

Chapter 8

Culture Computing: Interactive Technology to Explore Culture

8.1 Introduction

Culture, after it began to appear in the English language during the late eighteenth century, was regarded as the intellectual and spiritual cultivation of an individual or a social group. The word culture, which was derived from the Latin word *cultural* meaning *to cultivate*, has sparked controversies over its definitions. Raymond Williams [34] in his dealing with the definition of culture recognized three general categories. The first being the “ideal” in which culture is the state or the process of human perfection. The second is the “documentary” which refers to the body of intellectual and imaginative work being deemed as culture. The third is the “social” in which culture is a description of a certain way of life which expresses its meanings and values in art, learning, intuitions and behavioral patterns. Clifford Geertz [5] recognizes culture as essentially a semiotic one. He described man as an animal suspended in a web of significance, which Geertz understand as the culture and studying it is an interpretative one in search of meanings. Social anthropologist Ulf Hannerz [7] believes that culture is collective and above all a matter of meanings. He further adds that culture is the meanings which people create and which creates people as members of society.

In the rapidly transforming landscape of modern world, communicating traditional cultural aspects has to be cultivated within the same environment utilizing the existing channels thus influencing the participation. The integration of “cultural layer” and “computer layer” introduces intense challenges [15]. Culture computing is a new kind of computing system that introduces and transforms cultures through computer supported activities. Cultural computing uses scientific methods to model traditional cultures so that users could interact and experience these cultures through modern computing applications. As creativity is the mutual foundation of culture, science and technology, cultural computing explores and develops technology to advance creative activities that would be a positive impact on contemporary lifestyles and culture.

In this chapter, we present an overview of cultural computing research and the main features of cultural computing systems. We then present three cultural computing prototype systems developed in our research laboratory, namely Media Me,

BlogWall and Confucius Computer. User evaluation results are also presented and discussed.

8.2 Prior Research

There have been numerous efforts done in Cultural Computing over the past few years to reinstate traditional cultures using new dimensions or mediums to explore culture. Researchers were arguing throughout the years on how to utilize computing technologies to explore the human experience or to explore the world. The purpose behind these new computing tools is not only to fill the gap between human and their societies but also to explore and experience other cultures, too.

Some of the cultural computing projects help users understand the underlying cultural values, for example, Zenetic Computer [30], while some prompt the users to question them, for example, Alice [9]. Zenetic Computer uses computing as a method for cultural translation. It offers users a chance to engage and understand Buddhist principles of “re-creation” of the self. On the other hand, Alice is an augmented reality narrative with intelligent agents acting as characters who lead the user through virtual and real locations, moral choices and emotional states.

Another example is Hitch Haiku [31], in which the authors studied the reproduction of traditional haiku, a Japanese minimal poem form, by a computer. A user chooses arbitrary phrases from a chapter of a famous Japanese essay called “1000 Books and 1000 Nights”, and the system generates a haiku which includes the essence, then translates it into English. Therefore, the essence of a Japanese book can reach those unfamiliar with traditional poetry.

On the other hand, Virtual Reality (VR) technology is also explored in the digital heritage domain. VR technology provides an important educational tool to recreate the cultural heritage content in an immersive high-quality 3D environment for the users to enter and experience the culture in real time [29]. In the project “Interacting with the virtually recreated Peranakans” [28], the goal was to digitally recreate the Peranakans’¹ cultural heritage incorporating intuitive interaction techniques using VR technology. A 3D avatar of an Asian Virtual Tour Guide has been built in an immersive 3D environment to guide the visitors through the environment and interaction with a real Chinese calligraphy brush is provided.

We are inspired by the encouraging results from the above cultural computing projects. We would like to extend the cultural computing research into new global cultural domains like Sri Lankan and Chinese cultures, and also poetry literature. We employ extensive modern digital interfacing technologies, for example, SMS, social network chat, public social display and real time video mosaic. We enable the users to explore traditional cultures and literature through the use of modern everyday computing applications.

¹Peranakans are the descendants of the very early immigrants to the Nusantara region, including both the British Straits Settlements of Malaya and the Dutch-controlled island of Java.

8.3 Features of Cultural Computing

Based on existing works in cultural computing, there are several common features in current Cultural Computing systems. The our main features are summarized below:

- Visual Technology** Culture is a collective practice of a community or a society through which meaning communicated visual, aural or textual representations. Visual cultural practices provide a physical and psychical place for individual participants to inhabit and cultivate [27]. Thus visual is the stage where meanings are created and contested. Most of the cultural computing systems provide visual experience by using different kinds of visual technology. The aim of the visual technology is to impart information, meaning and pleasure to the consumer through numerous visual events using an interface [22].
- Social Interaction** Interaction with the society is one of the key factors of human beings in their day-to-day life and a part of most of the cultures. At every moment, humans are interacting with society in different ways. However, from the last few decades people and/or the societies are seriously obsessed with digital age media. As a result of this phenomenon, their social interactions seem to be diminishing, and exploring the cultural values becomes less important than before [11]. Cultural computing is introduced to conquer this divide between the culture and the people in the existing digital era. Hence people are encouraged to interact not only with their own cultures but also with others.
- Bit Literature** Cultural computing systems also aim to provide users with dynamic ways of experiencing and exploring cultures. Static literature found in traditional passive media, for example, books, only provides a linear understanding of complex multidimensional cultures, which may not provide comprehensive perspectives toward understanding of cultures, thus restricting the learning process. Bit literature is a new form of computer generated literature based on algorithmic composition of literature generated from both digital bits and literature bits. Bits of users' input and bits of literature (small chunks of literature) from the knowledge database interplay with the computer algorithm to generate digital bits literature. Bit literature is very relevant in the digital age because people's interaction and understanding of literature is changing. We are in the age of instant messaging, short message system (SMS), Twitter, etc. and bits of literature may be better fitted in such communication channels. Users from our modern society could significantly benefit from a more interactive and personalized literature, which is not possible in passive media.

Cross-cultural Making different cultures accessible to people is another main feature of cultural computing systems. Language barrier, which happens in communication without common language, keeps people away from accessing original cultures. For example, it is difficult for western people to study original Confucius classics written in the old Chinese language. The rapidly-changing communication medium, from paper-based to electronic-based, also causes the difficulties for young people to access traditional cultures. Younger generation gets absorbed into the popular cultures, such as the Internet and they are less interested in reading books. Literary arts such as poetry are less interesting to them [16]. Many of them would not go through the literary work such as poetry just for the joy of it [1]. Therefore, cultural computing aims to translate different cultures into a new and common “language” and “communication medium”, so that people, especially younger generation, could experience different cultures easily.

In order to address the barrier in cross-cultural communication and to promote the socio-cultural interaction, by using the concept of visual technology and bit literature, we have created three cultural computing systems, Media Me, BlogWall and Confucius Computers. The cultural computing features of our projects are summarized in Table 8.1, and the following sections will describe them in detail.

8.4 Media Me

8.4.1 Introduction

Media Me is a new form of personal media where a person can create and broadcast his/her own customized contents as image elements. For the current version of Media Me, religious, cultural, and historical movies of Sri Lanka are used to create a meaningful video mosaic. This system can also be used for educational purposes in an interactive way, for example, for exploring the national heritage of Sri Lanka. Similarly, the system also can be easily extended to explore various other cultures.

As an artistic reflection on new personal media, Media Me is an interactive video installation that displays a captured image of a person as a video mosaic [13, 14] made of hundreds of videos. We literally turn the body into videos, which artistically represent the revolution in personal media. Videos are continuously arranged in real time to form a mosaic representation of the background and to provide meaningful contents, such as cultural and historical media. When no image is captured by the system, Media Me activates and reflects the media itself by creating a mosaic of cultural and historical content.

