design materialization by rapidly generating design sketches and concepts. It excels at transforming inspiration, generating diverse design options, and improving the efficiency of the design iteration process. This accelerates design decisions and modifications and supports rapid iteration of design solutions, thus shortening the design cycle. Therefore, the application of Midjourney in Clothing design has dramatically improved design efficiency, especially in the early stages of design and during concept development, providing empirical support for the further application of AI technology in Clothing design and heralding the potential for an efficient and innovative design process.

**Table 1.** Comparison of Design Task Completion Times

Experimenter No.	Design Work No.	Whether to use Midjourney	Completed design task time
Experimenter 1	Design Work 1	Yes	3 hours 40 minutes
Experimenter 2	Design Work 2	Yes	3 hours 25 minutes
Experimenter 3	Design Work 3	NO	4 hours 57 minutes
Experimenter 4	Design Work 4	NO	5 hours 36 minutes

### 4.1.3 Reaction of Professionals to Clothing Design with Artificial Intelligence of Midjourney

To understand the Clothing professionals' response to the experimental results of the satisfaction the clothing design work using AI technology, market adaptability, and acceptance of the use of AI technology such as Midjourney for clothing design work, a questionnaire survey was carried out on the Clothing professionals. The questionnaire was distributed through a combination of offline and online questionnaires online at <https://www.wjx.cn/vm/YyOKG7Z.aspx>. 350 questionnaires were sent out, and 345 questionnaires were returned. Of these, 26 questionnaires were invalidated due to missing answers, and 319 were used for analysis.

The demographic characteristics of Clothing professionals were analyzed descriptively and statistically in this survey, as shown in <Table 2>, revealing diversity in terms of age, occupation, and years of experience in the industry. In terms of age distribution, 42.0 percent and 32.0 percent of the total number of respondents were aged 21-30 and 31-40, respectively, accounting for a total of 74 percent of the total number of respondents, reflecting the predominance of the young and middle-aged groups among Clothing professionals. At the same time, the survey also covered age groups under 20 and over 40, accounting for 5.6 percent and 20.4 percent, respectively, demonstrating coverage of all stages from youth to maturity. Regarding occupational distribution, the proportions of designers, pattern makers, professional students, teachers, and other professionals were 26.6 percent, 20.4 percent, 20.1 percent, 31.0 percent, and 1.9 percent, respectively, demonstrating that the survey covered key occupational roles in the Clothing industry. The distribution of years of experience shows a more even distribution of practitioners from 1 year to over 20 years, including professionals at different stages of experience. This broad distribution suggests that the survey results provide a more comprehensive picture of the views and experiences of Clothing industry professionals, providing a rich database for the research.

**Table 2.** Demographic characteristics of the research population(n=319)

Sample Statistical Characteristics	Item	Frequency	Percentage
Age	Less than 20 years old	18	5.6%
	21-30 years old	134	42.0%
	31-40 years old	102	32.0%
	Above 40 years old	65	20.4%
Occupation	Fashion Designer	85	26.6%
	Pattern Maker (in Fashion/Clothing)	65	20.4%
	Fashion Design Student	64	20.1%
	Fashion Design Instructor or Fashion	99	31.0%
	Design Teacher		
	Others (Other Positions in the Fashion Industry)	6	1.9%



Years of practice (study)	1-5 years	66	20.7%
	6-10 years	84	26.3%
	11-20 years	103	32.3%
	More than 20 years	66	20.7%

To gain a deeper understanding of clothing professionals' satisfaction and market applicability when applying Midjourney AI technology in apparel design, this research investigated the relevant attributes of four design works, covering design, innovation, and market appeal. The reliability and consistency of the questionnaire were ensured through the reliability test of these satisfaction attributes. The reliability test results showed that Cronbach's alpha coefficients for the satisfaction attributes of works 1 to 4 were 0.909, 0.921, 0.939, and 0.905, respectively, indicating that the questionnaire items had good internal consistency. Higher Cronbach's alpha coefficients for the design and innovation attributes, as shown in <Table 3>, further validated the reliability of the questionnaire. The AI technology design entries (Entries 1 and 2) generally had higher satisfaction scores on the Design & Innovation attribute than the non-AI entries (Entries 3 and 4), indicating higher satisfaction among Clothing professionals. Similarly, <Table 4> shows good reliability of the questionnaire items. The market suitability analyses in <Table 4> show that the works using AI technology were generally rated high in terms of market suitability, revealing the potential advantages of the technology in enhancing the market suitability of Clothing design.

