Feedback processes in multimedia language learning software

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Abstract: Feedback has been one of the important elements of learning and teaching theories and still pervades the literature and instructional models, especially computer and web-based ones. However, the mechanisms about feedback dominating the fundamentals of all the instructional models designed for self-learning have changed considerably with the interactive multimedia technology of today, which have recourse to a wider range of potential in terms of use and functionality. The study intends to indicate that feedback has double functions: On one hand, it has classic "triad" functions—feedback as motivator, reinforcement and information—in terms of computer-assisted instruction and, on the other hand, as it is emphasized in this study, it forms the core and maintains the continuity of the machine-learner interaction in multimedia software designed today. This work, originally a discussion paper, consists of a review of the related literature and analyses of the software programs designed for teaching French to adults as foreign language in French module of Multimedia Language Learning Centre at Charles-de-Gaulle University (Lille-France).

Key words: computer-assisted language learning; multimedia language learning software; feedback; interactivity

1. Introduction

1.1 Definition and polysemy of the term "feedback"

Feedback is a basic concept in cybernetics, for this reason, the term is used more and more frequently in domains to which cybernetics is applied, such as physiology, biology, psychology, informatics and instruction (Galisson & Coste, 1976). This wide field of use has made the concept of feedback a polysemous one. In fact, the term denotes an effect of an action on the source of this action, provided that this effect is likely to encourage an adjustment, an adaptation, or a regulation of the action according to preconceived objectives. For example, in a conversation, the feedback process is at work when the speaker adapts his argument to the listener's reactions. Feedback is a complex phenomenon that is based on self-regulation processes and assumes the following: (1) the existence of a device allowing the return of the action to the source; (2) the possibility of the source to analyze this effect in return; and (3) the possibility of the source to modify the action. Although the term originates in cybernetics and its definition fits a host of situations and systems, as Mory (2004) emphasizes, most educational researchers consider the term "feedback" as the context of instruction.

1.2. Background

1.2.1 Feedback in instruction

According to Carter (1984) and Cohen (1985), in the purely instructional sense, feedback can be defined as any communication or procedure given to inform a learner of the accuracy of a response, usually to an instructional question. In terms of technology-assisted instruction, as Sales (1993) says, feedback is information

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presented to the learner after any input with the purpose of shaping the perceptions of the learner. As pointed out by Hoska (1993) and Sales (1993), such information presented via feedback in instruction might include not only answer correctness, but also other information such as precision, punctuality, learning guidance, motivational messages, advice about lesson sequence, critical comparisons and learning focus. In fact, Wager and Wager (1985) consider feedback in computer-based instruction as being any message or display that the computer presents to the learner after a response.

1.2.2 Feedback and the theories of learning and instruction: A brief history of feedback through the learning theories

A review of the literature concerning feedback in instruction shows that feedback has been incorporated into many paradigms of learning, from the early views of behaviorism to cognitivism and through more recent models of constructivism. Although the earliest studies of feedback, as early as 1911, refer to E. I. Thorndike's *Law of Effect*, the first definitions of feedback, similar to the ones we use today, date back to the early 1900s. These are known as the "feedback triad": feedback as motivator, reinforcement and information (Kulhavy & Wager, 1993).

Through the *Law of Effect* Thorndike considers feedback as a "connector" between responses and preceding stimuli. He tries to show that a response followed by a "satisfying state of affairs" is likely to be repeated and increases the likelihood of learning (Kulhavy & Wager, 1993). This view of feedback as information accentuates the role that the learner has in learning with the ability to adapt his or her response according to information in the feedback.

By the end of the 1950s, Thorndike's works give the way to Skinner's (1957) study of programmed instruction. Using principles from the *Law of Effect* and the application of reinforcement on learners, Skinner proposes a solution to instructional problems existing in the use of classroom materials. He postulates that these strategically designed materials can take learners through information in a step-by-step manner, shaping behavior and strengthening desired responses. The programmed instruction of the 1960s views feedback in these instructional materials as serving both as a reinforcer and a motivator, perpetuating a confusion of learning and incentive (Mory, 2004).

Around 1970, most researchers begin to doubt the view of "feedback as reinforcement". Although a few studies provide some evidence that feedback is following positive responses acts in a reinforcing manner (Anderson et al., 1972), as Kulhavy and Wager (1993) point out, 10 years of research under this paradigm show no systematic feedback effects. Researchers then have to look at the basic functions of feedback and numerous studies carried out during this period (Anderson, et al., 1972; Kulhavy, 1977; Roper, 1977; Barringer & Gholson, 1979; Bardwell, 1981) support feedback's ability to correct inaccurate information (Mory, 2004).