Table 8.1 Cultural computing features of Media Me, BlogWall and Confucius Computer

Feature	Details	
Visual Technology	Media Me	<p>Research communicates comprehensive information on Sri Lankan cultural heritage. Users interacting with the system obtain a visual experience with the dynamic contents on the screen with their color, use of light, and exposure. The experience observed from the system could motivate users to explore the Sri Lankan culture and heritage more</p>
	Blogwall	<p>It creates novel poetries using poetry mixing up technology to deliver a creative and pleasant feeling to the user with calm and attractive visuals which encourage people to explore the system functions. The next major step of this research is to visualize the poetry mixing up process in a more aesthetic way</p>
	Confucius Computer	<p>It visualizes virtual Confucius thinking process to give users an insight to the complex flow of thoughts. It also uses beautiful dynamic Chinese paintings to allow users learn about traditional ancient cycles of balance and positive music based on Confucius philosophy</p>
Social Interaction	Media Me	<p>It is a media interactive art work which comments on the bidirectional relationship between people and the media through the use of a real-time video mosaic. It also provides the means to educate the masses including children while entertaining them. This will also bring new ways of communication between people and media, and new forms of social, educational, and cultural interaction</p>
	Blogwall	<p>It uses short message service as the medium of enabling interactions with large public displays using mobile phone. It can create technologically supported public discourse spheres in which they can both represent personal views and practice new ways of forming collective opinions and shared poetry. By using a mobile phone, even a novice user can now become a poet by interacting with the system</p>
	Confucius Computer	<p>It is designed for grandparents and parents to play simultaneously with children in order to promote intergenerational interaction. It provides a good avenue for grandparents to share their knowledge and values to the younger ones through interesting computing applications. At the same time, the grandparents can learn from the children about the usage of new media and technology</p>

Table 8.1 (continued)

Feature	Details	
Bit Literature	Media Me	The dynamic and personalized content created by Media Me illustrates Sri Lankan cultural heritage literature in a dynamic and more interesting way to explore. Dynamic arranging of content will motivate the user to explore and interact with other cultures rather than referring to the static literature. Alternatively, the users could use personal videos to experience the cultures in an interesting manner. For example, a personal video could play in foreground, while videos with cultural heritage are playing in the background
	Blogwall	It generates a novel bit literature, poetry mix-up, by mixing several existing poems, which provides a surprising and unpredictable experience. The system analyzes the emotional weight of the input short message and generates a poetry mix-up based on this emotional context. The final poem generated by the system is a novel and dynamic poem which is based on the user's SMS text
	Confucius Computer	It provides an interactive and personalized advice to the users based on their input. The system merges cultural values and philosophies into user's context, hence sparking the user's initiative of learning something new. The user can experience deep cultural philosophy through small bits of literary replies and chats
Cross-cultural Accessibility	Media Me	Even though Media Me system currently consists of Sri Lankan cultural videos only, it is capable of using any cultural content that could be fed into the system to explore other cultures. The users even not fluent in Sri Lankan language, Sinhala, can get to know the culture better and be motivated for further explorations
	Blogwall	It uses poems from old generations during the mix-up process inside the system. It brings up old and traditional cultural content and style into the new digital world of youth. Alternatively, the system is capable enough to allow for other cultural experiences by changing the poem database with applicable cultural content
	Confucius Computer	It uses modern media like Facebook and MSN to allow users have a deep cultural interaction with virtual Confucius. Users are also able to interact with virtual Confucius using English and graphical interfaces without the need to understand the complex traditional Chinese text

8.4.2 Motivation

Sri Lanka has a grand culture influenced strongly by the teachings of Lord Buddha and Buddhist rituals. It is not only Buddhism which radically changed the Sri Lankan society but the appearance of Indian industries of arts and crafts and the Brahmi alphabet [21]. These new influxes had affected the agricultural community of pre-Buddhist era, shaping them into a nation with a multifaceted culture. Buddhism has been established as the state religion and the relationship that had developed between the religion and state is well defined and amicably accepted, and each drawing strength from the association [2]. Thus began the long esthetic journey in the form of religious art and literature where the religious institution initiated and the state sponsored. Great Monastic establishments of ancient Sri Lanka such as Mahavihara, Abhayagiriya and Jetawana established their own form of fine art, which featured distinctively unique characteristics that instigated the grand cultural prototype in Sri Lanka.

The Buddhism and later the integration of Hindu rituals have enriched the culture of Sri Lanka, making it very significant in every aspect. Modern generation affected by the fast moving global finances and global concepts, with their tendencies towards global cultural trends falling away from the traditional cultural roots that have developed over many millennia. Modern generation has changed their attitude towards grand narrations in history, thus endangering the tangible and intangible cultural roots which belong to the future generations. The main intension of this research is to encourage people of modern generation to participate in the tour of experience in traditional cultural aspects without separating them or forcing them away from their familiar interactive digital environment.

One of the main advantages of using these computing techniques to explore Buddhism is that users can personalize the system according to their interest. Television has been the mass media for broadcasting media content for a long time. However, the developments in broadband Internet and social networks have made it possible for individuals to use their own personal media as broadcast media. As an example, users can capture and load their own recorded interesting cultural videos into the system. As younger generations are more willing to engage in novel concepts, this system can be more popular among people of the new generation. The simplicity and the user friendliness of the system promote its users to take advantage of the system generally.

8.4.3 System Description

The main component of the system is the pre-stored videos, which reside on the computer, categorized by selected topics in a central repository. The camera attached to the system captures real time image sequences, and then each image is built using pre-stored video sequences. The system analyzes each area of the foreground and

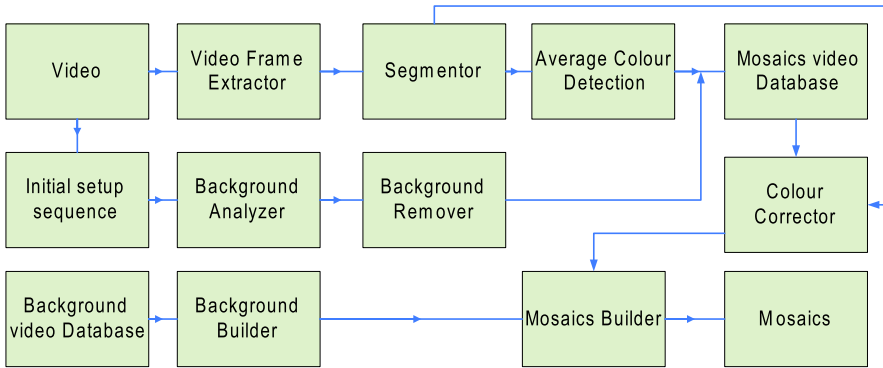


Fig. 8.1 Media Me system architecture

selects a video clip that can substitute that area. Some level of color correction is applied to the foreground video clips to attain a more natural look and feel.

When the system is initialized, the average color in the background is replaced by the system with extracted video frames from pre-stored videos that illuminate historical and cultural heritage of Sri Lanka. The full system architecture is shown in Fig. 8.1.

The main system components are a video camera, a computer, a green background screen and an electronic projector. The average color of the background is computed during the system initialization process and it is used to remove the background from the extracted video frame. The camera captures the image of the person who stands in front of the blue screen. The foreground is segmented to rectangular areas and the average color of each of them is calculated. This average color is used to find matching video clips from the video repository. Then the system outputs the final images with modified foreground and background images as in Fig. 8.2.

The capturing process uses Open Computer Vision (OpenCV) libraries to capture video frames (image sequences) from the video camera. When OpenCV acquires an image frame from the video stream, it passes a pointer to an “image structure” defined in a callback function in the application. However, the system may not be able to process the images at the same rate as OpenCV is acquiring them. Therefore, a Boolean variable is set to indicate that the system is ready to accept the image. If the system is ready to accept, it will clone the original image received into the callback function. When the system finishes processing the current image, it sets the Boolean variable, indicating that it is ready to accept a new image.

