# System Design for Academic Listening of Second Language Based on Strategy Object Mashups Approach

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**Abstract:** Most foreign students studying abroad lack of effective academic listening ability which is considered to be essential for them to achieve their academic successes. Moreover, as listening comprehension ability is also considered to be the most difficult to improve in contrast with the other three (Reading, Speaking and Writing), the purpose of this research is to support the training of academic listening skills for students pursuing academic success in a foreign educational institute. We have identified several learning strategies proved to be effective for cultivating academic listening skills from related work and built up the respective strategy models. Based on the established strategy models, we are now in the process of designing and developing various strategy objects (function units), so as the mashups environment where these objects can be assembled and operated. Unlike previous learning systems that provided identical functions to the learners, this research is expected to provide the learners with self-adjustable learning environment by putting together various strategy objects provided. We also attach semantic meanings (listening strategies and tactics) to each object to improve the metacognitive awareness of strategy application of the learners, for the effectiveness in listening practice as proved in past studies. Furthermore, a feedback agent is to be implemented to recommend proper strategy objects to the learners based on their learning situations. As a result, the learners are expected to be able to: practice their listening under an adaptive learning environment, strengthen their metacognitive awareness of the strategy application, and adjust their learning environment constantly with the support of the feedback agent or through peer reviews.

**Keywords:** Academic Second Language, Listening Strategy, Strategy Objects, Strategy Object Mashups

## 1. Introduction

Among the other language skills (Reading, Writing and Speaking), academic listening poses serious challenges to F/SL (Foreign, Second Language) learners. Even for students with high level of proficiency and being comfortable with everyday listening and conversation, listening tasks encountered in academia still seem formidable (Mason, 1995). Academic listening is complex, multi-faceted process that places enormous skill demands on the listener (Richards, 1983). Since researches have shown that effective academic listening comprehension skills are essential for the students to achieve academic success (Benson, 1994; Dunkel, 1991; Vandergrifft, 2004), studies focusing on this subject are actively conducted worldwide. Among those, listening strategy is an important subject, which is playing an important part in improving listening skills (Goh, 1998). Evidence from various studies revealed that F/SL learners, regardless of skilled or unskilled, were all applying some listening strategies, consciously or unconsciously (Goh, 2002). Some of those researches have shown that the difference lies in what they are using and the way of using them (Smidt and Hegelheimer, 2004). Learners with higher listening ability tend to choose listening strategies more adaptive to their learning and put the chosen strategies into practice more effectively than the unskilled ones (Goh, 1998). Moreover, since what learners know about their learning can directly influence the process and even the outcome of it (Palmer and Goetz, 1988), it has been proved more than once the

importance of improving learners' metacognitive awareness of listening strategy through various experiments of related researches (Goh, 1998, 2008; Holden, 2004; Bozorgian and Pillay, 2013). Goh (2008) stressed in her findings that learners need to be aware of how their listening comprehension is affected by their choice of listening strategies to develop flexibility in the use of listening strategies as well as find suitable ways for systematic practice, ultimately be able to obtain listening skills. In order to address this issue, we proposed a strategy object mashups approach (Li and Hasegawa, 2014) which enables learners to practice their listening ability under the adaptive supporting functions while making them aware of their strategy applications and how would they affect their learning. Moreover, by attaching semantic meanings (listening strategies) to the different functions used by each individual, we also expect the perceivable comparisons of different functions used among the learners to take place, which leads to the possibility for the communication on learning techniques and methods. Therefore, unlike previous researches that provide fixed identical functions to the learners, we entitle the learners with the flexibility of building up their distinctive learning environment by putting together function units provided, along with the self-adjustment supported by peer-reviews and system recommendation. In this paper, we discuss this approach in further details and introduce the system design. The following sections are arranged like this: we firstly talk about the concept of listening strategy and the difficulties existing among F/SL learners trying to apply proper listening strategies into their practices, and secondly identify the requirements and purposes of this research, and then we introduce our research method called strategy object mashups approach along with the system design, and finally provide an overall view of the system Graphic User Interface (GUI).