Used in the wider sense of cognitive psychology from the early 1970s, the concept of feedback leads researchers to focus on its influences on primary cognitive and metacognitive processes within a learner (Kulhavy, 1977). Examining feedback from an information-processing perspective, the learner participates in the system to correct his or her errors. As Mory (2004) notes, it is from this perspective that most research in the past 20 years has been conducted.

The latest philosophy of learning, constructivism, opens a new avenue for feedback research. Even though the majority of feedback studies in the past-examined feedback under the traditional learning theory paradigms of behaviorism and information processing, constructivist philosophy, rejecting all objectivist approaches and external knowledge within instruction, postulates that knowledge is constructed in the mind of the learner (Bodner, 1986). Feedback in such a context would aid learners in constructing an internal reality by providing intellectual

tools and would also help solve complex problems within contextual, relevant settings. Further, feedback might occur in the form of discussion among learners and through comparisons of internally structured knowledge (Mory, 1995).

1.2.3 Advances in technology

Feedback was an essential element of theories of learning and instruction in the past as an important part of instruction, and today it still pervades the literature and instructional models, especially computer and web-based models (Collis, De Boer & Slotman, 2001). In fact, as indicated by Mory (2004), these new learning systems have recourse to a wide range of the potential uses of feedback that were not utilized or considered before because the ability to provide rapid information from and to learners is today facilitated by advanced technology. Hence, there is quite a difference between Skinner's programmed instruction of the 1960s, which presented a linear series of steps, and that of today's interactive computer-based instruction.

The development of the microcomputer and its use for instruction starting in the early 1980s change the types of feedback mechanisms that were used before by learners. This is because, unlike many technologies of the past decades, the microcomputer allows interactivity: the possibility to record learner response information and the ability to adapt feedback and instruction with the aim of changing the needs of the learner within the interactive environment almost instantaneously. Towards the end of the 1980s, the growth of hypertext, hypermedia and multimedia technology, which have become increasingly common and available by means of specialized tools such as CD-Rom and DVD that incorporate all of these technologies, provide designers with the capabilities necessary to develop complex and interactive content-oriented learning software. Furthermore, emerging hypermedia and multimedia technologies not only remain in these off-line tools, but, with the subsequent rapid expansion of information connectivity of the internet during the 1990s, they also occur on the internet as "pages" or "sites" (Mangenot, 1998).

A literature review of the topic of feedback shows that it has been one of the important elements of learning and teaching theories and still pervades the literature and instructional models, especially computer and web-based ones. However, the feedback mechanisms dominating the fundamentals of self-teaching instructional models have changed considerably with today's interactive multimedia technology, possessing a wider range of potential in terms of use and functionality.

2. Purpose of the study

The study is intended to show that feedback has its classic "triad" functions—as motivator, reinforcement and information—in terms of computer-assisted instruction and also forms the core and maintains the continuity of the machine-learner interaction in multimedia software designed today. The main argument of the study is that not only does feedback in multimedia language learning software inform the learner about the results of his actions in the program through interface by informing him with "true-false" or "positive-negative" responses and motivates his future performance by consolidating his knowledge if the answer is true or positive, but it also forms the essence and maintains the continuity of the communication between machines and people.

3. Sources of evidence

Evidence sources of the study, originally a discussion paper, consists of the review of the related literature and analyses of software designed for teaching French to adults as a foreign language in a French module of

Multimedia Language Learning Centre at Charles-de-Gaulle University (Lille-France).

4. Technology and language learning

Unlike the other fields of science, foreign language teaching/learning, when considered from a historical perspective, has been renewed and reshaped, on one hand according to the conditions and requirements of the period in which it exists and on the other by the effects of scientific innovations and developed technology. However, unlike the other branches of science, this change has never been able to establish the field on exact and definite scientific data. In other words, as reported by Janitza (1990), language teaching has not become a branch of science with definite rules and principles. Yet, this change gives the field an eclectic structure. Therefore, as Useille (2002) also stated, all of the methods, approaches, techniques and principles used in language teaching have always been brought with an eclectic understanding from the past up to now.

The field of language teaching, which now has a 5000-year history (Germain, 2001), developed under the shadows of traditional grammar, rhetoric and pedagogy until the early 20th century. Developments in the fields of psychology and linguistics in the first quarter of the 20th century led to radical changes in this field, too. In the 1950s, these changes were combined with sound and picture technologies that emerged and developed rapidly during and after the World War II. This combination opened the field of language teaching to the masses, becoming a rentable field. This state maintains itself up to the present and gives way to the emergence of a field of business and industry (Kartal, 2005).

The field of language teaching needs scientific innovations and technologic inventions more than the other fields in social sciences. The principal reason for this is to produce sounds and pictures for speakers of the taught language and then to use them as course material in language classes and laboratories. For, as Coste (1996) remarked, to learn a foreign language is only possible through the discovery of that language's native speakers' behaviors and life styles, namely, culture.

