Design Studies and Intelligence Engineering
L.C. Jain et al. (Eds.)

doi:10.3233/FAIA220748

Pleasure and Improvement - A Study on Digital Artistic Expression of Health Data Generation for Professional Women

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Abstract. Professional women need to pay more attention to their health issues because of the pressure from careers and families. The digital art of health data generation reconstructs the health status of working women in a continuously changing "tree" image, aiming to help them pleasantly improve their health. The image combines electromyographic acquisition, physiological health data screening, data visualization, 3D real-time rendering technology, and human-computer interaction to investigate the relevance of continuous health monitoring and digital art generation. The image of the "tree" is generated by digital art, which presents the health condition more vividly. According to the experimental and statistical results, this kind of visual representation based on periodic health data can enhance their continuity, motivation, and action to focus on health and help them alleviate their anxiety about health problems.

Keywords. Professional women, digital art, pleasure, continuous improvement, health

1. Introduction

The research of this paper is based on the concern of working women's health condition. In response to the need for more vivid visualization of working women's health data, we propose letting them grasp their health condition more pleasantly through digital art. As the proportion of working women in the workplace continues to expand, the social value of working women becomes more and more significant. Still, professional life often makes most working women neglect healthy work and exercise. Because women in the workplace often shoulder the dual responsibility of family and career, they are under increasing pressure. All these factors may damage their health, so studying working women's health issues is significant for women's personal, family, business, and society [1].

These factors have led to the increasing prevalence of subhealth in the workplace, which is unique because it does not show obvious disease symptoms and can be easily ignored. Still, they may develop into a disease if not corrected in time and effectively [2].

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The health problems caused by this specificity have changed people's concepts and way of life. Contemporary working women need a scientific and practical way to improve their health. For example, "health care" as a reasonable way is becoming a topic of increasing concern. White-collar women under high work pressure have become an essential audience for developing a wellness culture [3].

However, implementing various health improvement activities not limited to wellness services requires knowledge of one's health status. Compared to traditional medical checkups, the use of digital art images to present health diagnosis results has the advantages of being convenient, fast, easy, and fun, which is more in line with the needs of white-collar modern work life and more capable of calming the anxiety about health problems.

Therefore, we hope that through more vivid and beautiful digital art images, professional women can understand their health status in a pleasant mood, and through a series of digital art generated according to their health conditions, constantly changing and developing, to motivate working women to take active measures to continuously improve their health level, thus assisting them in long-term monitoring and prevention of health diseases.

2. Related Jobs

In response to the expectations raised above, we have done relevant research on visual representation and analysis of health data, studied the appropriate experiences and research methods of other scholars in this area, and, based on these experiences and strategies, provided the prerequisites for realizing the interesting digital art construction of health data for women in the workplace.

Research on visualization and analysis of health data is rich. Butz Andreas et al. designed a human-centered MARiS system based on a PDA hospital information platform to digitize patients' medical records, which has the advantages of convenience, low cost, and environmental friendliness compared to traditional paper medical records, providing a reliable way for patients to view medical information via mobile devices [4]. Vijayaraghavan Bashyam et al. developed a structured clinical medical visualization system to address the problem of pervasive information in common electronic medical records, organizing the visit records in four dimensions: time, space, presence, and causality, which facilitates doctors to grasp patient medical conditions more quickly and accurately [5]. Based on the characteristics of mobile medical data, Annie Hu et al. proposed to visualize the presence of mobile medical data according to the four steps of first clarifying the target, then screening the content, then selecting the form and finally portraying the details, effectively enhance the visualization effect and improve the user experience [6]. Shang Jinqiu et al. researched a visualized medical assistance system for clinical diagnosis in response to the problem that a large amount of information in electronic medical records is not fully utilized. The system is based on visual analysis of medical data combined with data mining-related algorithms, aiming to assist doctors in diagnosis by discovering potential contents in medical records [7].

3. Design Case

Combining the theoretical and technical results mentioned above, we conducted innovative research on the visual representation of health data. By collecting and integrating data on the health status of working women aged 25-45, these data are combined with a set of algorithms to generate digital artworks that present the health status of working women in a fun way. In the design case, we will describe the process and content of the work, build an algorithmic model and framework for generating digital art for the health data of working women, and give it a visual correspondence system.

3.1. Data collection and integration

The data collection is done through the product developed by Eight Pulse Technology Company to collect the user's health data. Through the product's sensors and circuit chips, the user's immunity, waist, neck, chest and other data can be calculated based on the human body's collected surface electromyographic signals (sEGM). The data obtained are divided into six categories of health data, including the user's health index, immunity index, bone state, circulation state, organ state, and hollow organ state. The internal organs can be subdivided into ten categories: spleen, lungs, liver, kidney, heart, bladder, large intestine, stomach, small intestine, and gallbladder.

