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"State-of-the-Art and Adaptive Open-Closed Items in Adaptive Foreign Language Assessment "

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SUMMARY

In the era of multilingualism, foreign language testing needs to be immediate and accurate. This paper will make a full description of the state of the art in Computerized Adaptive Language Testing, with reference to current implementations in this field. Moreover, the paper will focus in one of the main problems in CALT, regarding the valid and reliable discrimination between the proficient foreign language (FL) examinee and the good examinee. Finally, the paper will describe a method applicable in close-ended items that will give the opportunity to proficient FL examinees achieve higher marks without influencing the scores of the other examinees.

KEY WORDS: *Computer Adaptive Testing (CAT), English as a Foreign Language (EFL)*

INTRODUCTION

Computer Based Testing (CBT) or Computer Adaptive Testing (CAT) is an official branch of Computer Adaptive Language Learning (CALL) and research in this area aims to create systems that will measure language proficiency as accurately as traditional means of foreign language testing. CAT is regarded superior to paper-and-pencil (P&P) tests as it consists of a larger and ever changing adaptive item bank, it can be individually administered, and it is interactive and time independent.

CBT can accurately assess both receptive and productive skills. Certain exercise types such as gap-filling, multiple-choice (MC), true/false, word order, crosswords and jigsaw puzzles can be easily programmed by foreign language (FL) examiners. Close-ended questions can be easily authored and assessed in electronic form, while open-ended questions and compositions still need more specialized programming entailing Natural Language Processing (NLP) software. Nowadays, CBT is not only a field under research, but it is also used as an alternative assessment tool for authorized foreign language examinations such as TOEFL.

Though a promising field of study, little implementation in large-scale language assessment has taken place. In this paper, we will make a review of CAT. Then, we will review the implementations up to date. Finally, we will present a model for computer adaptive open-closed items, which will contribute to item discrimination parameters and will be able to discern better between proficient and good learners.

PERSONALIZED LEARNING AND ASSESSMENT

Global on-line education has created diverse, cross-culture, mix-ability students. The one-to-many, teacher-centered tutoring model that was used in traditional education up to date and in the previous generation of Computer Aided Instruction (CAI) is no longer applicable to distance education due to students' heterogeneity. Modern adaptive learning environments acknowledge the fact that there is no average student model with predetermined behavior and are adapted to students' diverse educational and socio-economic background, age, sex, nationality, motivation and time and place accessibility. Moreover, the rapidly evolving Information Society demands constant retraining of the global workforce (Twigg, 1994). Thus, today and tomorrow's students stem from various age groups. In personalized learning and assessment emphasis is given in students' differing ability, interest, motivation, learning needs, and achievement. In order to foster learners' success, we need to adapt learning environments to accommodate learners' diversity accordingly. To this end, tomorrow's education needs to provide the new student society with the tools to construct their own knowledge with their own pace, ability, individual learner characteristics and aptitude (Schunk, 1996).

ALTE (The Association of Language Testers in Europe) is an association of providers of European foreign language examinations. One of ALTE's main aims is to establish common levels of proficiency (the ALTE Framework) in order to promote the transnational recognition of certification in Europe (Jones, 2001). New technologies promote personalized learning due to their flexibility, scalability and multiplicity. Therefore, new advances in education pave the way for new opportunities in education and learning, bridging the gap between students' diversity and classroom based homogeneous learning. Research on constructivist teaching and learning models also enhances student, and especially at-risk student engagement. Emphasis must be given on the practice of basic skills in the context of working on authentic tasks and the integration of higher order thinking skills, authentic tasks and mixed ability groupings. It is proven that the new technologies as an instructional medium are profoundly preferable to students, whenever they make the lesson interesting (Ali, 2001), motivating and interactive. The computers' multimedia and hypermedia software together with the computer peripherals, such as digital cameras, digital audio, scanners, projectors and computer access solutions for students with special needs can provide student centered learning and authentic, interactive and intra-active experiences, that will sharpen student cognition and decision taking.

COMPUTER ADAPTIVE TESTING (CAT)

CAT is a branch of CBT and Artificial Intelligence (AI) that provides personalized testing and more accurate results concerning the cognitive level of every individual. In other words, CAT is tailored to the ability and level of each examinee. Based on an algorithm, the computer can update the estimate of the examinee's ability after each item and select the next item on the basis of the new ability estimate. On the basis of the examinee's previous answer, the system acts as a human examiner and selects the next item which is of greater difficulty if the examinee has answered correctly, or of less difficulty in case the examinee gave a wrong answer.