4.1 Multimedia language learning software

Although the terms "multimedia" and "interaction" first emerged with the laser disc, they have reached their current dimensions thanks to CD-Rom technology and the "hypertext" technique and begun to spread rapidly (Dufresne, 1996). While at first CD-Roms could usually only be used in institutions, they have become available to the public through various fields of use, such as music, film, games, dictionaries and encyclopedias and of course along with the fall in PC prices. With this new tool, which has made it possible to store about one-and-half hours of sound, one hour of picture (video) or thousands of texts numerically, namely on a digital platform, learning software have gained an impetus. However, no scientific branch invests in this technology as much as language teaching does.

Numerical "sound-text-picture" unity, namely, multimedia technology, has not been content with only off-line tools such as CD-Rom, disc or hard-disc, but it has taken its place on the Internet, spreading all over the world in the 1990s as "sites" or "pages". Teaching/learning sites in almost all languages are designed on the web. Thanks to the services provided by the language teaching sites and Internet technology, such as electronic mail, forum groups, synchronous-diachronic chat rooms and video conference, there appears to be a chance for individual and remote teaching. In accordance with all these developments, classical language teaching laboratories begin to be replaced by multimedia autonomous language learning centers starting in the first half of the 1990s. At these centers today, multimedia software—CD-Rom, DVD and Internet sites—are used instead of

magnetic sound bands and video films.

Parallel to the developments in informatics and communication, the number of software programs and sites designed for language teaching both increased and gained variety. Today there are many software programs and internet sites designed for the teaching of certain languages, such as English, Spanish, French and German, and they are still on the increase. The main reason why these products, which are available everywhere from large shopping stores to small street shops and which are, as Martinez (1996) also stated, often designed as out-of-school teaching tools, are so popular is that they are put on the market with the claim that these tools are available for interactive and individual learning (Chevalier & Perrin, 1997).

4.2 General structure of multimedia language learning software

The software designed at the Multimedia Language Teaching Laboratory in Charles-de-Gaulle University (Lille-France) for the teaching of French as a foreign language, which was analyzed in the corpus of the study, is structurally similar to such materials and tools as other methods and exercise books, audio and video cassettes used in this field. Courses, units or modules usually start with a short film, go on with various activities on the film and end with consolidation exercises. It does not escape observation that the documents added to the modules for consolidation are not authentic, but specially produced for that software; almost none of the software programs in question make references to the daily lives of the French or the ancient French civilization.

The exercises and activities presented in the software vary in type from one program to the next. However, almost all of them are based on "comprehension", especially "oral comprehension" and general grammar rules of French. Just as the exercises and activities for oral and written narrative are too small in number, so it cannot be said that they are communicative.

When the teaching methods and techniques revealed by these tools are closely analyzed, it can be seen that there is a return to the theory of behavioristic learning and its structuralist language approach, which is said to have been abandoned. Given the trio "stimulant (sound)—response (student's oral response)—consolidation (always right answer)", which would take place in the structural exercises applied at language laboratories as the application design of the hear-and-speak method: (1) "sound stimulant" is transformed into such stimulants as picture, picture-sound and picture-sound-writing; (2) "oral response" is converted into the student's response to the stimulant in question through the computer; and (3) "consolidation" is replaced by the direct or indirect feedback provided by the computer to this manipulation. This series of manipulation-feedback is called "interaction". On the other hand, almost all of the presented exercises, namely stimulants, are in the form of traditional exercises such as "fill in the blanks", "multichoice tests" and "true-false", often designed for vocabulary, grammar, pronunciation and cultural teaching. Although these kinds of exercises strengthen the students' ability to comprehend what they read, they hardly enable them to express themselves orally and in written language (Kartal, 2005).

5. Application of feedback in multimedia language learning software and interactivity

In multimedia software, "interaction" is realized through different simulations, dialogues and various manipulations. For example, the user selects the module after opening or starting the software. Following the selection of the module, the program presents him with a short film related to the subject to be taught. The software asks the user some questions about the content following the film or gives a series of instructions under the names of different activities and exercises. Upon the user answering these questions or following the