**Table 3.** Results of Clothing Professionals' Satisfaction and Reliability Analysis of Design Work

Attribute	Item	Work 1 (Using Midjourney)		Work 2(Using Midjourney)		Work 3 (Not Using Midjourney)		Work 4 (Not Using Midjourney)	
		Mean	Cronbach's $\alpha$	Mean	Cronbach's $\alpha$	Mean	Cronbach's $\alpha$	Mean	Cronbach's $\alpha$
Design Attributes	Clothing Style	3.93		3.96		2.90		2.64	
	Clothing Color Coordination	3.84	0.805	3.91	0.825	2.81	0.862	3.12	0.830
	Clothing Patterns	3.92		3.90		3.12		3.23	
	Clothing Accessories	3.89		3.82		3.19		3.22	
	Design Attributes	3.89		3.90		3.05		3.05	
Innovative Attributes	Inspiration and Creativity	3.89		3.92		3.18		3.14	
	Stylistic Innovation	3.93	0.854	3.92	0.868	3.18	0.911	3.12	0.832
	Pattern Innovation	3.96		3.90		3.16		3.22	
	Colour combinations	3.91		3.89		3.12		3.31	

Innovative use of fabrics and accessories	3.97	3.99	3.16	3.19
<b>Innovative Properties</b>	<b>3.93</b>	<b>3.92</b>	<b>3.16</b>	<b>3.19</b>

**Table 4.** Analysis Results of Market Applicability and Credibility of Design Works

Attribute	Item	Work 1 (Using Midjourney)		Work 2(Using Midjourney)		Work 3 (Not Using Midjourney)		Work 4 (Not Using Midjourney)	
		Mean	Cronbach's $\alpha$	Mean	Cronbach's $\alpha$	Mean	bach's $\alpha$	Mean	bach's $\alpha$
Market Applicability	Attractiveness of Clothing to Female College Consumers	3.90		3.80		2.83		3.08	
	Trendiness of Clothing in the Marketplace	3.91	0.832	3.87	0.818	2.81	0.915	3.19	0.881
	Practicality of Clothing	3.94		3.85		2.80		3.20	
	Market Demand for Clothing	3.91		3.84		2.78		3.31	
	Market Applicability	3.91		3.84		2.80		3.20	

This research examines the differences in Clothing professionals' evaluation of their satisfaction with using AI technologies such as Midjourney in apparel design and their market applicability through a non-parametric test method, the Mann-Whitney U Test. The test results show that in terms of satisfaction, the Mann-Whitney U-value is 20497.500, the Z-value is -13.061, and the two-tailed asymptotic significance is less than 0.001, indicating a statistically significant difference. Similarly, the analysis of market suitability yielded similar results with a Mann-Whitney U-value of 20497.500 and a Z-value of -13.068 with the same two-tailed asymptotic significance of less than 0.001. These findings demonstrate a clear preference among Clothing professionals for garments designed using AI technology in terms of satisfaction and market suitability, showing the significant benefits of AI design in these areas. This research further assessed the overall satisfaction of clothing professionals with using Midjourney AI technology in design. The results showed that 72.4 percent of respondents were either "satisfied" or "very satisfied," while only 11.3 percent were dissatisfied, reflecting high acceptance and satisfaction with AI design work.

By investigating Clothing professionals' acceptance of using Midjourney and similar AI technologies, this research reveals their attitudes towards this technological innovation and their intentions for future use. The survey results (Figures 5 to 8) provide insights into using AI technology in Clothing design. The majority of respondents (74.3%) have already used AI technology. This result suggests that the vast majority of professionals within the clothing design field already have experience using AI

technology, indicating that this technology is trendy in the industry. Views on using AI technology to improve design efficiency mainly noted that it provided at least some help. Attitudes toward the impact of AI technology on design innovativeness showed diversity, but the vast majority indicated a willingness to consider using AI technology in the future. This reflects that despite differences in perceptions of AI technologies regarding efficiency and innovation enhancement, most Clothing professionals are open to adopting these technologies in the future.