## 2. Issue Addressed

### *2.1 Listening Strategy & Comprehension Tactics*

In cognitive psychology, the term 'strategy' is linked to the conceptual framework of human learning and memory and refers to mental steps or operations carried out to accomplish cognitive tasks (Clark and Lisa, 2009). As a result, listening strategies are mental mechanisms carried out by second language learners to achieve reasonable comprehension when processing information contained in a large input of utterance, for they have to work under the constraints of an overloaded working memory, and a lack of linguistic, sociolinguistic and content knowledge (Call, 1985; Farch and Kasper, 1986; Goh, 2000). O'Mally and Charmot (1985) categorized listening strategy into three classifications: Metacognitive strategy, Cognitive strategy and Social strategy. Generally speaking, cognitive strategies are fundamental operations taken by the learners directly on their learning subject to obtain knowledge. Metacognitive strategies are concerned with how to learn or with learning to learn, involving with planning, monitoring and self-evaluation combined with the learning process. Social strategies are social behaviors learners conduct when communicating with others, and examples include asking skilled ones for advises, to compare notes and etc. The concept of comprehension tactics (which is referred as tactics in this paper) was brought up by Goh (1998). She defined tactics as individual mental techniques through which a general strategy is operationalized. Goh also identified that the tactics used for the same strategies vary from learner to learner, and skilled learners demonstrated better on strategy choices and the combination of appropriate tactics (Goh, 1998). In this research, we refer tactics as the learning procedures or processes when constructing strategy models, and also as the semantic meanings attached directly to the strategy object mashups of each learner, which will be explained in later sections. For the comprehension tactics are processions of understandable learning behaviors to operationalize listening strategies, it is possible to identify and organize comprehension tactics proved to be effective in academic listening, and then correspond these tactics to the according listening strategies under the classifications of the meta-cognitive, cognitive and social define by O'Mally (1989).

### *2.2 Difficulties in Applying Listening Strategies in Academia:*

Although researchers in the field of linguistics have repeatedly proven the effectiveness of consciously adopting adaptive strategies in listening practice through various methodologies, there are several

difficulties for foreign students to successfully utilize proper listening strategies in most of the cases. Firstly, it is difficult to consciously put listening strategies into operation. Indeed, there are efforts having been put into teaching the techniques to insinuate the application of listening strategies (Hossein, 2013), and the result of which was positive. However, in academic life in which foreign students often are pressed by hard schedules and mostly failed to attend such classes, self-directed learning is the main approach for practicing. As a result, they tend to resort to their inefficient accustomed way of practicing without being aware of what strategies they are using and how these strategies affect their learning. Secondly, it is difficult to flexibly adopt adaptive listening strategies. Factors including personal traits, motivation level and cognitive style may influence the strategy choice (Oxford and Nyikos, 1989). Because of their lacking of strategy knowledge and guidance from experts in strategy application, it is difficult to come up with an adaptive combination of listening strategies which suits the learners' characteristics and learning goals. Thirdly, it is difficult to put social strategies into practice. As for self-directed learning is the mainstream among foreign students to build up the necessary skills of the targeted language, it is considered inconvenient for them to get involved actively in communication or cooperation with like-minded people to ask help, exchange ideas and acquire advices. This leads to the missing of learning opportunity and sharing of knowledge.

### *2.3 Related work and Research Requirements:*

Back in the late 80's, and early 90's, with the fast development of information technologies and the prevailing use of computer, CALL was breaking ground in the new technology frontier and began to draw attention. Up to now, numerous CALL systems have been developed to meet different requirements. Some of them are working as an additional supplement to the actual teaching courses known as blended learning (Wiki), which are not designed for self-directed learning and proved performing better in the combination of instructors' involvement (Li and Wang, 2012). Furthermore, for CALLs appropriated for self-directed learning, there are still some limitations. First of all, they did not pay attention on how to improve learners' metacognitive awareness of learning strategies. They provided the learners with sets of pre-designed supporting functions without explaining the reasons why those functions were introduced and how would they affect the learning. Secondly, the supporting functions provided to the learners were not adaptive to everyone, since the learners were offered with the identical learning environment. Despite of the fact that there are researches on the adaptive learning system actively conducted throughout the years, most of them focused on the adaptation from the viewpoint of learning materials, not the learning functions (Yang, Hwang, Chiang and Yang, 2013; Wang and Mendori, 2013; Fisser and Strijker, 2014;). In those researches, learners were not in the position of choosing or adjusting system functions to meet their individual learning needs. Thirdly, they are not providing enough support to take social strategies into account, which causes the lack of communication among the learners themselves. There have been studies such as the one on enabling limited sharing and peer-reviews on learning outcomes (Ogata and Yano, 2004), the learning techniques of each learner and the strategy application are not the focuses to be represented in a universally recognizable way.