Adaptive tests can be designed without being computerized. Yet, the technological advances over the last decades have developed computers with high speed and storage in low prices, making them available to people of all ages and economic background. Apart from that, all public schools have networked computer labs, where pupils can get accustomed to the use of Internet and hypertext from a young age. Finally, most international testing organizations have started delivering their tests in CBT and CAT mode, making their tests available to even more people, more frequently and in less time.

CAT systems have certain advantages. To begin with, CAT systems are student centered as they – contrary to the P&P counterpart – can update the estimate of the examinee's ability, called User Profile, after each item and can be used in the selection of the subsequent items. They also have increased efficiency, greater precision with less items, longer duration as only a few items from the item bank are exposed. Thus, the tailored item selection can result in reduced standard errors and improved accuracy for scores for high and low ability test takers. Tailored item selection also leads to avoidance of examinee's boredom from answering too easy questions and of frustration from answering too hard questions. Many problems associated with P&P tests such as ambiguous answers or physical problems with the answer sheets (Wainer et al, 2000) are being solved. Moreover, these systems are time-effective, since fewer items are needed to achieve accuracy. Computer Adaptive Tests (CATs) offer also greater test security (Wainer et al, 2000) than traditional P&P tests, as the item pools are great and it is impossible for the examinee to know the items in advance. CATs share all advantages of CBT, such as immediate feedback and self-pacing. Web-based CATs exploit the capacities of the net, such as on-line, immediate scoring, easily downloadable software, and low cost software and item pool update.

Yet, research has revealed some drawbacks. Firstly, CAT, similarly to CBT, requires an equipped computer lab and computer literate examinees. Furthermore, CATs are not applicable to all subjects and skills, as they are based on the Item Response Theory model (IRT), which is not applicable to all item types. The fact that CATs require careful item calibration renders that incapable of including items that cannot be easily calibrated, such as open-ended questions. Apart from that, hardware limitations may restrict the types of items that can be administered by the computer. Another crucial drawback is that the examinees are not permitted to go back and change answers, as the program selects next items on the basis of the answered items. This fact renders reviewing implausible, and in many cases examinees that sat both P&P and CATs failed or achieved low marks in computerized testing. Studies show that only when both P&P and CAT had the same test-taking flexibility (e.g. item review), test results were equivalent (Sawaki, 2001). CAT philosophy, however, prohibits reviewing. To sum up, CAT systems have both merits and flaws, and they cannot specialize on every plausible item.

TEST THEORY IN FL TESTING

Classical test theory is closely related to psychology and error correction. Studies in test theory tried to explain the occurrence of errors and their anticipation. Variation in examinee's ability seems to be the most important systematic cause of variation in responses. Every other cause including environmental, or psychological conditions are non-systematic in nature (Linden and Hambleton, 1996).

Foreign language tests are divided in large-scale and classroom-based and they are separated in various categories. Aptitude tests assess learners' general ability prior to learning. Placement tests put learners in levels and arrange courses. Admission tests define which learners will be admitted in a particular course. Achievement tests aim in language certificates. Progress tests assess learners' progress at different stages of the course. Proficiency tests assess examinee's proficiency in the target language, and diagnostic tests define learners' strengths and weaknesses (Bailey, 1998). These tests can be delivered in traditional, P&P, in-class or CBT form. Traditional tests are fixed-length, whereas computerized tests, especially CATs can also be variable-length. Some tests can also be self-assessed.

In foreign language assessment, a well-constructed test needs to have some basic qualities. Test scores measure the degree of examinees' proficiency and should be valid and reliable. A test needs to have reliability in order to measure examinee's performance accurately and to certify the true ability of the examinee in various successive versions of the same test (Hughes, 1989). Any error of measurement in an individual's score is due to lack of reliability and in such a case the test is considered unreliable. Validity is the second test quality that shows whether the test has measured the intended skills and abilities it was constructed to measure (Bachman and Palmer, 1996). A valid test needs to assess examinee true ability accurately. A test needs also to be practical and economic. Maximum quality with less effort and within less time is preferable. Economy in time and item selection can result in increased test production and higher scores from the part of examinees. In order to be complete, foreign language tests should measure evenly productive – speaking and listening – and receptive – reading and writing – skills. The subsets of every skill have to be analogous in length, level and time. Finally, test developers should take into consideration the impact of their test. Tests can affect a society in many ways. Assessment methods depict the philosophy of the educational system, serve the needs of the society (Bachman, 1990) and can influence examinee's behavior.