instructions, the software gives feedback. Then the user again acts on the feedback provided and thus the feedback process concerned, namely the continuity of the machine-human interaction, is enabled (see Figure 1). In this process, "feedback" is regarded as the software's reaction to the user's choice of answer, but even so it is understood that it forms the essence of "machine-man" interaction and secures its continuity. Briefly, it can be said that "interaction" is impossible without "feedback".
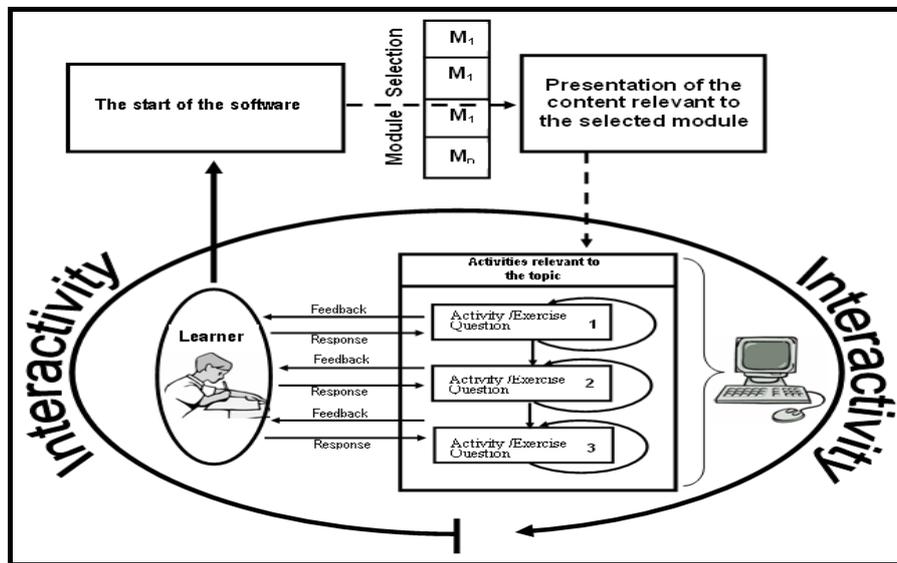
Figure 1   Feedback and interactivity

5.1 Feedback and types of questions

In language teaching software, the direct correction of the teacher has been replaced by the feedback of the computer, which may be either positive or negative (Eisenbeis, 2001). In almost all of the multimedia software developed for language teaching, there are two types of feedback: indirect and direct. In multiple choice questions for the purpose of "oral comprehension" that contain questions on the content of the video and in other "written and oral comprehension" activities and exercises, direct feedback has been preferred (see Figure 2).
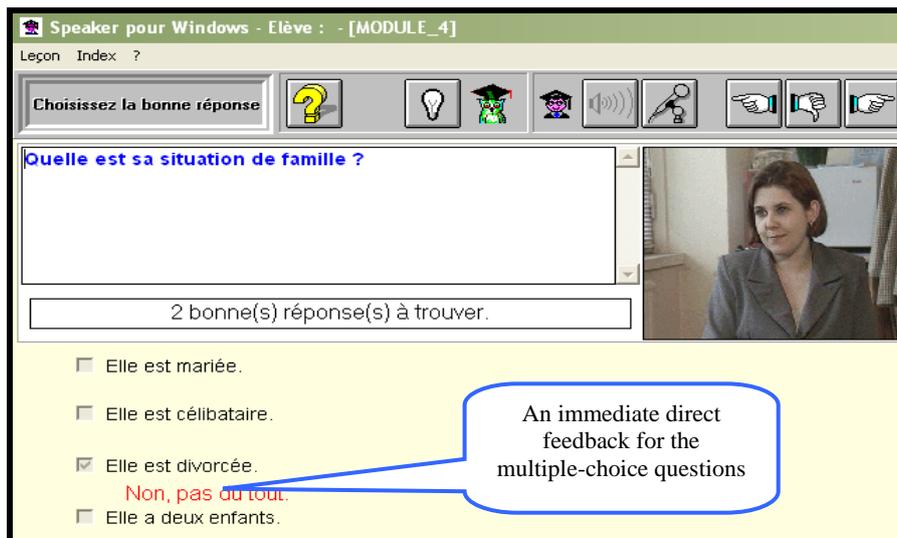

Figure 2   Direct feedback for the multiple choice questions [*Je vous ai compris 1*, Module 4: Chez le médecin]

However, even if they have a one-answer solution, it is given indirectly for the oral and written production exercises as seen in Figures 3 and 4.
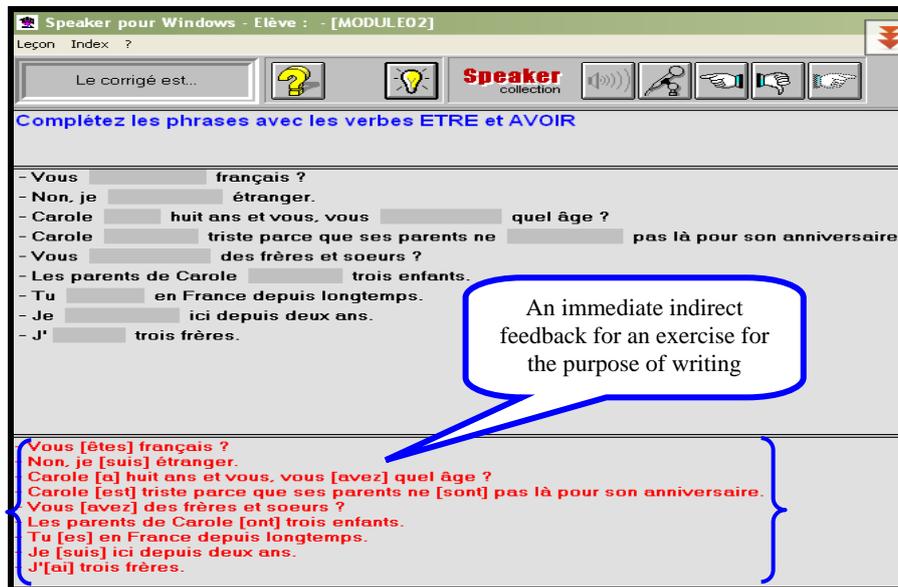