3.2. Visual system design framework

The conceptual framework of the visual system design is shown in Figure 1. the conceptual framework of the visual design illustrates the six indices corresponding to the visual effects in digital art. the health and immunity index is calculated based on a percentage system, with higher values representing healthier users, corresponding to warm to cold hues, with white being the healthiest state. The other four indices are calculated based on an impact scoring system, with lower values representing healthier users, with decreasing health status from white to color. The other four indices are based on an impact scale, with lower values representing more excellent health and decreasing health status from white to color. Generating digital art through visual transformation comes from the rhythm of digital changes. As shown in Figure 2, different health conditions generate different health data, and the rhythm of the line graph connecting these health data is the inspiration for our visual transformation.

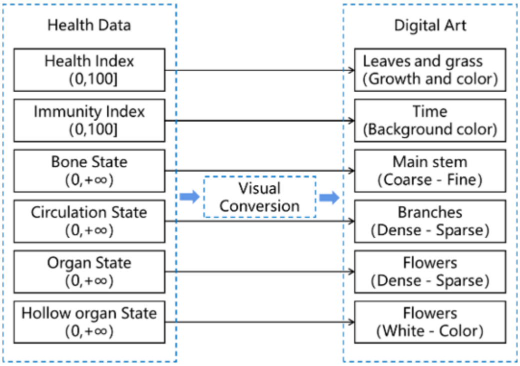


Figure 1. Visual design framework.

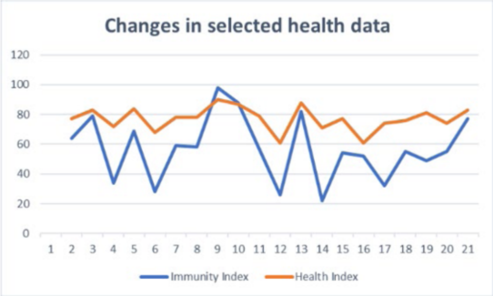


Figure 2. Changes in selected health data.

3.3. Algorithm model building framework

The framework of the algorithm model for generating digital art from health data is shown in Fig. 3. The collected data are input into the algorithm model, and digital artworks generated from health data can be constructed after three stages of processing: pre-processing, data calculation, and visual correspondence.

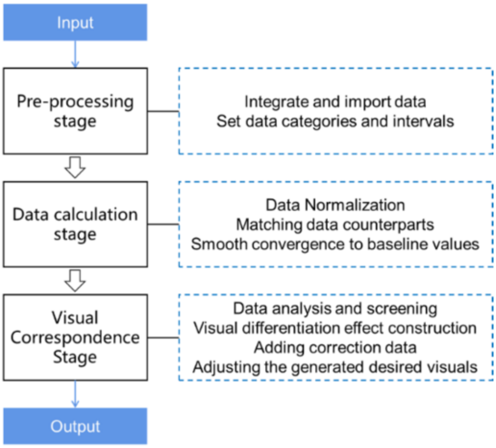
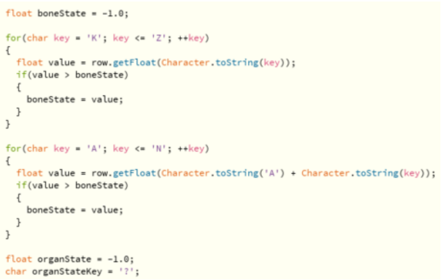


Figure 3. Algorithm model.

The programming software is shown in Figure 4. As shown in the figure, we use the software Processing as a programming drawing tool for identification and calculation, a code in the software Processing that calculates the state of the bone.



```
float boneState = -1.0;

for(char key = 'K'; key <= 'Z'; ++key)
{
  float value = row.getFloat(Character.toString(key));
  if(value > boneState)
  {
    boneState = value;
  }
}

for(char key = 'A'; key <= 'N'; ++key)
{
  float value = row.getFloat(Character.toString('A') + Character.toString(key));
  if(value > boneState)
  {
    boneState = value;
  }
}

float organState = -1.0;
char organStateKey = '?';
```

Figure 4. Partial Programming.

3.4. Visual effect display

The final result of the digital artwork is shown in Figure 5, a digital image constructed based on the health data of different volunteers, part of which is shown in Figure 6. We selected two representative images from the digital art gallery to explain in Figure 7.