CALT AND THE FOUR SKILLS

Traditional Computer Adaptive Language Tests (CALTs) follow a patterned procedure. Test items are categorized in terms of levels of difficulty. The test starts with an item of average difficulty that corresponds to the level of the average student. If the item is answered correctly, the system selects an item of a higher level of difficulty, while in the opposite case, the chosen new item is less difficult than the previous. The test proceeds in the same pattern, until the stopping parameter comes. The test score derives from the average level of difficulty of the items answered correctly. Item response times can also be monitored in order to be tailored to each examinee or give some information about the examinee's performance. Response times are different for each individual and reveal various traits and cognitive skills. This supposition is against strict time limits, advocating that there should be given adequate time per item, in order for the test taker to decide calmly (Schnipke and Scrams, 1997). Research has also shown that response times for wrong answers are longer that those for correct answers (Hornke, 2000). Therefore, the more time an examinee spends on an item, the more prone he/she is to mistake.

Vocabulary knowledge in FL is considered one of the most important factors indicating FL fluency. Different lexical items are measured in various levels of language proficiency. Adaptivity of vocabulary items is therefore important and imperative. One way to assess vocabulary is by categorizing words into levels of competence. Some lexical groups presuppose the knowledge of others in lower levels, and this is an indication of the size of vocabulary each examinee has. Another way to assess vocabulary is by measuring the strength of vocabulary knowledge, which can be separated in four levels of difficulty, starting with the easiest: receptive recognition, receptive recall, productive recognition and productive recall. Studies in this field have shown that adaptive tests measuring vocabulary knowledge in terms of size and strength have managed to assess examinee's level of vocabulary knowledge accurately (Laufer, et al, 2001).

Up-to-date, most large-scale administered adaptive tests do not have an adaptive component in oral proficiency. Yet, research in this field is taken and some systems are already in use. The Center for Applied Linguistics (CAL) has developed the Computerized Oral Proficiency Instrument (COPI) in Arabic, Chinese and Spanish, an adaptive test that gives many initiatives to the test-takers. Examinees are given more control of various aspects of testing and a self-assessment tool enables the system to extract more information about the examinee's oral proficiency. Thus, the CAT has plenty of information to rate and calibrate the examinee's performance, leading to scoring accuracy.

CAT is widely used in large-scale examination for the assessment of examinees' FL reading and listening proficiency. Reading is a receptive skill and can be easily assessed in multiple-choice, close-item form or in the form of close-open items that can be easily computed in an adaptive algorithm. The important issues in the development of adaptive reading items regard the reading construct validity, the IRT theory used and the measurement of the items. Adaptive listening items assess examinees' ability to understand a range of oral speech, from short utterances, such as single words to short monologues and dialogues and to longer discussions (Dunkel, 1997).

Open-ended questions and open writing tasks are still marked by human examiners, as there is no valid NLP technology to undertake electronic marking. However, recently advances have been made in text and speech recognition, enabling electronic short answering, information retrieval and summarization with the use of semantic parsers, syntactic parsers, text mining, language databases and electronic corpuses (Harabagiu and Ciravegna, 2002). Some large-scale tests, such as GMAT make partial use of e-marking programs, together with human readers. E-rater is am essay scoring e-marking NLP program developed by The Criterion Online Essay Evaluation Service in Education Testing Service (ETS). The system is designed to mark the two types of essays of the GMAT examination holistically in a few seconds, based on cue-words, terms and structures recognition techniques (Burstein, et al, 2003). The program marks together with a human reader, and it is regarded highly reliable (Burstein and Wolska, 2003). However, scores of essays written by non-native speakers of English had a slightly bigger variation between e-rater and human readers, showing that there are some non-native syntactic and semantic structures not evaluated by the e-rater (Burstein, and Chodorow, 1999). Though promising, e-rater cannot still be used exclusively, without the surveillance of a human reader, as studies have proven that such programs can be fooled by experts in writing (Powers, 2001). Future research on electronic paraphrasing and lexical metonymy may enhance its accuracy (Burstein, 1996).