Having considered these limitations existing in current CALL systems, and in order to address the difficulties encountered by foreign students described in section 2.2, we come up with three corresponding requirements, which if satisfied, are assumed to be able to improve the current learning situation for self-directed listening practice. These requirements are:

1. A learning environment where not only effective supporting functions are provided but also the strategic meaning of each function are provided in order to improve the awareness of strategy application.
2. The flexibility of adjusting the supporting functions in the learning environment by the learners themselves according to their own characteristics and learning needs.
3. A more effective communicative platform where not only the sharing of established knowledge can take place, but also the learning techniques and strategy applications of each learner can be perceived and communicated, while probably leading to the proper adjustments to their learning environment.

Aiming to effectively address these requirements, this research intends to design and develop a self-directed and community-based learning environment with the main purposes of: making the learners aware of strategy application, helping them build up adaptive learning environments, and

enabling them to communicate on not only leaning resources and knowledge but also on learning strategies and techniques. We expect the learners to learn and improve their learning skills through: the strengthened metacognitive awareness of their strategy application; the process of building up their adaptive learning environments which will be constantly adjusted by themselves from peer-reviews and system recommendation; and the awareness of the relationships between their learning activities and the according listening strategies.

## 3. Approach

### *3.1 Concept of Strategy Object Mashups Approach:*

Figure 1 describes the concept of this approach. Strategy models are learning procedures or processes commonly adopted to execute listening strategies. Based on the established strategy models systematized from listening strategies that have been proved to be effective for cultivating academic listening skills, the respective function units, which are referred as strategy objects in this paper, can be developed. The learners are expected to choose their interested strategy objects to compose their personal distinctive learning environment that we refer as strategy object mashups in this paper. In this approach, there is also a social strategy platform implemented to support the communication not only on learning knowledge but also on strategy object mashups, which can be perceived as peer reviews on learning techniques. As the learners are building and adjusting their learning environment, a feedback agent collects and analyzes all strategy object mashups created by everyone to recommend the learners with more appropriate strategy objects for the proper functional adjustment according to their features and learning goals.

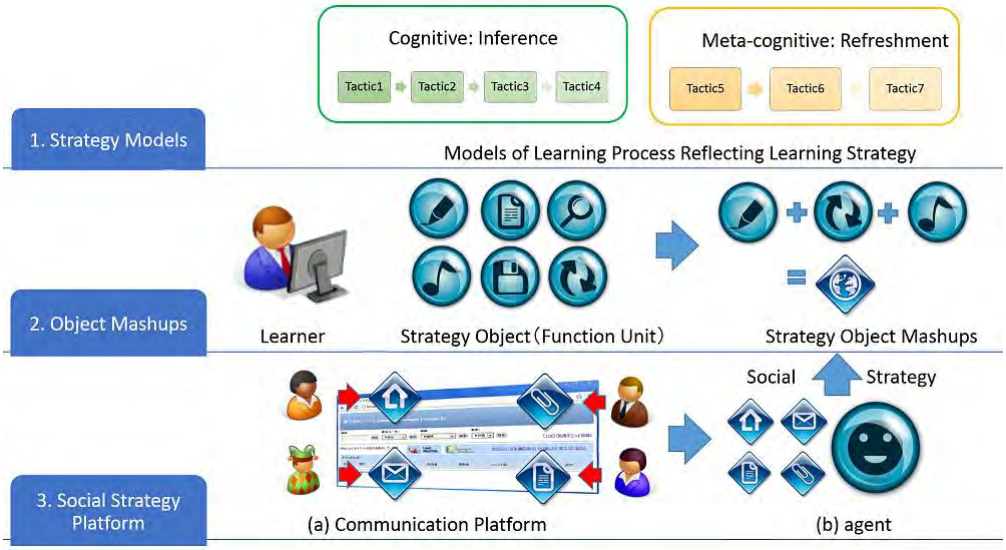


Figure 1. The Concept of Strategy Object Mashups Approach.