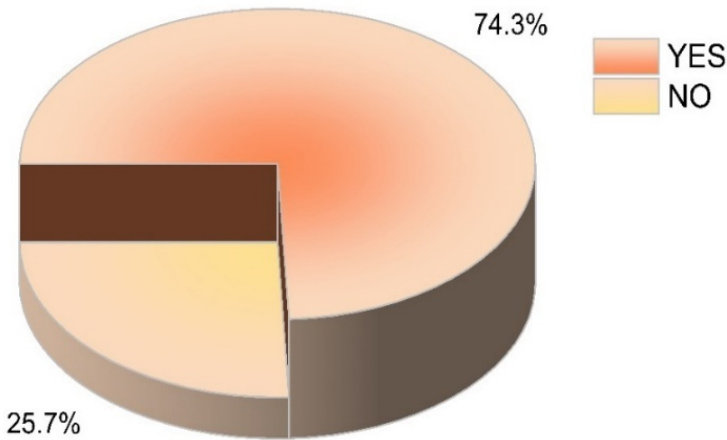


Fig. 5. Survey on Apparel Professionals' Experience with AI Technology

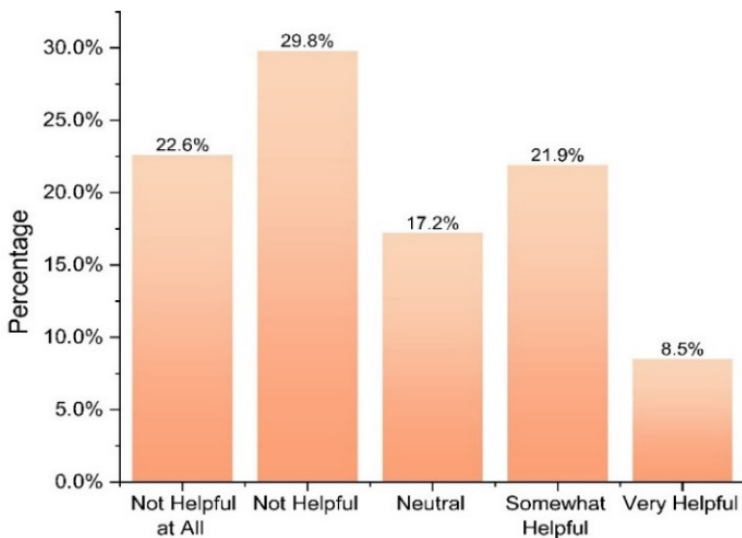


Fig. 6. Views on AI's role in improving clothing design efficiency

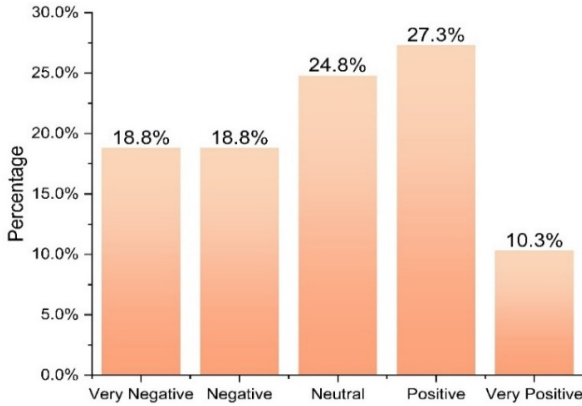


Fig. 7. Apparel Professionals' Views on AI's Impact on Design Innovation

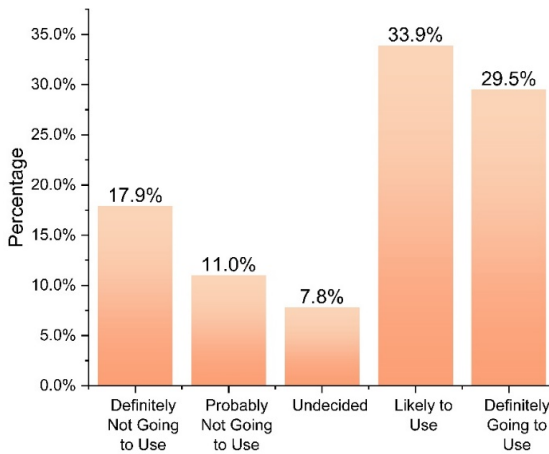


Fig. 8. Intentions of Apparel Professionals to Use AI in the Future

### 4.2 Discussion of Experimental Findings

The experiments in this research reveal that applying Midjourney technology in the Clothing design process significantly improves design efficiency and innovation. By automating the generation of design sketches compared to traditional methods, Midjourney reduces the time designers spend on inspiration gathering and initial program development, allowing them to focus more on deepening and refining their ideas. This rapid iterative process accelerates design completion times and stimulates broader innovative thinking. The results of the questionnaire show that most Clothing professionals have a positive attitude towards using Midjourney's design work, especially in terms of innovation and marketability. This reflects the industry's openness to design work that blends traditional skills with modern technology, the widespread acceptance of AI technology, and the recognition of its potential value. This phenomenon reflects the industry's cheerful acceptance of emerging technologies and signals the possible

importance of AI in the future of Clothing design. While most professionals are open to AI technology, concerns about its over-reliance remain. Therefore, future research needs to explore the best ways to apply AI technology while preserving the essence of traditional design. Consequently, the application of AI technologies such as Midjourney in Clothing design not only increases efficiency and innovation but also provides a new direction for the industry's future development.

## 5 CONCLUSION

This research provides an in-depth analysis of the role of Midjourney AI technologies in Clothing design innovation and finds that these technologies significantly improve design efficiency and innovation. Specifically, AI technology reduces designers' workload in the early stages by automatically generating design sketches, allowing designers to focus more on creative deepening. This speeds up the design process and facilitates the expansion of innovative thinking. The questionnaire survey showed that the vast majority of Clothing professionals positively evaluated the work using Midjourney technology and appreciated its innovation and market adaptability, reflecting the industry's wide acceptance and recognition of AI technology while pointing out that AI technology is a significant development trend in clothing design.

However, there are also challenges and limitations. Some professionals are concerned about over-reliance on technology and a preference for traditional design methods, suggesting that valuable traditional design elements need to be retained when promoting AI technologies. Therefore, AI technology not only opens up new working modes and creative spaces for designers but also suggests future research directions: an in-depth exploration of the application of AI technology in design, a comprehensive understanding of industry acceptance, and an exploration of how to merge traditional and modern technologies to promote the continued innovation and development of the Clothing design industry.

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