CALT APPLICATIONS IN LARGE SCALE TESTING PROGRAMS

The Oxford University Press Quick Placement Test (QPT)

QPT is the official Oxford placement test that is issued in both paper-and-pencil and CBT form. It is designed to calculate accurately English language learners' level of proficiency, from the beginner to the very advanced (Cambridge Proficiency Examination) stage. Its computer-based version is adaptive, using item banking and IRT and it takes 15-20 minutes to administer, whereas its P&P counterpart takes 30 minutes to complete. Thus QPT CBT needs half of the time to make estimation. Another advantage over the P&P version is that QPT CBT can assess vocabulary, grammar and reading proficiency, and also listening comprehension. All items are in MC form, making the test easy even for the computer illiterate examinees to complete. The existence of both versions can assert the reliability of the computer-based version, as a failed examinee in the computer-based version can reassess his/her level by taking the P&P version and compare the scores. Examiners can save precious time that can be dedicated to assessing examinee's oral and writing skills with face-to-face interviews and short essays. In such a way, examinees may have the opportunity to assess all language skills quickly and time-effectively.

TOEFL

The computer-based version of the test was introduced in 1998. TOEFL has a wide examinee population from divergent cultures. The adaptation of the system to this bulk of examinees is a great challenge, considering the cultural and linguistic diversity of the test takers. Today, the test is partly adaptive, incorporating a wide range of items and question types that can be fount in its P&P version together with new items that exploit the visual and audio capabilities of ICTs.

To prepare students for the CBT version, tutorial lessons have been developed, teaching examinees basic computer skills. Only the Listening and Structure sections of the test are adaptive, altering their level of difficulty by presenting error correction and MC items according to the examinees' performance. The reading section consists of an arbitrary and not adaptive selection of passages with questions. Finally, the writing section can be either computer-based or paper-based, marked by specially trained examiners via an on-line scoring network system (OSN) (Lee, 2001). Examinees have the opportunity to change answers as long as they do not confirm the final choice. When the confirmation button is selected, the examinee cannot go back to change the answer and the system selects the next item. The greatest challenge of TOEFL is how to guarantee validity and reliability in the unidimentional IRT calibration and scaling, and in the item selection algorithm for multicultural examinees.

Computerized Oral Proficiency Instrument (COPI)

The Computerized Oral Proficiency Instrument (COPI) is a self-administering, adaptive, multimedia speaking test that allows examinees control over various aspects of the test situation. Its speaking tasks follow the model of the tape-based Simulated Oral Proficiency Interview (SOPI). However, unlike the SOPI, on the COPI examinees are given at least partial control over several aspects of the test administration. These aspects include amount of thinking and response time, speaking functions and topics to which to respond, level of difficulty of several of the tasks, and the language of task instructions. While examinees typically respond to seven tasks, a large underlying pool of tasks, together with the flexibility of multimedia, allows examinees this control. Speaking tasks on the COPI are grouped into four levels of difficulty. At the start of the COPI, examinees complete a self-assessment of their speaking ability. The outcome of the self-assessment provides both the examinees and the test administration software information regarding at which level of difficulty to start the test (Malabonga, 2000, Malabonga, and Kenyon, 1999).

BEST PLUS (Oral English Proficiency Test)

BEST Plus is the oral component of the Basic English Skills Test (BEST), developed by the Center of Applied Linguistics (CAL). It has a computer-based, adaptive section and a semi-adaptive printed test booklet for the assessment of oral proficiency. In its computer-adaptive version, the algorithm selects the appropriate item out of a large pool, so that very few items can be repeated and the validity of the test is increased. Items are categorized according to personal, community and occupational language use domains, and the algorithm selects items related in terms of theme and level of difficulty in order to simulate the element of human communication (Stauffer and Kenyon, 2001). Answers are listened and scored by the test administrator, while the algorithm selects next items prompted by the previous score. The test can assess all proficiency levels in terms of listening comprehension, language complexity, and communication of meaning. BEST Plus was successfully pilot-tested and is widely used for multicultural learners of English.