### *3.2 Ontology-driven Multi-layer Map Model:*

Considering the three requirements described in section 2.3, the relationships among strategies, tactics and the learning environment need to be created in order to ensure every strategy object be traced to its according tactics and strategies. For this reason, we have designed the system model in an ontological manner. A multi-layer model is a core of this learning environment and intended to perform as a GUI for self-directed S/FL learners for self-directed and community-based listening practice. Figure 2 shows the model, which possesses of four layers. The object layer is where the system presents all the strategy objects for the learners to choose and assemble. Also, the detailed description of each object will also be provided to the learners to help them make reasonable choices. The learners choose their wanted objects and the system assembles the selected ones into strategy object mashups on the upper layer where

basically, the learners conduct their listening practice while making references to the mashups of others if necessary. The tactic layer is where to display the tactics being adopted based on the learners' object mashups, by putting together the tactics traced from the selected objects. And accordingly, the listening strategy operationalized by the tactics can be found on the strategy layer. The upper two layers are meant to attach semantic meanings to object mashups of each learner, with the purpose of improving their metacognitive awareness of what listening strategies and tactics are being used and how they affect their learning. For example, if we assumed that one of the learners in Figure 3 picked the objects of "display comments of other people, "display background knowledge" and "input keywords", the chosen three objects are working together as object mashups to support the learning activity. By tracing the comprehension tactics related with the chosen objects, the tactic "inference from related background knowledge and comments of others and input keywords" is generated and so does the corresponding strategies which are inference and cooperation in this example. Basically, with this system, the learners are expected to be capable of: (A). Creating their personal mashups; (B). Referring to others' object mashups to make adjustment to their own; (C). Adjusting their personal mashups by the recommendation from feedback agent. As mentioned before, we have designed this model using ontological manner to connect these four layers, which will be explained in details later. The connections between layers are to be stored and analyzed by the feedback agent for the proper recommendation of the object mashups for the learner. Therefore, by using the proposed system, the learners would be able to assemble their personal object mashups by putting together proper objects, to refer to others' object mashups for possible adjustment of their own, and to take into account of the system's recommendation of new object mashups that could be more effective.

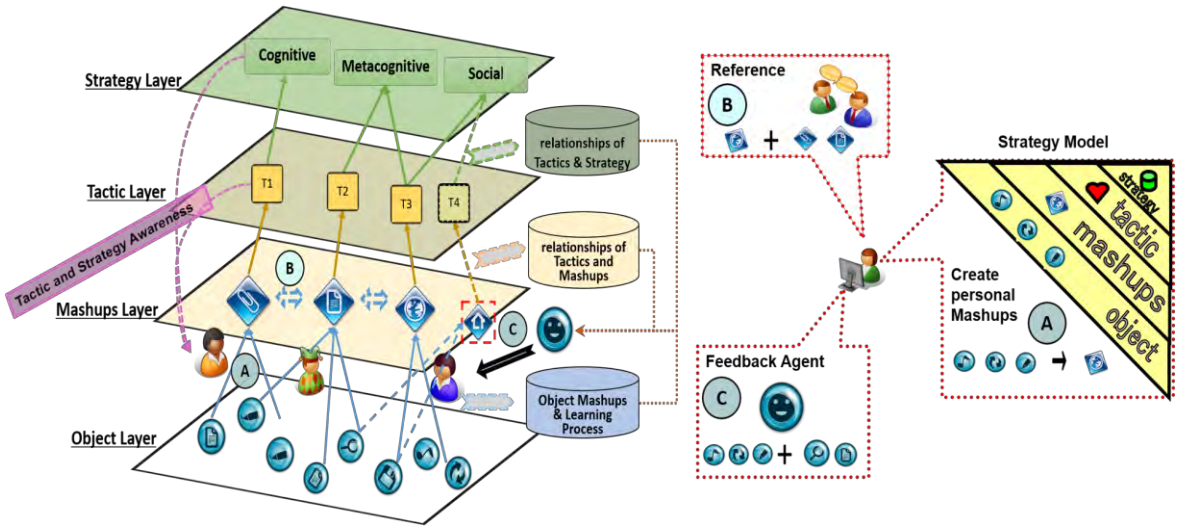


Figure 2. Multi-layer Model.