Figure 3   Indirect feedback for an exercise for the purpose of writing [*Pour tout dire 1*, Module 2: Qui est Carole?]
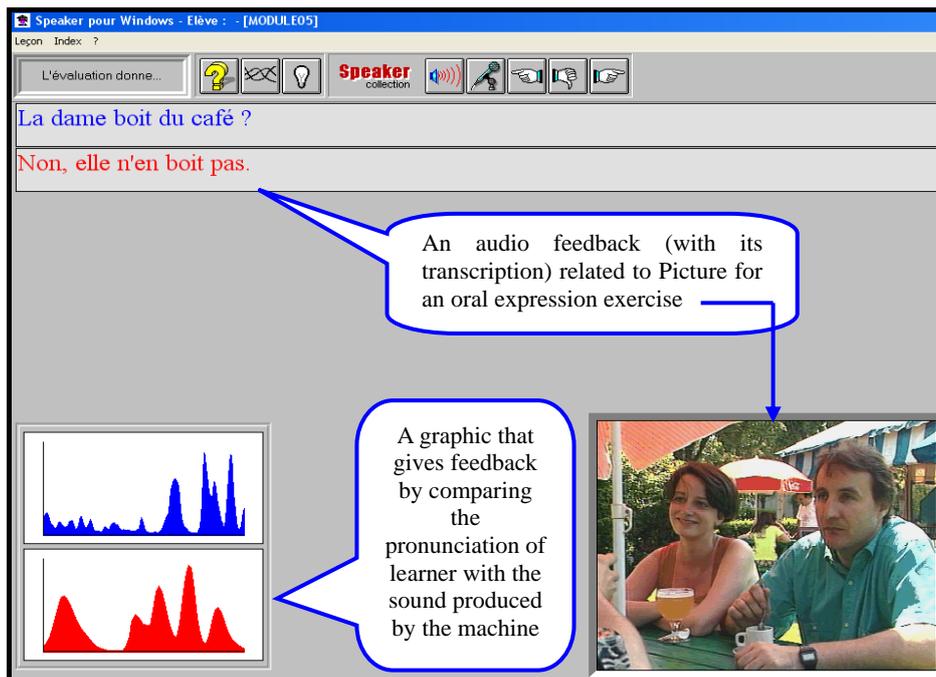

Figure 4   Indirect feedback for oral expression exercises [*Pour tout dire 1,* Module 5: Au marché]

In fact, the most important factor that determines the form of the feedback, direct or indirect, in these software programs is the types of questions in the activities and exercises presented. Since the programs are created for autonomous learning (Derville & Perin, 1998; Mangenot, 1997), the questions contained in them are usually "closed-type" questions (alternate-response); in other words, they have just a single correct answer, such as "true/false", "yes/no", "association, or matching", "fill in the blanks", "multiple choice" and "marking". The

programs contain open-ended questions for writing skills, but no feedback whatsoever can be provided for such activities (Figure 5).
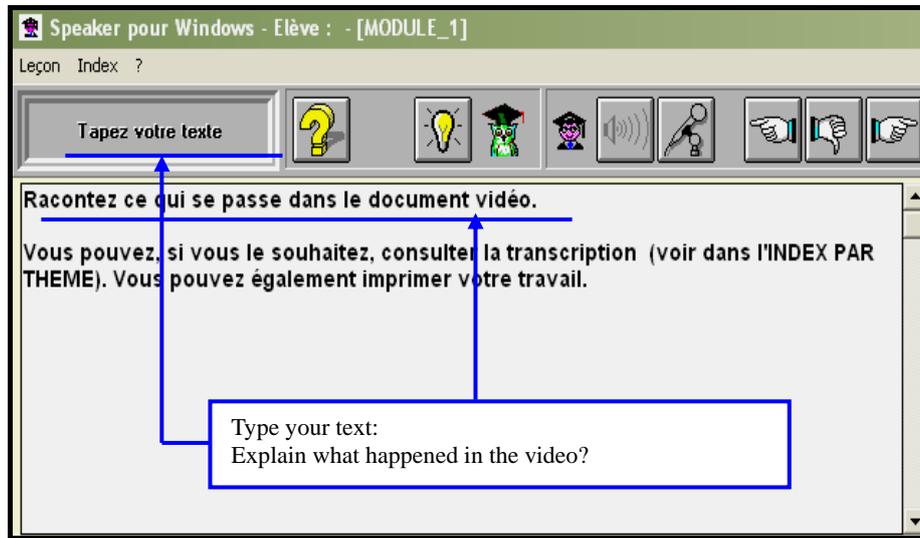