The video clips in the repository are pre-analyzed and organized based on their average color. Since the system has only a finite number of videos, small color correction is applied to the selected video clips in order to attain the realistic look and feel. The video clips used for the foreground in the repository have size of 40×30 pixels and are pre-analyzed and organized based on their average color. The average color is used to calculate an index that is used to find a matching video clips from the video repository. The background of the original video is replaced

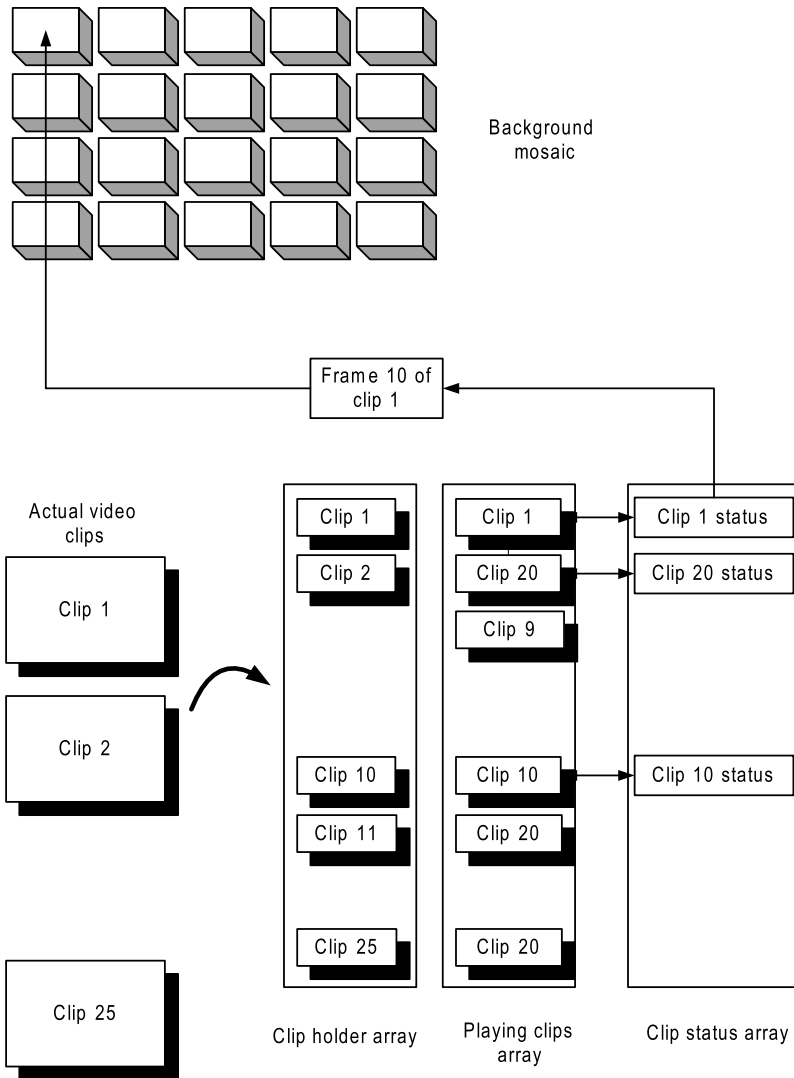


Fig. 8.2 Clip selection

by larger mosaic videos. The average and standard deviation of the background is calculated and used to identify the background of the video.

Finally, the background and the foreground are combined to create the final mosaic as in Fig. 8.3. The process of combining the background and foreground videos applies small color correction to the pixels of the foreground clips to attain a realistic look and feel. The electronic projector projects the final video mosaic onto a large screen in front of the person.

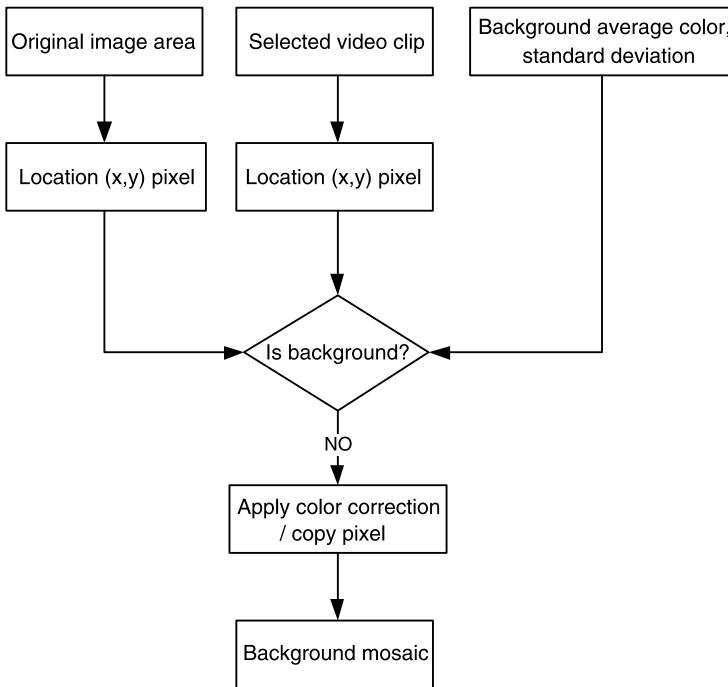


Fig. 8.3 Final video mosaic

The index used to find matching video clips from the video repository is computed as

$$Index = \text{floor}(B/32) \times 64 + \text{floor}(G/32) \times 8 + \text{floor}(R/32), \quad (8.1)$$

where $\text{floor}(x)$ is the function that returns the largest integral value that is not greater than x , and

- B = blue value of the average color of the region,
- G = green value of the average color of the region,
- R = red value of the average color of the region.

8.4.4 Video Indexing

Based on the indexing, the system required a total of 512 ($8 \times 8 \times 8$) videos. However, a normal computer cannot handle such a large number of videos. Therefore, an intermediate array was used to expand a smaller number of videos. In reality, the system consists of 216 video clips. Those videos are duplicated to a color space of 512. One array of size 216 is holding the reference to the video clips, and the expansion array is holding the index to that array. Multiple elements in the expansion

Fig. 8.4 Video indexing

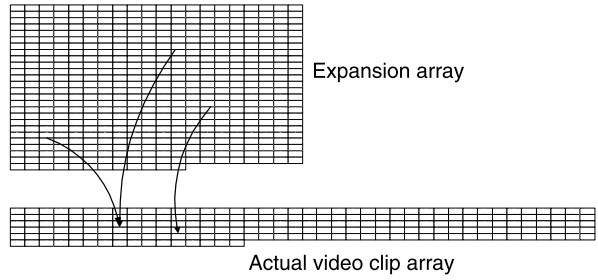


Fig. 8.5 National heritage of Sri Lanka

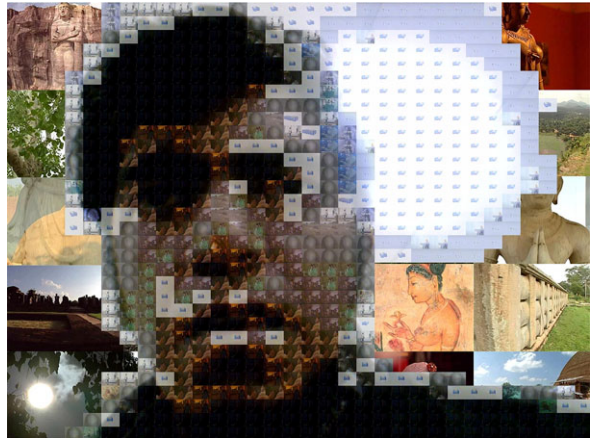
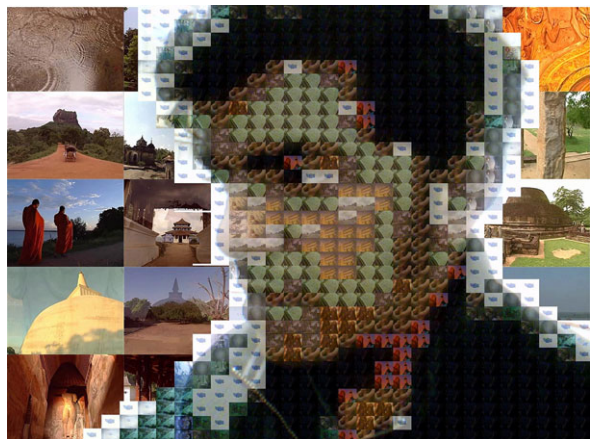


Fig. 8.6 Buddhism in Sri Lanka



array are referring to the same element (video) in the video array as illustrated in Fig. 8.4.