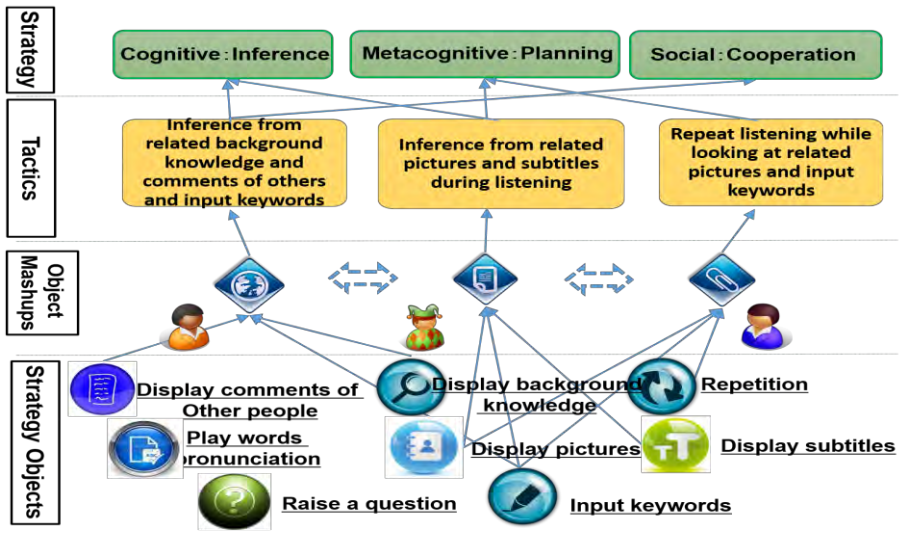


Figure 3. A Concrete Example of Multi-layer Model.

### *3.3 System Framework:*

Figure 4 describes the framework of this system. At the beginning, a learner selects the listening materials, which in this research will be in the form of the lecture videos. And then, he/she will select the needed strategy objects to construct a distinctive personal listening environment. The next step would be practicing his/her listening and along the way, making adjustments to the learning environment. The learner can compare the mashups having been adopted by the other learners who have listened the current listening materials. Through the comparison of each other's application of object mashups, along with the attached tactics and listening strategies, the learner can adjust his/her own mashups and strengthen the metacognitive awareness of the strategy application of his/her own and the others. The strategy objects, comprehension tactics and listening strategies are managed by the system in an ontological manner which will be discussed in detail in the following section, to trace back the according tactics and strategies for the learner based on his/her choices of the strategy objects. Meanwhile, a feedback agent, as another aspect of this research, will be designed and developed to recommend proper object mashups to learners through the analysis of the mashups of the current learners and the ones who has listened the learning material, combined with the current learner's performance. In this way, we hope that the learners will be able to adjust constantly their learning environment through system recommendation and peer reviews and eventually, build up their listening skills in the process. As to the mechanism of this feedback agent, please refer to our published paper (Li and Hasegawa, 2014).

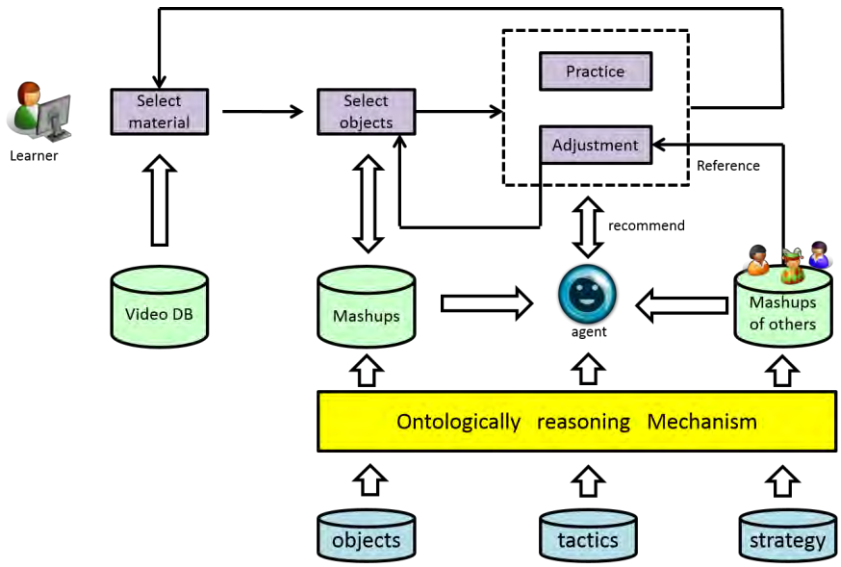


Figure 4. System Framework.

### *3.4 The Ontological Relationship among Strategy Model, Strategy Object & Strategy Object Mashups:*

The ontological relationships between the listening strategy and the tactics are referred as the strategy models as shown in Figure 5. And then the strategy objects will be developed based on various established strategy models. In order to visualize each tactic into minimum-sized function units yet capable of being operated either alone or cooperatively, we take into account the actions learners usually take (See, Write and Listen) while doing listening practice, and then combine them into the strategy models. Because we intend to attach tactics and strategy to the object mashups composited by the learners, we relate the items of strategy, tactic, and strategy object and object mashups in an ontological manner as shown in Figure 5. The strategy models are expected not only to be able to represent the learning processes of different learners who uses diverse tactics for the execution of the same listening strategy, but also to be presented as the model of the intellectual activities with the applicable description for designing purpose. The following example better illustrates this ontological

mechanism by introducing several strategy models we have established along with the according tactics and strategy objects.