Figure 5   Open-ended writing activity for which no feedback can be given [*Je vous ai compris 1,* Module: La dispute]

5.2 Functionality and quality of feedback

As pointed out by Alessi and Trollip (2001), the most common function of feedback in multimedia software is to inform the learner about the accuracy and validity of the answer he or she gives. According to Schimmel (1988), the feedback provided by these tutorial software programs should always be positive and corrective, and the learner should be encouraged to improve his or her ability to think and comprehend in particular. The feedback provided to the learner in the software analyzed in the corpus of the present study is usually positive and corrective, as indicated in the research literature; it is also observed that it both informs the learner about the accuracy and validity of the answer he or she gives and encourages him or her to improve thinking and comprehension (see Figures 2 and 4).

5.3 Timing of feedback

In such software, "timing of feedback" refers to whether feedback occurs immediately after an error or is delayed (Alessi & Trollip, 2001). In the software under analysis it is observed that the feedback is usually given immediately (see Figures 2 and 7) but it may occur later or with delay in some software programs, as in the example of LTV Français (Figure 6).

Moreover, a review of the literature on the timing of feedback indicates that proper timing of feedback depends on the nature of what is being learned and how it is being learned. For example, Kulik and Kulik (1988) maintain that in studies in which the nature of learning is similar to that of taking a multiple-choice test with feedback, delayed feedback shows an advantage. In contrast, studies in which the nature of learning is more like a typical multimedia program, as in the software under analysis in the study, show an advantage for immediate feedback. Additionally, immediate feedback, as emphasized by Anderson (1982), is more likely to enhance the learning of procedural knowledge. It may also be the case, as Gaynor (1981) indicates, that learners believe that the computer is not working properly when feedback is delayed. Therefore, it is recommended that immediate feedback should always be used in multimedia programs.
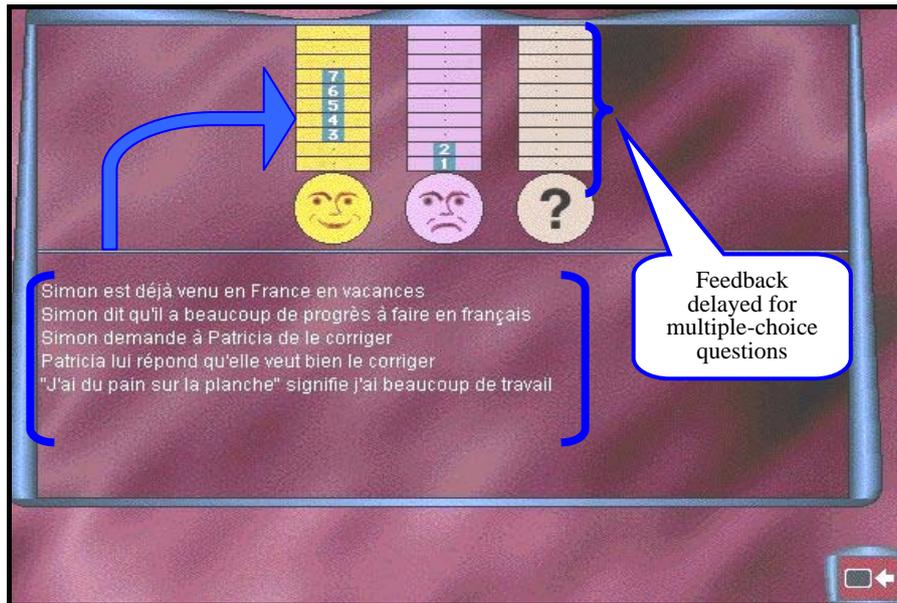
Figure 6   Feedback delayed for multiple-choice questions
[*LTV Français*, Module: Le voyage, Sequence: Rencontre à l'aéroport]