In Fig. 8.5, the face (foreground) and the background mosaic are constructed with video clips showing national heritage of Sri Lanka. Similarly, Fig. 8.6 shows the mosaic constructed from videos of Buddhism in Sri Lanka. The background videos

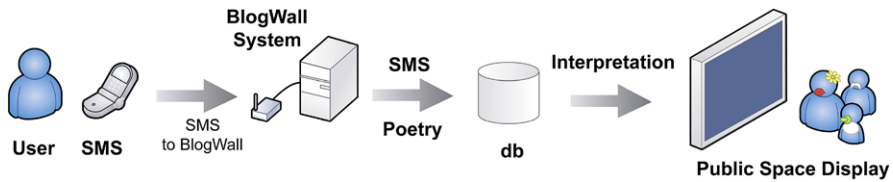


Fig. 8.7 Concept design of BlogWall

are randomly selected and arranged by the system. The system analyzes each area of the foreground and selects a video clip that can substitute that area. As shown in the figure, some level of color correction is applied to the foreground video clips to attain a more natural look and feel.

8.5 BlogWall

8.5.1 Introduction

BlogWall is an extension of the existing text messaging to a new level of self-expression and public communication, combining visual art and poetry. It provides a new form of communication in the networked digital era which represents a combination of digital bits and cultural bits. Mixing poetry is the major element of this system which transforms the users into experiencing the state of being a poet by mixing short messages into poems.

As seen in Fig. 8.7, the user basically sends a short message to the system which contains a pre-configured mobile number. Then the extracted text from the SMS will be transferred to the processing unit, excluding any inappropriate words, will be processed and mixed to generate new poetry, and the end result will be displayed.

8.5.2 Motivation

Interacting by reciting or writing poetry has been a very energetic practice from the ancient times. Poetry is considered as one of the most highly intellectual forms of communication and an exceedingly refined mode of sharing information. Wordsworth considered poetry as a result of the overflow of uncontrollable feelings [17]. From rulers, courtiers, clergy to civilians, many participated in the interactive exchange of culture through poetry. Roman poets of the Imperial times wrote poetry to interpret and glorify the emperor to the public, thus surprisingly communicating the real person to the masses [20]. Japanese Emperor Tenji (626–672), a genuine poet himself, had a very literary oriented court where a Princess had introduced the famous debate in lyrics on which season is much lovelier, Spring or Autumn; the

topic, to this day, is able to evoke a highly interactive dialog [17]. The very famous Japanese literary work “The Tale of Genji” [25] reveals most eloquently the poetic communications of Genji which was exceedingly enterprising form of interaction between the various subjects. Japanese Haiku is also one of the entrancing conversations with the nature and with vernacular injects that transcend the social divisions, thus making it Japan’s most influential contribution to the global communication [26].

In the new age of digital communication, instant messaging, short messaging, blogging and similar applications, instead of poetry, are more and more widely used by people from all over the world. People are beginning to express themselves openly and also read in the form of short bits of information, such as SMS and Twitter, which we can term a new form of literature bits. The media mix strategy also disseminates content across broadcast media and portable entertainment technologies, and alternatively, this permits communication based on various forms of social interaction between users [12]. Mixing was made popular in hip-hop culture during the 1980s and 1990s, and has continued to be musical and visual DJ (disk jockey) and VJ (video jockey) culture which young people presently enjoy. Regardless of the context, the essential idea remains the same. A mash-up allows users to combine information of varying granularity from different possibly disparate sources [18]. Consequently, a new type of communication system is in need to facilitate the interactive culture of digital communication, literature bits, and mash-up.

From both literature-bits (short bits of writing) and digital-bits (electric communication) we can invent “bit literature” and introduce digital poetry as a new form of communication. Therefore, by blending SMS and poetry, we have developed a poetry mixer called BlogWall to extend SMS (Short Message Service) to a new level of self expression and social communication. This research is an exploration in search of new avenues of communication opened to embrace the traditional poetry while providing the experience of the contemporaneity. One of the main advantages of this system is that it can cross all cultures and build upon the constant short message communication which people are expressing themselves in our connected society.

8.5.3 System Description

The general setup of BlogWall requires a high-end computer with a good graphics card, a projector, and a screen. Dedicated GSM/GPRS modem is used to receive SMS messages. The user stands in front of the projector screen and sends an SMS to a given number. The application issues AT commands to the modem to locate the SMS. All the messages received by the server will be written to a log file along with originator phone number and the date/time. The application consists of several modes of operation. Based on the enabled modes, it offers different services to the user. The complete system architecture is shown in Fig. 8.8.

Even though the main focus of BlogWall is poetry, there are several other ways it can be used. The additional modes of BlogWall can be activated based on user’s requirements. These modes are mainly used as value addition to the overall system.

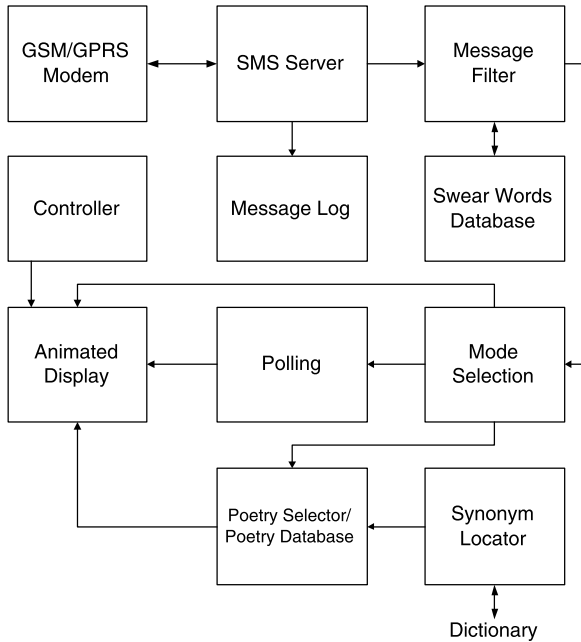


Fig. 8.8 System architecture

8.5.3.1 Standard Display Mode

If the application is in the standard display mode, it will immediately display the text message with some animation. When the system receives an SMS, it selects a random animation for the SMS.

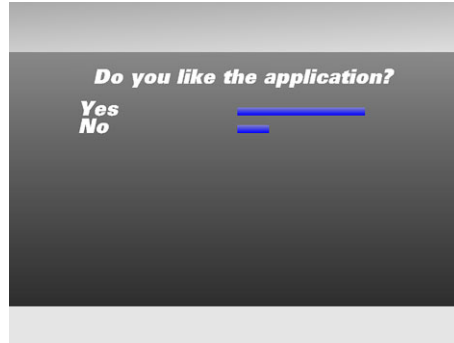
8.5.3.2 Polling Mode

The polling function is used to collect user opinions. The system displays a polling question and available answers as shown in Fig. 8.9. The answers are indexed by a single alphabetical letter within parentheses. To vote, users send SMSs with appropriate indexed letter of the answer to the system. BlogWall also has the capability to provide statistical data to system administrators.