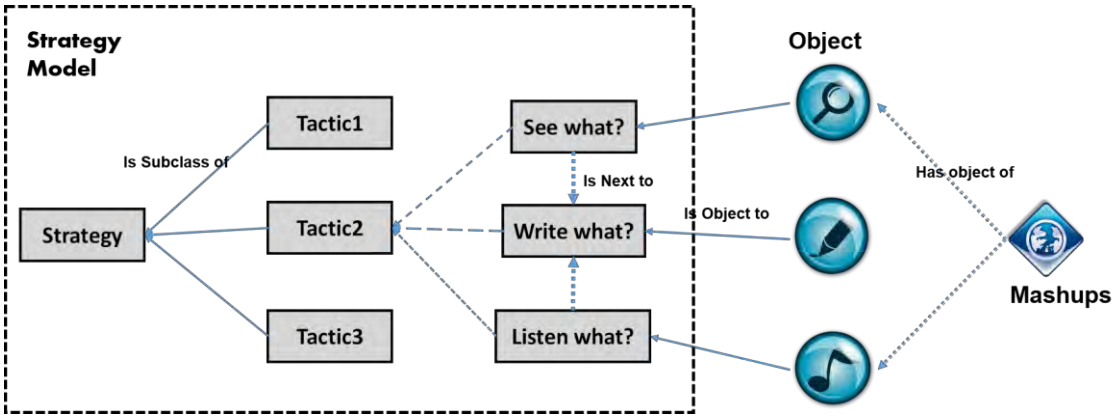


Figure 5. The Ontological Manner among Strategy Model, Strategy Object and Mashups.

Figure 6 shows partially the ontological mechanism of how we systematize the listening strategies into strategy models and how the strategy objects are being derived. All the listening strategies are subclasses of the three major categories whose relationships have been determined by O'Mally (1989). The tactics are the ones organized from various related researches that have been proved to have the positive effect on academic listening. In this figure, there is a typical cognitive strategy called 'take note'. Ordinarily, to operationalize this strategy, we suppose the learners can summarize the important keywords from the transcript of a learning material beforehand or, they might want to dictate the whole transcript while checking the subtitles to monitor their accuracy. Hence, we identified these two tactics, which, by taking account of the learning actions the learners commonly take, are divided into learning procedures. For the former tactic, the learners first action would be seeing the transcript followed by writing important keywords from it, leading to existence of the objects 'show transcript' and 'write down keywords'. As to the latter tactic, with the same process, we firstly conclude that the learners need to listen the learning material and then dictate all the content along the way, checking the subtitles constantly to correct their errors and collect knowledge. As a result, the objects needed would be listening to a video (we plan to use videos as the learning materials), writing transcript and seeing the subtitles. In this way, we expect, the strategy mashups composited by the learners can bear semantic meaning of tactics and strategies by being traced back the objects consisted of.