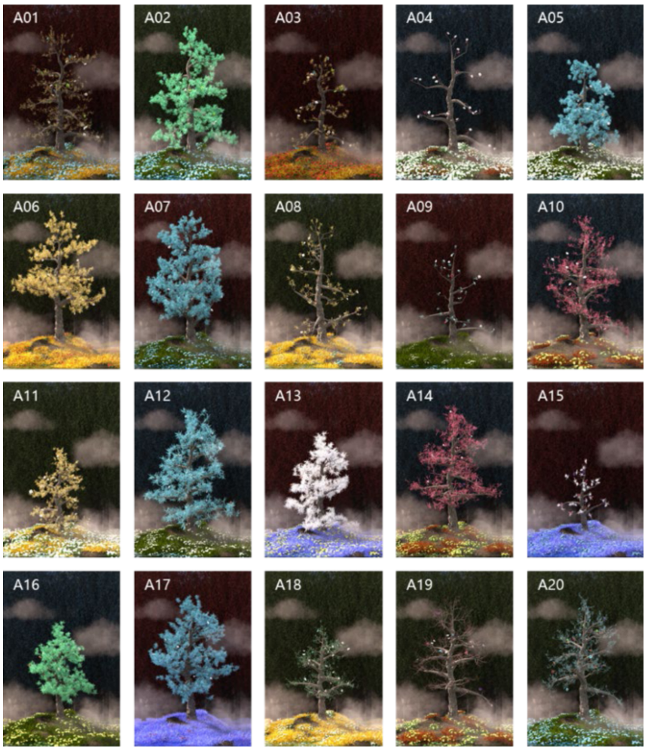


Figure 5. Twenty sheets of digital art.

Age	Immunity Index	Health Index	Circulation State	Bone State				Organ State					Hollow organ State				
				TH3	L5	C5	S4	spleen	lungs	liver	kindey	heart	bladder	large intestine	stomach	small intestine	gallbladder
25	64.00	77.00	9.29	7.36	9.5	7.58	7.8	7.16	9.5	6.66	9.5	9.5	9.5	8.53	7.88	5.38	6.87
40	79.00	83.00	9.5	7.24	4.88	8.87	9.3	9.5	9.24	8.28	8.98	8.92	9.5	9.5	8.73	9.14	8.78
37	34.00	72.00	7.82	3.55	9.5	6.76	4.54	8.32	6.95	9.5	9.5	7.19	7.26	7.82	5.95	5.73	6.38
26	69.00	84.00	9.5	8.19	9.5	7.8	8.85	7.9	7.85	8.31	6.14	8.89	8.92	9.5	6.92	9.5	8.42
33	28.00	68.00	9.5	7.73	3.55	7.49	6.58	7.83	9.5	6.66	4.74	6.66	4.01	5.46	6.49	8.55	6.58
30	59.00	78.00	9.5	8.87	7.4	7.56	8.85	9.5	9.5	4.58	8.33	7.0	7.15	8.87	7.75	7.28	8.93
26	58.00	78.00	9.5	4.64	9.5	6.15	9.5	6.93	9.5	8.8	8.13	8.23	6.96	4.94	6.26	8.16	7.44
35	98.00	90.00	9.24	9.25	9.5	9.5	8.52	9.24	9.23	9.5	8.97	9.24	8.44	9.24	9.5	9.24	8.99
41	88.00	87.00	9.2	9.04	9.5	9.5	9.5	8.66	8.19	9.5	9.02	9.15	8.21	8.83	7.38	9.15	8.28
33	57.00	79.00	7.83	8.37	5.25	5.82	8.44	9.5	7.5	8.44	6.75	7.54	8.64	8.44	7.66	8.44	8.44
31	26.00	61.00	7.85	7.03	2.99	4.58	7.07	8.84	6.98	6.98	9.5	7.07	6.58	9.5	9.5	2.96	9.5
29	82.00	88.00	8.9	9.13	8.64	7.64	9.08	9.12	8.36	9.5	9.5	8.4	9.13	9.5	8.74	9.5	8.75
40	22.00	71.00	6.82	5.88	9.5	7.91	7.98	9.5	5.49	7.91	6.32	4.57	5.4	5.09	7.45	9.5	7.6
35	54.00	77.00	8.34	7.32	8.27	8.21	8.21	6.74	7.24	9.5	7.2	8.21	7.49	6.49	6.69	6.24	6.59
29	52.00	61.00	8.89	8.32	3.87	2.99	6.83	2.99	8.18	7.12	2.99	7.17	2.98	4.36	2.99	2.98	2.99
45	32.00	74.00	9.5	8.4	7.54	6.71	7.0	9.5	6.33	9.5	7.0	4.25	9.5	4.25	3.45	7.4	7.76
36	55.00	76.00	9.33	7.2	7.56	7.09	7.47	7.1	9.5	8.24	7.72	6.75	9.1	4.27	6.21	2.98	8.22
33	49.00	81.00	9.24	9.22	9.5	9.32	8.08	7.05	7.02	8.99	9.16	9.34	6.1	9.42	8.73	6.97	7.12
28	55.00	74.00	6.01	2.98	8.07	6.19	6.09	2.99	6.29	8.1	8.13	9.5	2.99	9.5	7.17	9.5	7.17
26	77.00	83.00	8.49	7.18	8.72	9.24	5.64	6.89	8.67	8.62	9.5	7.31	8.65	8.67	9.5	8.61	7.33