GRE – Graduate Records Examination

The Graduate Records Examination (GRE) is not a FL examination. However, it includes the Verbal Ability measure module, which is adaptive. In general, GRE General test aims to assess students' verbal, quantitative, and analytical writing skills in English, both as a native or foreign language. Two of the aforementioned skills – verbal and qualitative – are adaptively tested.

The items of Verbal Measurement are separated in four sections: analogies, antonyms, sentence completions and reading comprehension, selected in arbitrary order. They measure the ability to use synthesis and analysis skills, understand terms and concepts, extract specific information and find relationships between words or sentences.

Comparability studies in 1992 showed student acceptance of the CBT version and final equation of the CBT linear mode and its P&P counterpart (Schaeffer, et al, 1995). A second comparability study took place in 1998, that resulted in higher CAT mean scores for lower-scoring P&P groups, such as minority students and women, due to the implementation of the 80% scoring method (Schaeffer, et al, 1998), which lead to the initiation of the proportional scoring method.

The CBT version of Verbal Measurement is different from its P&P counterpart (GRE Practice General Test, 2003/2004). The final score depends on the statistical characteristics of each item, the content covered, the variety of the items, and the item answered in the allotted time, while the CAT functions like a test assembler, managing also, among other things, item exposure and overlap, and conditional standard errors of measurement (CSEMs) (Schaeffer, et al, 1995). Scoring uses an IRT maximum likelihood theta estimation procedure, building the examinee's ability estimate after his/her performance on every item. The final score is a scaled score that can be compared with the "number-right" true score (Schaeffer, et al, 1995).

GMAT CBT

The Graduate Management Admission Test (GMAT) measures basic verbal, analytical writing and mathematical skills, acquired via school or academic education and work. The analytical writing section (AWA) is administered to assess analytic skills on processing issues and arguments. Two tasks are administered and should be analyzed in 60 minutes. The essays are scored either by two human examiners or by one human examiner and the E-rating electronic system by ETS. There is special treatment of non-native test-takers by the examiners.

The verbal section of the GMAT has three types of MC items: reading comprehension, critical reasoning and sentence correction, assessing both cognitive and language skills. Reading comprehension assesses word understanding, logical relationship between concepts and arguments, inferences drawn, and understanding of qualitative concepts in verbal form. Critical reasoning assesses argument construction and evaluation and plans of action evaluation. Finally, sentence correction assesses correct and effective expression in lexical, grammatical, and structural terms. To ensure validity, GMAT scores are compared with students' grade point average (GPA) as well as other predictors to (GMAC Validity Study Service 2002–03).

Both GRE and GMAT developers acknowledge the fact that these tests cannot accurately measure the actual examinee performance on a working or academic environment. Therefore, the aforementioned tests can assess ability partially and not holistically, making only estimations on students' abilities (Guidelines for the Use of GRE Scores).

THE PROBLEM

CALT technology can and should be student-centered. CALT nowadays is based on a solid programming that is collective rather than individualized and fails to include crucial cognitive parameters of student language competence and performance (Giouroglou and Economides, 2003). Such systems cannot replace the human examiner without nasty consequences for its group of examinees.

As described above, the vast majority of the current FL CATs use multiple-choice (MC), close-ended items to discriminate among proficient, good and weak learners. This is mainly due to the fact that MC items are easily programmed and calibrated using adaptive technologies. The program can easily identify correct and wrong answers and move on to easier or more difficult items. This technique is also reliable and valid as long as items are adequately pre-tested and correctly calibrated. Examinees receive valid assessment, while the guessing parameter is decreased in proportion to the number of items presented. However, MC items cannot allow active expression and language production. Examinees are passive viewers of the proposed answers and they only try to segregate the correct answer out of the destructors. This method is widely used by official language testing organizations, such as the University of Michigan Certificates in English, while other organizations use a variety of MC and open-closed items, such as the Cambridge Syndicate. Proficient learners answering MC items are not given the opportunity to discriminate themselves from good learners by openly typing the correct answer in an open-closed item in case they know it. They are forced to choose among the four intended choices and receive the same marks as other learners who will purposefully or accidentally choose the correct item. This limitation does not allow the proficient learner discern from others by testifying active language production. CAT programmers can easily prepare an additional alternative path for examinees, rewarding the proficient ones and not influencing the mark of those who fail to answer.