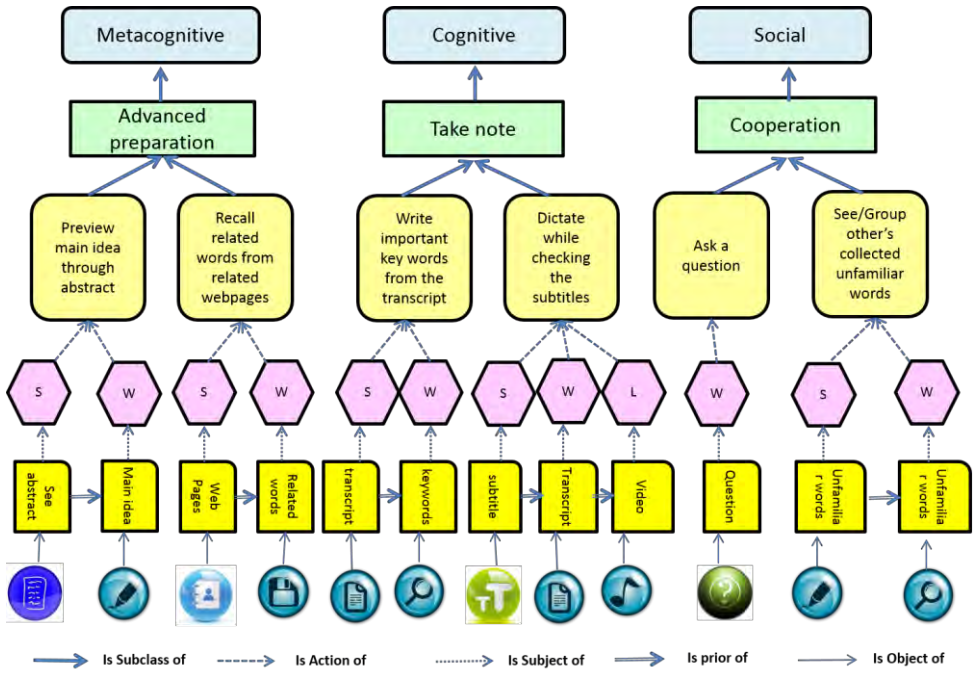


Figure 6. An Example of the Ontological Mechanism.

## 4. The Concept GUI of the Proposed System:

In this section, we will introduce the image of the system GUI and how learners would apply it in their self-directed learning for listening practice. As the pilot system is still under construction, please be noted that the graphs used below contain partially Photoshop-edited items in order to best illustrate the gist of the learning environment.

We have grouped all the developed strategy objects according to the action learners usually take from listening practice on the left side, so the learners are assumed to be able to quickly decide on their choices for strategy objects as long as they are sure of what to see, what/how to listen and what to write. Meanwhile, considering the fact that academic listening mainly takes the form as lecture-taking, it is considered reasonable to divide the phases of this process into pre-listening, on-listening and post-listening. Therefore, on the right side of the screen, there are these three listening phases into which the learners can drag and drop the objects they think might be helpful as shown in Figure 7. As some of the objects are not to be allowed to use in certain phrases (For example, all the objects related with audio control apparently are not appropriate for pre-listening), and some objects only work effectively in combination with certain others, and examples of this include that the objects for inputting (writing keyword, etc.) are of no meaning without being used together with objects like (display related pictures/abstracts, etc.), we will design the rules and reminding cues into the ontological mechanism to regulate object selection aiming to achieve maximum effectiveness.

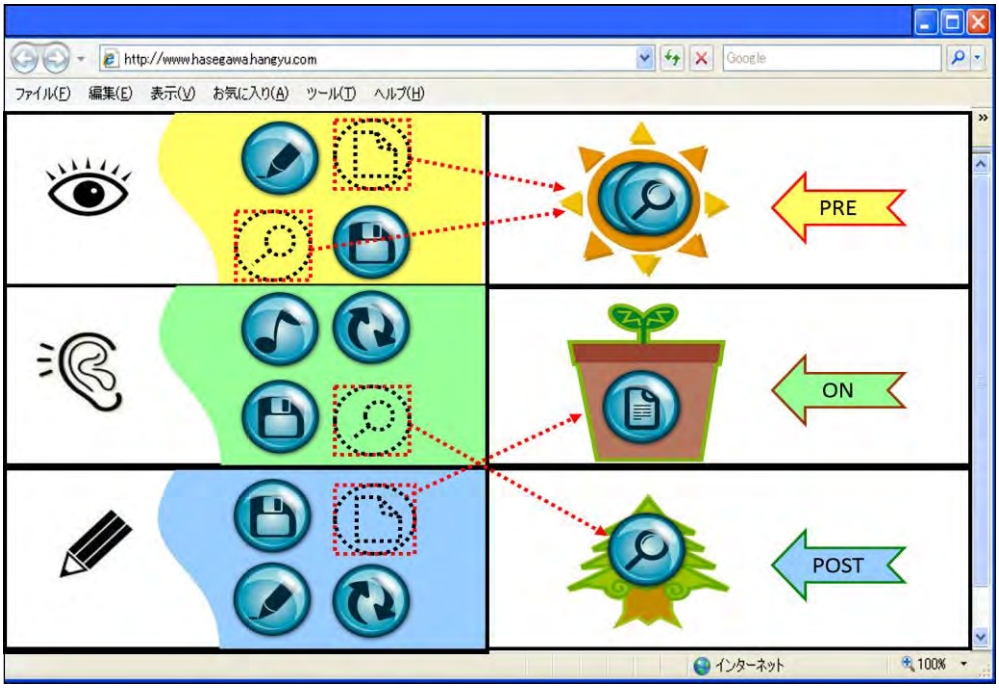


Figure 7. The Process of Building Strategy Object Mashups.