Figure 6. Selected Health Data.

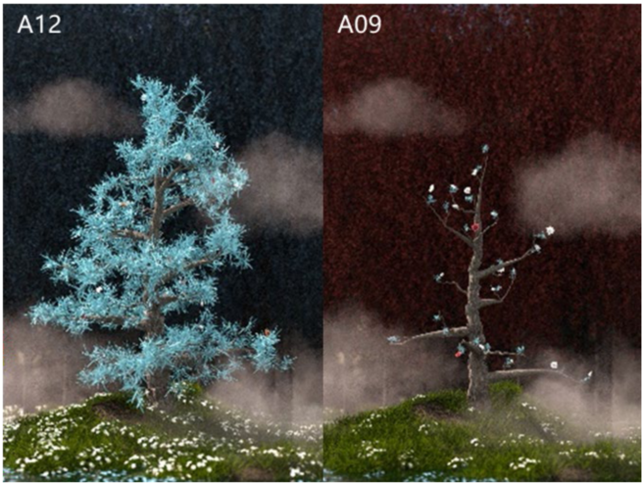


Figure 7. Typical images.

According to the framework of the visual system, the lush vegetation and cool tones in the image on the left indicate that the subject has good health and a strong immune system, and other indicators, such as bones and organs, are at a relatively healthy level. On the other hand, the image on the right is very depressed, indicating that the subject is in poor health, and the narrow tree trunks and sparse branches indicate that the subject may have some problems with bones and circulation. The red color of the trees in the background indicates that the immune status may be a health risk.

4. Case Study

4.1. Case Study Methodology

In this study, we recruited 20 volunteers from urban white-collar workers, working women aged 25-45 years, and asked them to collect health data and use a digital art generation system. In the experimental preparation phase, we used the SHMS V1.0 scale for subhealth assessment (scale retest reliability of 0.644 ($p<0.001$); Cronbach's alpha coefficient of 0.917; split-half reliability of 0.831, a reliable subhealth measurement tool [8].) The health status of the volunteers was assessed, as Table 1 demonstrates the partial screening questionnaire. People with a history of or experiencing major illnesses were excluded from screening for suitable candidates who met the study requirements and avoided interference with the experimental results. The scale was scored using the internationally accepted Likert five-point scale, and the volunteers' mean scores for each dimension were PS=71.75±12.57, MS=65.14±14.35, and SS=63.09±15.02.

Table 1. Part of the Subhealth Rating Scale

Question	Answer				
1. How is your appetite?	○Worst	○Worse	○Normal	○Good	○Excellent
2. How is your sleep?	○Worst	○Worse	○Normal	○Good	○Excellent
3. Are you satisfied with your hair growth?	○Worst	○Worse	○Normal	○Good	○Excellent

4. Do you feel bitter or dry mouth?	○Never	○Rarely	○At times	○Often	○Alwayst
5. Do you have gastrointestinal discomfort?	○Never	○Rarely	○At times	○Often	○Alwayst

At the beginning of the experiment, the researchers conducted the acquisition of health data from 20 volunteers through human surface electromyographic signal (sEGM) technology, recorded the results and input them into an algorithmic system to generate digital artworks, marked the main health problems corresponding to the volunteers, and named the group of digital artworks by number. During the experimental phase, the researchers asked the volunteers to participate in an interview after appreciating their digital artworks. The interview was divided into three main parts: (1) asking the volunteers to describe the content received through the images, aiming to understand the clarity of the digital artworks in conveying information, (2) asking about the volunteers' intuitive feelings, aiming to understand the emotional impact of the digital artworks on them, and (3) collecting the volunteers' opinions on the experiment with questions and suggestions.

Researchers interviewed volunteers and questionnaires through open-ended questions and recorded and took notes on the interviews. These questions included the volunteers' experience using the experimental system, their emotional state of participating in the experiment, their feedback on the content conveyed by the digital art images, etc. The questionnaire's content was designed concerning the System Usability Scale (SUS) [9] to understand the system's usefulness, as Table 2 shows some of the questionnaire contents.