8.5.3.3 Keyword Triggering Mode

Keyword triggering mode enables the application to trigger an internal function based on a word in the SMS. This feature is somewhat similar to the features found in popular chat programs like Windows Messenger. For example, if the SMS contains word “love” the application may replace the word “love” with an image of

Fig. 8.9 Polling mode of BlogWall



a heart. The keyword triggering mode can also display a small verse based on the words found in the SMS. The images as well as verses are selected from an internal database.

8.5.3.4 Poetry Mixing Mode

The most prominent feature of the application is its ability to mix poetry. In the poetry mode of BlogWall, a poem will be created with the means of the user SMS. The application enables the user to assume the role of a poetry jockey. The main system component, the poetry generator consists of several building blocks as shown in Fig. 8.10. By integrating several intelligent methods such as NLP (Natural Language processing) and Information retrieval techniques, the system is capable enough to generate poems which have both meaningful and emotional weights to entertain the users. The system details will now be outlined.

When the short message is received by the system, the words in the message are arranged according to their importance by the system. For instance, from the text “I love thunder and rain”, the words “love”, “thunder”, “rain” would be the most uncommon and important words to select. Common words such as “I” and, “the” would not be helpful in identifying a suitable poetry line. The uncommon words such as “thunder” can be more valuable in identifying a suitable poetry line. The system is also able to obtain synonyms from the dictionary [4] to expand the search criteria. This might enable the system to provide exciting and surprising results at the end.

The importance of a particular word is denoted by a numerical weight which is often used in information retrieval and text mining. This number, called the *tf-idf* weight, is the product of two values: the term frequency *tf* and the inverse document frequency *idf*. The term frequency is a measure of how often a term is found in a collection of documents, in this case poem lines. The inverse document frequency *idf* is used to measure how rare a particular term appears in a given text:

$$w_{i,d} = tf_{i,d} \times \log(n/df_i), \quad (8.2)$$

where $tf_{i,d}$ is term frequency of the i th word in each poem line in a set of d poem lines; n is the total number of poem lines; df_i is the document frequency of the

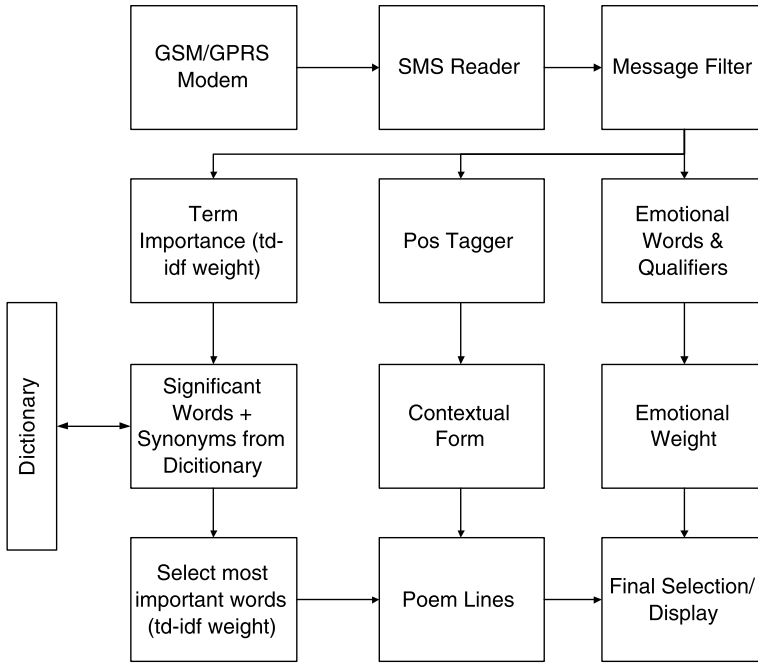


Fig. 8.10 Poetry generation processing of BlogWall

i th word. For each word i , the system then returns poem lines such that $\sum w_{i,d}$ is maximized.

In order to make meaningful connections between the user input and the poem lines in the database, resulting in an original and meaningful poem, word sense disambiguation is necessary and this is the second part of the analysis. The system uses a part of speech (POS) tagger for basic disambiguation. The tagger used in BlogWall is the English POS tagger [32], primarily for the tagging speed and ease of integration. The input message and each poem line in the database are tagged using a POS tagger. In order to avoid poems that do not make sense, these tags are used to pick only those poem lines which use a particular keyword or its synonym in the same sense as in the input message.

The third analysis is the calculation of an emotional weight. Analogous to the $tf-idf$ weight described earlier, which ranks words in the input message according to importance, calculation of an emotional weight also is used in the system to rank words according to the input message, which assigns a numerical value based on the emotional content or the mood of the message. The database includes words that can derive the emotional state of the sentence and the corresponding weight of the word along two axes, the degree of arousal and degree of pleasantness. The weights are modeled after the Russell Dimension for emotions [24]. In addition, a database of qualifiers and their corresponding multipliers is also maintained. The system thus analyzes the input message and attaches a numerical value denoting the

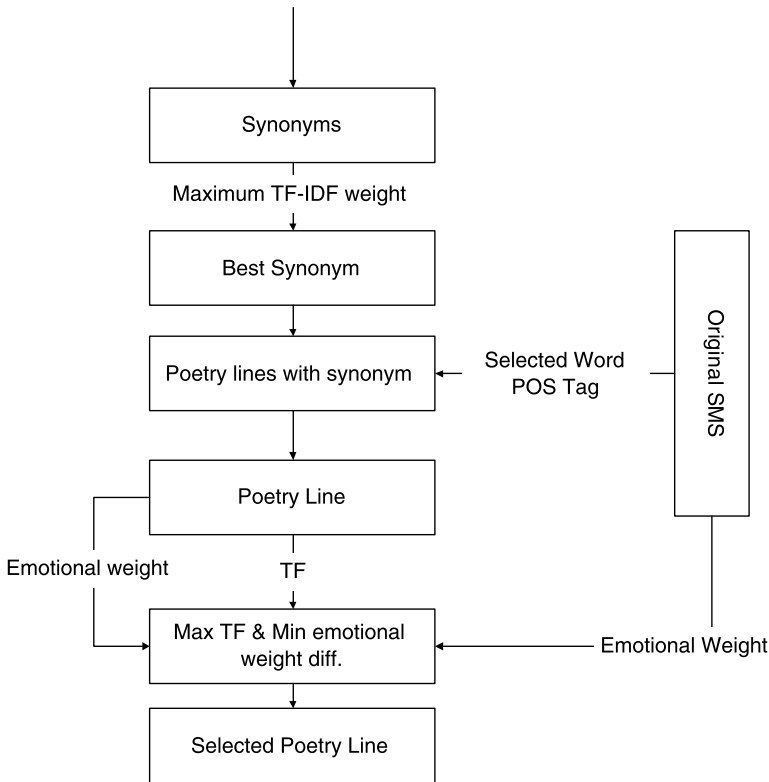


Fig. 8.11 Poetry selection processing of BlogWall

emotional weight. Similarly, all the poem lines in the database will also be assigned a numerical emotional weight. Finally, the system will select the poem lines with the closest weight to the input text.