5.4 Types of feedback

The type of feedback in the software is determined by the question types in the activities and exercises presented. The types of feedback in the software programs in question can be categorized in three groups:
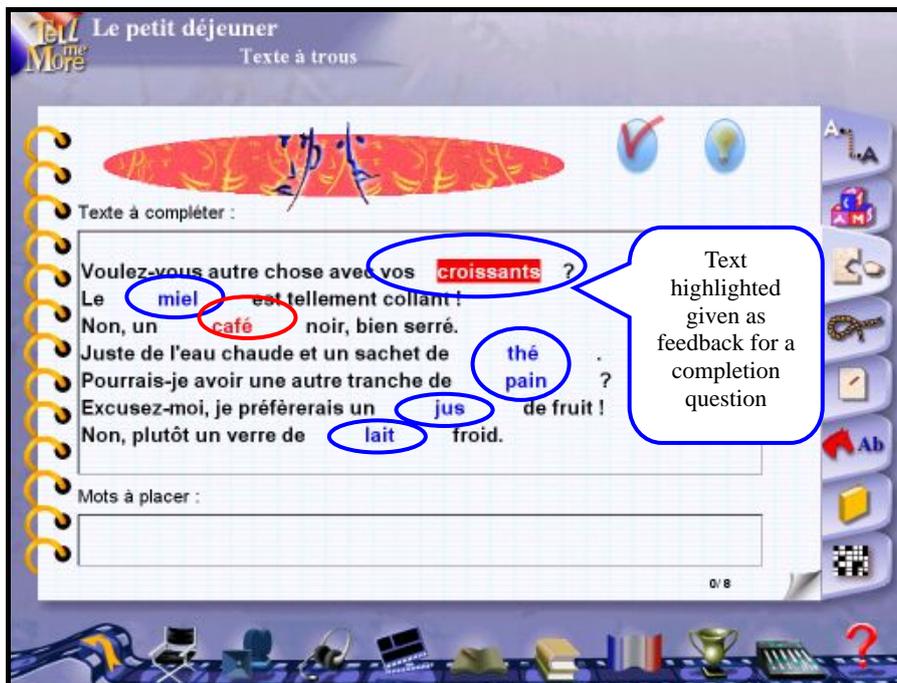

Figure 7   Text feedback given for a completion question [*Tell me more 2*, Module: Le petit déjeuner]

5.4.1 Text feedback

In all these software programs, the most common type of feedback is providing the correct answer in text form below the learner's incorrect response (see Figure 2). For completion questions, this is usually the word or

phrase most preferred in the blank (see Figure 3). In these types of questions, feedback in the form of the correct answer may be inserted directly into the blank (or blanks) in the original question as seen in Figure 7.

Although aesthetically pleasing, as emphasized by Alessi and Trollip (2001), feedback of this type might go unnoticed by the learner because the eyes may be looking for a response lower on the screen. Hence, a learner is more likely to miss something that is added to the screen above the last item read than below it. A technique for highlighting text is probably advisable to make feedback obvious, as shown in Figure 7.

5.4.2 Audio feedback related to picture and graphic

This kind of feedback is especially seen in the activities and exercises of oral expression, oral repetition and phonetics (see Figure 4). Additionally, audio feedback is used in exercises like alternate-responses in some software programs, as in the example Tempo 1. After the learner marks the answer alternative related to the question he or she is asked, such as true or false, he or she is encouraged by such exclamatory feedback as "bravo", "excellent" and "you succeeded" if he or she gives the right answer so that he or she goes on with the subsequent steps. However, in the case of wrong answer, the learner is responded to with such expressions as "you lost", "sorry" and "no", and then he or she is asked to return to the exercise again.

On the other hand, such software programs as "Pour tout dire" (To say all) and "Je vous ai compris" (I have understood you) produced with the multimedia program called "Speaker" offer the learner a chance to compare his or her own pronunciation with the available pronunciation of the same word or sound in the program by recording his or her own pronunciation via microphone. Thanks to this apparatus, the user can get feedback about his or her own pronunciation (see Figure 4). According to Schimmel (1989), such feedback presented in graphics also encourages further analysis and thinking rather than merely giving the correct answers to the learner. On the other hand, as Alessi and Trollip (2001) claimed, audio may be most useful as feedback related to visual but nonverbal information (such as a picture or map) because it allows inspection of the visual information while listening to oral feedback.
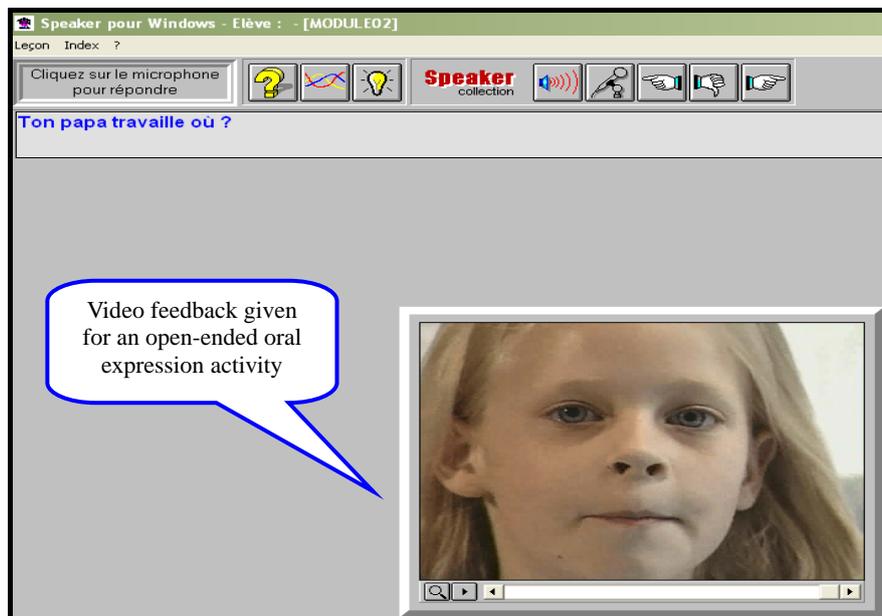
5.4.3 Video feedback