Table 2. Usability questionnaire part content

No.	Question	1 strongly disagree – 5 strongly agree				
1	I would like to use this system	1	2	3	4	5
2	I found the system complicated	1	2	3	4	5
3	I think the system is easy	1	2	3	4	5
4	I need professional help to use this system	1	2	3	4	5
5	I found that the system functions were well integrated	1	2	3	4	5

The researchers then transcribed and anonymized the audio recordings of the interviews and analyzed the interview data using thematic analysis (a common qualitative method of psychological analysis commonly used to identify, report, and interpret people's opinions, perspectives, or experiences [10]). The researchers first coded these transcribed data, then filtered and classified the codes by finding common themes and reviewing them, and finally defined themes to obtain the analyzed outcome themes.

5. Case Study Results

We counted the results of filling out the SUS scale and obtained the results of the number of people and the mean score results for each subscale of the 10 questions in the scale, e.g.: **Table 3.**, through conversion, the score of the SUS was calculated to be 71, which indicates that the usability of the system is acceptable [11].

Table 3. Number of scores and average score

No.	1	2	3	4	5	Average
1	0	0	3	12	5	3.1
2	7	9	2	2	0	3.05
3	0	1	4	11	4	2.9
4	5	6	5	3	1	2.55
5	0	2	1	13	4	2.95
6	3	8	7	1	1	2.55
7	0	1	2	10	7	3.15
8	4	7	5	3	1	2.5
9	0	1	6	8	5	2.85
10	6	7	5	1	1	2.8

Continue to follow the research methodology combined with the above case design for the experiment, and through thematic analysis, we finally identified two themes: (1) emotional experience, and (2) action transformation.

(1) Emotional experience: This is an essential manifestation of how digital art images affect emotions. If it is a lush image with vegetation, the volunteer understands that her health condition is relatively good when she sees the vibrant image, which makes her feel relaxed and happy. In contrast, if it is an image with withered vegetation, the volunteer is shocked by the desolate and depressing scene when she sees it and soon associates it with her health problems, which makes her start to worry about her health status. Overall, this novel approach allows them to accept their health condition more relaxedly than a cold medical report.

(2) Action Transformation: This is the practical effect of emotions further influencing action. Digital art images change with periodic health data collection, so improved health results are captured and entered through the data, and eventually presented as digital artwork. While the volunteers marveled at the ability to grasp their health status through digital images, they all felt that this approach gave them timely feedback on their efforts, and the visible transformation of their health status made them willing to monitor their health and prevent related problems over time in this way.

5.1. Results Analysis

Based on the study results, it is clear that working women could understand the expressive intent and expression of the digital artwork during the experiment and perceive the emotional changes caused by the images. Through the feedback, we learned that such emotional changes ranged from positive relaxation at the sight of a beautiful image to negative anxiety at the sight of a depressing image, and we also recognized that this creative expression was attractive to working women and was a fun and enjoyable way to manage health. At the same time, the images of stage changes constructed by periodic data monitoring have a positive effect on motivating working women to take care of their health, and the comparison of the images visualizes the health transformation status while triggering the interest to persist in improving health activities and continuously using digital images to monitor health. In addition, other volunteers also provided us with informative suggestions, such as the generated images are too desolate to easily generate anxiety, fear and other emotions; the various parts of the images corresponding to health data are not well associated and need to be prompted for comparison to understand, and the use of cool colors to represent good health does not conform to the public perception, which also inspired us to think in a new way.

6. Conclusion

This paper constructs digital artworks by collecting health data from working women to provide innovative and enjoyable solutions for the long-term improvement of the subhealth problems of working women.

Through the experiment, we see that using digital images to monitor health is attractive and motivating for working women to take steps to improve their health. Furthermore, due to the specificity of the digital artwork being able to change and evolve accordingly to the data collected, it is suitable for working women to monitor and improve their health status over time.

However, after returning to the experiment and reflecting on the program, we recognize the study's visual effect and sample size limitations. Regarding visual effects, the figurative tree images make it difficult for volunteers to quickly and accurately identify areas corresponding to health data. If the generated images are depressed and silent, they may trigger negative emotions such as anxiety and fear, and the visual effects lack relevance to the traditional perception of the general public; in terms of sample size, the number is small, the scope of the study is not broad enough, and the classification of the study subjects is not refined enough, so the sample size lacks extensiveness. In future research, we will expand the number of research samples to be more convincing and further improve the visual presentation of digital images so that they can be associated with health data classification to achieve more intuitive and clear visual effects in order to improve the usefulness of this system.

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