These three processes are important to the final output. As shown in Fig. 8.11, in the first case, the significant words whose *tf-idf* weights are the highest will be augmented by fetching synonyms from the Internet. A second round of calculation of *tf-idf* weights results in the most important words from this combined set. These words, together with the contextual tag from the POS tagger and the term frequency of the lines, are used to shortlist poem lines. Only the poem lines which contain these words used in the same context (noun, verb, etc.) as well as have the highest term frequency are shortlisted. The final output to the user will be the lines that maximize the term frequency and minimize the emotional weight difference (closest in emotional weight to the input message) of the poetry.

This unique ranking system enables the system to borrow lines of poetry from different poets. Therefore, the final outcome of the system could be unusual, surprising, or maybe amusing.

Table 8.2 POS tagger tags

I	NNS	Used of a single unit or thing
love	NN	Have a great affection or liking for
the	VBP	Definite article
way	VBP	How something is done or how it happens
feel	NNS	Undergo an emotional sensation or be in a particular state of mind
now	DT	In the historical present, at this point in the narration of a series of past events

Table 8.3 Emotional weight of message

x -value (degree of pleasantness)	+1
y -value (degree of agitation/arousal)	+0.6
On this day, I speak only of the glorious consequence	(1, 0.6)

Table 8.4 The $tf-idf$ weights of the words

Word	$tf-idf$ weight
feel	1.14
way	1.57
now	1.45
love	1.18
I	1.03
the	0.54

8.5.4 An Example of Poetry Mixing

Suppose the user sends the SMS “I love the way I feel now”.

For this example, the words are identified by the POS tagger as shown in Table 8.2.

Based on the Russell Dimensions, the line is assigned numerical values based on the emotional weight along two axes. The poetry mixer maintains a list of words and qualifiers that influence the emotional state of the line or message. The system searches for the occurrence of these words in the message. In this example, the result is as shown in Table 8.3. The word “love” produces a positive value (+1) on the degree of pleasantness axis and +0.6 on the degree of agitation/arousal.

Important selected words are “feel”, “way”, and “now” based on term importance. The number of selected words corresponds to the number of poetry lines generated by the system. The application picks three words in the default setting. The $tf-idf$ weights of all the words in the SMS are shown in Table 8.4. Note that a weight of -1 indicates that the word or phrase did not appear in the poetry corpus in the mixed poetry.

The system then searches for synonyms for each of these selected words. For example, synonyms found for the word “feel” would include “feeling”, “experience”, and “sense”. Similar sets of synonyms are found for “way” and “now”. In this case,

Table 8.5 Fetching synonyms

Word	Synonyms
feel	feeling, flavor, look, smell, spirit, tactile property, tone, experience, find, finger, palpate, sense, feel
way	agency, direction, elbow room, fashion, manner, means, mode, path, room, style, way of life, right smart, way
now	at once, at present, directly, forthwith, immediately, instantly, like a shot, nowadays, right away, straight off, straightaway, today, now

Table 8.6 The *tf-idf* weights of synonyms for “feel”

Word	<i>tf-idf</i> weight
sense	1.15
feel	1.14
look	1.02

Table 8.7 The *tf-idf* weights of synonyms for “way”

Word	<i>tf-idf</i> weight
style	2.11
path	1.69
room	1.61

Table 8.8 The *tf-idf* weights of synonyms for “now”

Word	<i>tf-idf</i> weight
now	1.45
instantly	1.36
forthwith	0.95

the following words were chosen from the set augmented with synonyms: “feel”, “way”, and “now”. The complete sets are shown in Table 8.5.

Based on the types of the original words in the SMS, the system calculates the *tf-idf* weights of all the words in these augmented sets once again. The final lists of *tf-idf* weights, sorted in descending order, are shown in Tables 8.6, 8.7, and 8.8. Note that the words that are not in the system database are not shown in the tables.

In each set, the word with the highest weight is selected (“sense”, “style”, and “now”). Subsequently in the first step, for each selected word, the system shortlists poetry lines where the term frequency of the word is the highest, the selected word is used in the same context as in the original SMS and the emotional weight of the poetry lines is closest to the emotional weight of the SMS. The results are shown in Tables 8.9, 8.10, and 8.11.

Table 8.9 Poetry lines for “sense” (selected for “feel”)

Line	<i>tf</i>	Emotional weight
May they also sense the love	0.16	(1, 0.6)
love you now, and sense what may	0.1	(1, 0.6)

Table 8.10 Poetry lines for “style” (selected for “way”)

Line	<i>tf</i>	Emotional weight
I love so much their style and tone	0.11	(1, 0.6)
I feel I can do my thing without style	0.09	(−0.6, 0)

Table 8.11 Poetry lines for “now” (selected for “now”)

Line	<i>tf</i>	Emotional weight
And now if I might say	0.16	(0, 0)
I love the way my heart floats now	0.12	(1, 0.6)

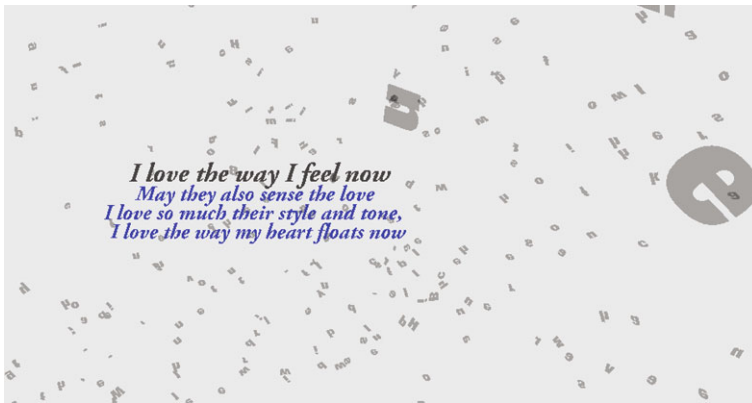


Fig. 8.12 Output of BlogWall poetry mixing. The input SMS is in *black* and the output poetry is in *blue*

In the final phase, the poetry line that maximizes the term frequency and minimizes the emotional weight difference (closest in emotional weight to the input message (which as mentioned above is (1, 0.6))) is selected. The following is the final output of the system as shown in Fig. 8.12.

May they also sense the love
 I love so much their style and tone
 I love the way my heart floats now

8.6 Confucius Computer

8.6.1 Introduction

Confucius Computer is a new form of illogical cultural computing based on the Eastern paradigms of balance and harmony, which is radically different from the ancient Greek logic normally experienced in computing. It aims to facilitate intergenerational cultural communication by enabling the young to gain deeper understanding of the ancient Chinese culture using the modes of communication they are familiar with. The system uses new media to revive and model these historical philosophies and teachings, presenting them in new contexts, such as online social chat, music and food. The system aims to increase the physical and psychological proximity [33] and understanding between the older and younger generations.

8.6.2 Motivation

Confucianism is an Eastern ethical and philosophical system that has had great impact, especially in the Asian countries, for more than 2500 years. However, Confucian philosophies are extremely complex, and thus may not be easily accessible to people, especially given the cultural, intergenerational, and language barrier. Traditional passive media provides only a linear understanding of his profound teachings, which restricts the learning process. Whereas in our connected digital era, young people are more inclined to use the new literacy of modern Internet based and social digital media. Furthermore, due to global aging population, issues of family intergenerational communication are becoming increasingly relevant [19]. Confucius firmly believed that good family relationships were the key to reforming society:

The gentleman concerns himself with the root; and if the root is firmly planted, the Way grows.

(1:2, Analects)

There have been encouraging results on the use of modern communication technology in bridging the intergenerational gap, such as the use of video blogs for the old people to communicate with the young people [6]. Therefore, it motivates us to combine Confucius and eastern philosophies and culture with the media literacy of the new digital generation of social networks, chat and interactive games.