Figure 8   Video feedback given for an open ended oral expression activity [*Pour tout dire 1*, Module 2: Qui est Carole?]

Though rare, feedback is provided to the user via video in some open-ended oral expression activities, as seen in Figure 8. However, the video provided here offers neither a visual sequence nor a visual sign about the feedback issue. The feedback provided via video cannot go beyond being the vocalization that can be the answer to the question concerned. It is at this point that with reference to the theory of Lalley (1998) and Pavio (1986) called Dual Coding, it can be said that video feedback may be especially beneficial when a visual sequence or process is being taught.

6. Conclusions

A review of the related literature and analyses of the software programs designed for teaching French to adults as a foreign language in the French module of Multimedia Language Learning Centre at Charles-de-Gaulle University in Lille of France make up the study, which was originally a discussion paper and in which the processes of feedback in the software programs concerned are dealt with. Following the literature review concerning the term feedback within the context of the study, the types of feedback in the software have been determined and their structure, functionality, quality, timing and type have been analyzed. Then an attempt has been made to interpret the findings obtained through the findings of the present study and those of the literature. A review of the literature regarding feedback shows that feedback, which used to be an important part of learning theories in the past, also is an important role in the new learning environments designed today with the use of technology in the instructional field.

It has been observed that not only does feedback in multimedia language learning software inform learners about the results of their actions in the program through interface by informing them with "true-false" or "positive-negative" and motivate them by consolidating their knowledge if the answer is true or positive, but it also forms the essence and maintains the continuity of the communication between machines and people. On the other hand, it is also seen that besides the software's own technical features (as in the example of "Speaker"), all the qualities of feedback in language learning software are directly related to the structural, content and linguistic purposes of the activities and exercises provided.

In almost all of the software analyzed within the corpus of the study, the learner is given two types of feedback during his/her interactions with the software: direct and indirect. It is seen that the most important factor that determines the type of feedback is the form of questions in the exercises. As the software programs concerned are designed for self-teaching, the exercises usually consist of closed-ended alternate-response questions. Especially following the video at the beginning of the module, "direct" feedback is provided for the multiple-choice questions to the learner for "oral comprehension" and the questions for "written and oral comprehension" in the other closed-ended alternate-response form. Yet the user is provided with "direct" feedback even if the questions in the "written" and "oral" expression exercises are closed-ended and have a single answer. It is observed that the feedback introduced in the software is usually, as indicated in the literature, positive and corrective in quality, timing and functionality, and it motivates learners to think about their answers by informing them about the accuracy and validity of their answers as they are given instantly. On the other hand, three types of feedback are presented: text, picture-supported audio and video. It is seen that the type of feedback presented is determined by the types of questions in the exercises.

As a result, the developments in the field of informatics and technology find their reflection in the teaching environments designed for self-teaching. Feedback is the basis of all self-teaching designs, and its mechanisms

have changed considerably thanks to multimedia interactive computer technology, it also embraces a wider range of potential in terms of functionality and usage. One of these change mechanisms is, as the author has have tried to maintain in the study, that feedback did not only emerge as a measurement tool in multimedia interactive software but also enables the continuity of the interaction, or communication, between machine and learner. Accordingly, the author has arrived at the conclusion that, while designing new teaching models, such qualities regarding feedback should also be taken into consideration.

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Appendix:

Software analyzed

Je vous ai compris 1 (I have understood you). (1996). Paris: Neuro-concept.

LTV Français (LTV French). (1996). Paris: Jériko.

Pour tout dire 1 (To say all 1). (1997). Paris: Neuro-concept.

Tell me more 2. (1998). Paris: Aurolog.

Tempo 1. (2000). Paris: Didier.

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