METHOD

In order for the proficient learner to excel, each item should provide each examinee with two options. The introductory sentence or question will be presented alone (fig.1), without the multiple-choices. Two buttons below the item will allow examinees either to answer the question as an open-close (O/P) item in the form of gap filling or constructed response (CR), or proceed to the MC selection mode.

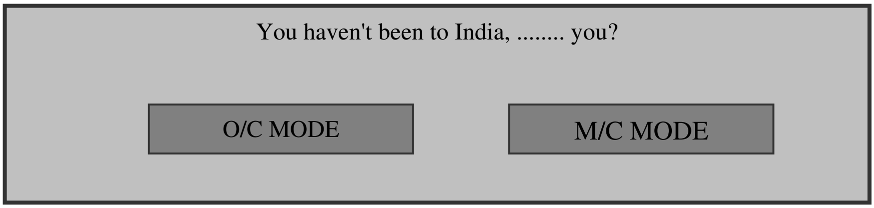

Figure 1: Item presentation

If the examinee knows the answer and is able to produce it, then he/she will select the O/C mode (fig.2) and will have the opportunity to demonstrate his/her advanced knowledge. A correct answer will receive a bonus in the total score and will update the User Profile of the examinee. A wrong answer will not affect the final score and it will immediately direct the examinee to the MC mode. When the MC mode is displayed, the examinee cannot go back to the O/C mode.

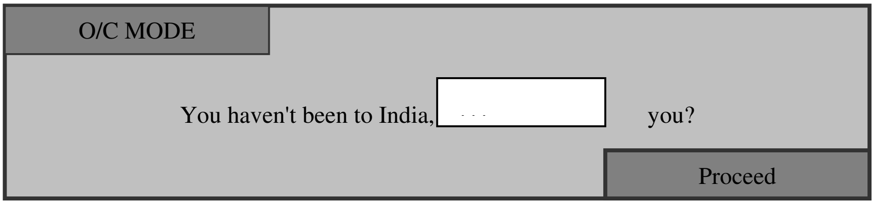

Figure 2: Open-closed mode

Examinees that do not select the first option will not be negatively scored. This method will not affect the final score of the test or punish a wrong O/C answer. Instead, it will give the opportunity to the examinees to demonstrate productive FL use and active FL extraction from their long-term memory. Moreover, the examinee will not know whether the item is answered correctly in the O/C mode. After filling-in the gap, the examinee will proceed to the MC mode of the same item. This technique will ensure that in case the examinee gives a wrong answer, he/she will not be facilitated by the system by knowing that mistake. If the examinee knows that he/she has answered wrongly, and his wrong answer is also one of the distracters, then the program will have helped him and the validity of the answer will be decreased. All in all, this method aims to increase the discrimination parameter among examinees, produce more valid ability estimation and decrease the guessing parameter that has a high percentage in MC items. This method is under development and will soon be pilot-tested to EFL examinees.

CONCLUSION AND FUTURE CHALLENGES

CALT research in the future will still be concerned with ways to administer valid and reliable tests that will assess in no time the four language skills. To this end, advances in a number of fields is required in order to administer tests able to assess both close-ended and open-ended items, as the validity of multiple-choice testing has been seriously criticized (Chapelle, 2001). Firstly, we need to fully explore and explain cognitive abilities regarding language learning. Cognitive Linguistics, Contrastive Analysis and Error Analysis studies will help CAT systems discern between examinees' errors and mistakes, knowledge and lack of knowledge, understanding and lack of understanding. How are we going to ensure that a CAT assesses the real language competence of a student? How we will minimize errors of measurement? Secondly, with the aid of AI, we will create assessment systems that will accurately measure competence in productive skills, such as speaking and writing. It has been acknowledged that up to date, no published speech recognition software can be adequately used for pedagogical or assessment purposes in language testing (Chapelle, 2001), as it does not possess basic communicative techniques and cannot understand the foreign speaker's interlanguage. Corpus Linguistics can also help towards this direction. Large language and interlanguage databases can instruct the computer on how to mark student responses more accurately. To sum up, in order to create valid CALTs, we need to adopt and work towards a new test theory (Mislevy, 1996), gathering information from various disciplines and assimilating this information in the new assessment medium.

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