8.6.3 System Description

Confucius Computer is a new form of illogical computing based on the Eastern paradigms of balance and harmony, which are radically different from the ancient Greek logic normally experienced in computing. It aims to facilitate intergenerational cultural communication by enabling young and old to interact and explore ancient Asian cultural heritage. The system uses new media to revive and

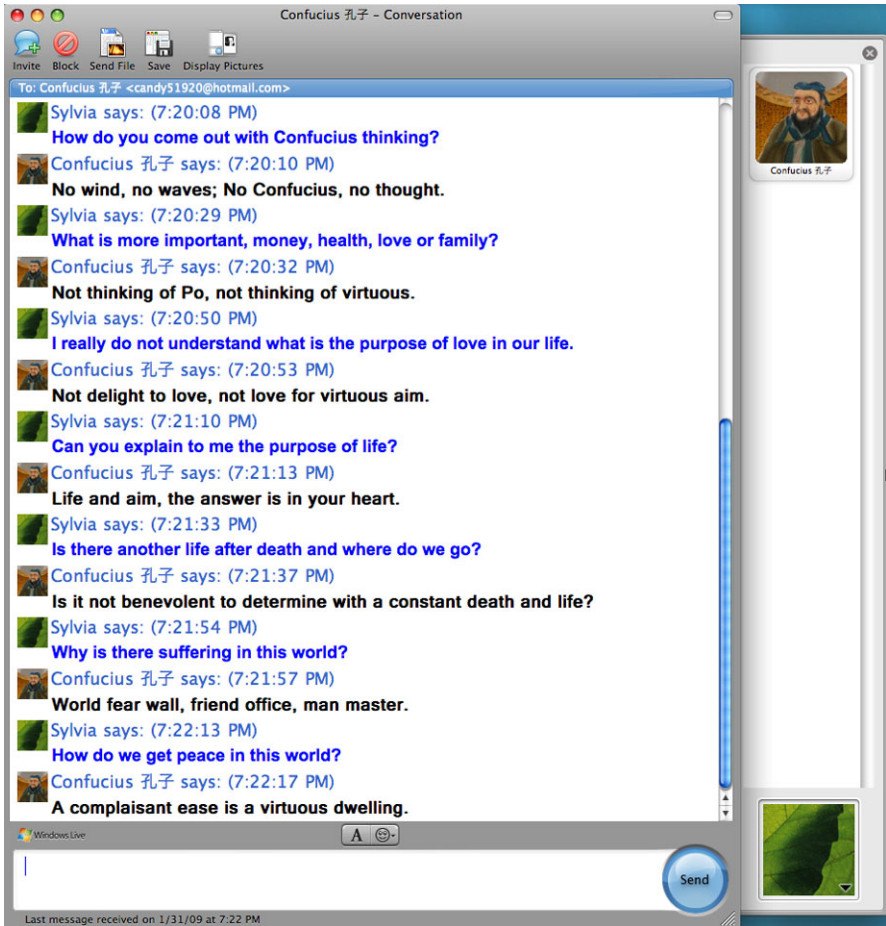


Fig. 8.13 Interactive chat with virtual Confucius

model these historical philosophies and teachings into three sub-systems, Confucius chat, Confucius music-painting and Confucius food, thus enabling people to experience and explore ancient culture using the literacy of digital interactivity.

Confucius chat can be viewed as a new form of computer generated literature, which we call “bit literature”, an algorithmic composition of literature generated from both digital-bits and literature-bits. The core of the system is a virtual Confucius thought engine that models Confucius knowledge from the Analects and his teaching method Yin Cai Shi Jiao (teaching student according to his/her aptitude) [8]. Based on the question asked, Virtual Confucius identifies the Yu (sub-domain of knowledge) in the Analects. The system then further queries the user to determine his Hui (aptitude) on that topic. According to Yu and Hui, Virtual Confucius replies to the user. A screenshot of the MSN chat history with virtual Confucius is shown in Fig. 8.13. Users from our modern society could significantly benefit from

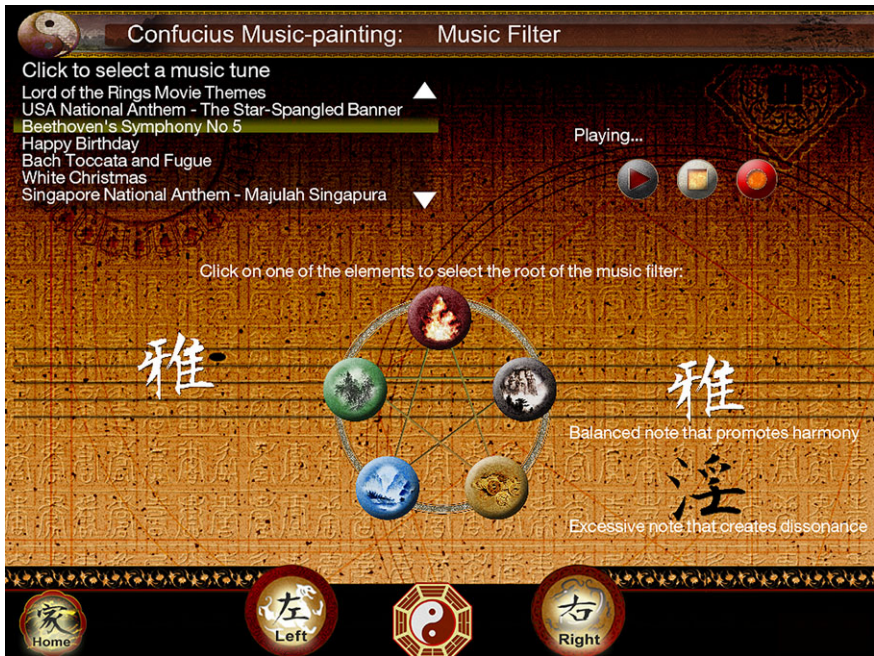


Fig. 8.14 Confucius music that filters input music into positive output music

this interactive and personalized advice from ancient virtual Confucius, which is not possible in passive media, such as printed text.

The core virtual model of Confucius also allows customized modules or even widgets. For example, Confucius Computer introduces algorithms to filter and transform any type of music into “positive” music that could promote personal character development [35]. The system filters the timbre, rhythms and scale of the music, and outputs the “positive” music as shown in Fig. 8.14. The output music is in the Chinese pentatonic scale which corresponds to the cosmological theory of the five elements [10]. At the same time, based on the ancient cycles of balance [3] and the five elements, the music is then visualized in the form of a dynamic Chinese painting. Details seen on the painting are generated based on the interaction between musical notes which are expressed as objects whose properties belong to the five elements. For example, the lotus represents the wood element and it corresponds to the second note in the scale. The sequence of notes played generates and destroys objects in the painting based on the cycles of balance, for example, water generates wood. As shown in Fig. 8.15, the fifth note (water) is played after the second note (wood) generates lotus on the water. The painting enables the users to not only visualize Confucius philosophy about music through beautiful Chinese painting, but also to learn about ancient Chinese model of the cycles of balance and the relationship between the five elements.

Another example is the Confucian cooking module as shown in Fig. 8.16. Confucius emphasized that being physically healthy is an act of filial piety. According to



Fig. 8.15 Screenshot of the final Chinese painting generated from Confucius music-painting system

traditional Chinese medicine, the human body is a miniature universe [23]. To maintain a healthy body is to maintain a balance of Yin–Yang. One way to achieve this is by choosing the correct food which is divided into hot, cold and neutral. Factors that influence the choice include the current body state and the external environment (e.g., season). Using deep modeling of such philosophy, the system allows users to gain insights into the complex concept of Yin–Yang in a unique context of food through recipe mixing game.

Before the start of the game, virtual Confucius queries the user’s body state by prompting the user to answer some questions typically asked by traditional Chinese physicians as shown in Fig. 8.17. The user then proceeds to mix and match the recipe she desires. The system calculates the Yin and Yang value of the recipe. This value is then compared with the user’s personal body state to determine if the recipe is suitable for her. It offers recommendations and alternatives if the recipe is unsuitable.

For example, in Fig. 8.17, the user’s body state is balanced but he has chosen mutton, onion and shrimp which are hot food, as the stuffing for the moon-cake. Also he has chosen 1,000 layers moon-cake skin which is warm in nature. Virtual Confucius then commented that the food is too hot for the user and advised him to eat more cold food, for example, bamboo shoots, abalone and red beans.

8.7 Conclusion

In this chapter, we have given an overview of cultural computing research and identified the main features of cultural computing. We have presented three cultural computing systems: Media Me, BlogWall and Confucius Computer. Employing extensive modern interactive media, for example, SMS, social network chat, public



Fig. 8.16 Understanding Yin–Yang concept about food through recipe mixing games



Fig. 8.17 Confucius queries the user’s body state by prompting the user to answer some questions

display and interactive video mosaic, and deep modeling of cultures, we have extended cultural computing into new cultural domains, for instance, Sri Lankan, Chinese and poetic cultures. We enable the users to explore traditional cultures and literature through the use of modern everyday computing applications, and have cultural enrichment in an entertaining manner. We are looking into evaluating the learning and transmission of culture using cultural computing systems that we have created. We hope that our research will in the future be used to allow new interactive experiences with all forms of deep traditional culture, including Greek, Arabic, African culture.

References

1. Benton, M.: Poetry for children: a neglected art. *Child. Lit. Educ.* **9**, 111–126 (1978)
2. De Silva, K.: *A History of Sri Lanka*. C. Hurst, London (1981). ISBN 0-905838-50-5
3. Feng, Y.L., Bodde, D.: *A History of Chinese Philosophy*, vol. 2: The Period of Classical Learning. Princeton University Press, Princeton (1952)
4. Free dictionary website. <http://www.thefreedictionary.com>
5. Geertz, C.: *The Interpretation of Cultures*. Basic Books, New York (1973)
6. Gonzalez, V.M., Kurniawan, S.H.: New media for intergenerational communication: the case of geriatric1927. In: *IEEE International Symposium on Technology and Society, ISTAS, 2008*, pp. 1–4
7. Hannerz, U.: *Cultural Complexity: Studies in the Social Organization of Meaning*. Columbia University Press, New York (1992)
8. Hao, H.F.: Confucius teaching methods in the Analects. *Chuanshan J.* **3**, 113–115 (2007)
9. Hu, J., Bartneck, C., Salem, B., Rauterberg, M.: ALICE's adventures in cultural computing. *Int. J. Arts Technol.* **1**(1), 102–118 (2008). doi:[10.1504/IJART.2008.019885](https://doi.org/10.1504/IJART.2008.019885)
10. Huang, S.C.: Musical art in early Confucian philosophy. *Philos. East West* **13**(1), 49–60 (1963)
11. Huang, K.-H., Deng, Y.-S.: Social interaction design in cultural context: a case study of a traditional social activity. *Int. J. Design* **2**(2), 81–96 (2008)
12. Jenkins, H.: *Convergence Culture: Where Old and New Media Collide*. New York University Press, New York (2006)
13. Klein, A.W., Grant, T., Finkelstein, A., Cohen, M.F.: Video mosaics. In: *NPAP'02: Proceedings of the 2nd International Symposium on Non-photorealistic Animation and Rendering*, p. 21. ACM, New York (2002). <http://doi.acm.org/10.1145/508530.508534>
14. Mackay, W., Pagani, D.: Video mosaic: laying out time in a physical space. In: *MULTIMEDIA'94: Proceedings of the Second ACM International Conference on Multimedia*, pp. 165–172. ACM, New York (1994). <http://doi.acm.org/10.1145/192593.192646>
15. Manovich, L.: *The Language of New Media*. MIT Press, Cambridge (2001)
16. Merrick, B.: Poetry and pleasure. *Child. Lit. Educ.* **10**, 203–205 (1979)
17. Miner, E.: *An Introduction to Japanese Court Poetry*. Stanford University Press, Stanford (1968)
18. Murthy, S., Maier, D., Delcambre, L.: Mash-o-matic. In: *DocEng'06: Proceedings of the 2006 ACM Symposium on Document Engineering*, pp. 205–214 (2006)
19. National Research Council U.S. Panel on Statistics for an Aging Population, Gilford, D.M.: *The Aging Population in the Twenty-First Century: Statistics for Health Policy*. National Academies Press, Washington (1988)
20. Nauta, R.R.: *Poetry for Patrons: Literary Communication in the Age of Domitian*. Brill, Leiden (2002)
21. Rahula, W.: *History of Buddhism in Ceylon*. M.D. Gunasena, Colombo (1956)

22. Rampley, M.: *Exploring Visual Culture: Definitions, Concepts, Contexts*. Edinburgh University Press, Edinburgh (2005)
23. Rong, J.Y., Huang, G.H., Zhang, H., Wu, M.M.: Exploration and analysis on harmony thought of inner canon of huangdi. *Chin. Arch. Tradit. Chin. Med.* **12**, 2620–2621 (2007)
24. Russel, J.A.: A circumplex model of affect. *J. Pers. Soc. Psychol.* **39**(6), 1161–1178 (1980). doi:[10.1037/h0077714](https://doi.org/10.1037/h0077714)
25. Shikibu, M., Suematsu, K.: *The Tale of Genji*. Tuttle, Tokyo (2006)
26. Shirane, H.: *Traces of Dreams: Landscape, Cultural Memory, and the Poetry of Basho*. Stanford University Press, Stanford (1998)
27. Smith, M., Morra, J.: *Visual Culture: Critical Concepts in Media and Cultural Studies*, vol. 1. Routledge, London (2006)
28. Song, M., Elias, T., Müller-Wittig, W., Chan, T.K.Y.: Interacting with the virtually recreated Peranakans. In: *GRAPHITE'03: Proceedings of the 1st International Conference on Computer Graphics and Interactive Techniques in Australasia and South East Asia*, p. 223. ACM, New York (2003). <http://doi.acm.org.libproxy1.nus.edu.sg/10.1145/604471.604515>
29. Song, M., Elias, T., Martinovic, I., Mueller-Wittig, W., Chan, T.K.Y.: Digital heritage application as an edutainment tool. In: *VRCAI'04: Proceedings of the 2004 ACM SIGGRAPH International Conference on Virtual Reality Continuum and Its Applications in Industry*, pp. 163–167. ACM, New York (2004). <http://doi.acm.org.libproxy1.nus.edu.sg/10.1145/1044588.1044621>
30. Tosa, N., Matsuoka, S., Thomas, H.: Inter-culture computing: Zenetic computer. In: *SIGGRAPH'04: ACM SIGGRAPH 2004 Emerging Technologies*, p. 11
31. Tosa, N., Obara, H., Minoh, M., Matsuoka, S.: Hitch haiku. In: *DIMEA'07: Proceedings of the 2nd International Conference on Digital Interactive Media in Entertainment and Arts*, pp. 6–7
32. Tsuruoka, Y., Tsujii, J.: Bidirectional inference with the easiest-first strategy for tagging sequence data. In: *HLT'05: Proceedings of the Conference on Human Language Technology and Empirical Methods in Natural Language Processing*, pp. 467–474
33. Weaver, R.L.: *Understanding Interpersonal Communication*, 7th edn. Allyn & Bacon, Needham Heights (1997)
34. Williams, R.: *The Long Revolution*. Chatto & Windus, London (1961)
35. Zeng, Z.: On the 'linear' phenomenon in traditional Chinese music. *J. Southwest China Norm. Univ. (Hum. Soc. Sci. Edn.)* **30**(2), 167–169 (2004)