When the learners finish the process of building object mashups, they can begin their listening practice as shown in Figure 8. The training page is divided into two blocks. The right one is where the learners conduct their listening practice, which is consisted of multiple windows that respectively are the visualizations of the selected strategy objects. The learners can change the size of each window and drag and drop the selected ones into places they think fit. On the left side, the system presents the structures of object mashups of all the three phases in connection with the according tactics and strategies. The reasons for this GUI representation are, first of all, to help the learners improve their awareness of their strategy application by presenting the structure of the relationships between their object mashups and the according strategies and tactics; secondly, by navigating through objects across phrases, the learners will strengthen the connections between strategies and learning phases, which might lead to their proper operation of listening strategies and tactics in their real academic life.

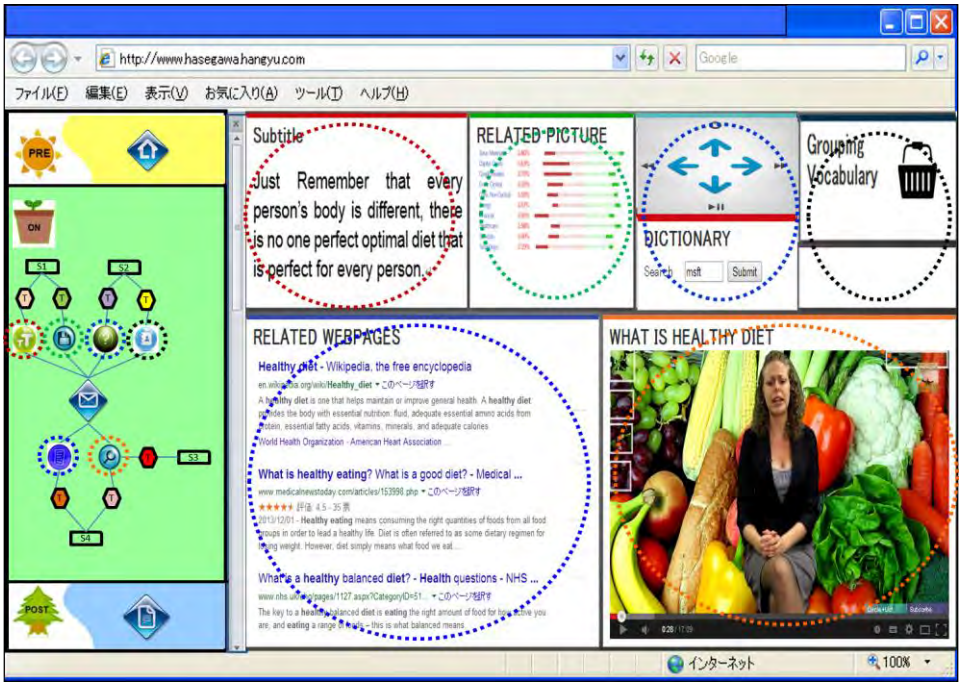


Figure 8. An Example of GUI for the Phase of On-listening

## 5. Conclusions & Future Work:

This paper has designed the learning environment where the learners not only are able to construct adaptive supporting functions by putting together wanted strategy objects, but also to be aware of the corresponding comprehension tactics and listening strategies they are adopting and how are they affecting their learning with the purpose of improving their listening skills, through the ontological reasoning mechanism. Moreover, the learners are expected to learn through building up object mashups, which can be flexibly adjusted by the comparisons with that of others' and the recommendation from the system feedback agent. We believe this research might open the possibility of providing an adaptive learning environment for diverse learners and a more recognizable format for reference and communication on learning skills and methods in a virtual place.

In the near future, we firstly will continue our design and development of the strategy objects based on the established strategy models, so as the mashups environment as web services using Microsoft ASP.NET MVC. After finishing the pilot system, an evaluation will be conducted in our institute using the video archive of lectures, which contains all the courses in our department. We will firstly to make sure whether the learning effectiveness can be improved through building up object mashups, and secondly whether the adjustment of mashups positively affected by peer comparisons and from the system recommendation.

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## References

Benson, M. J. (1994). Lecture listening in an ethnographic perspective. *J.Flowerdew, (ed), Academic listening: Research perspectives*, 181-198.

Call, E. (1985). Auditory short-term memory, listening comprehension and the Input Hypothesis. *TESQL Quarterly, Vol.19*, 4, 765-781.

Clark C., Lisa, C. (2009). Cognitive Strategy. *The Gale Group, Inc*. http://www.education.com/reference/article/cognitive-strategies/

Dunkel, P. (1991). Listening in the Native and Second/Foreign Language: Toward and Integration of Research and Practice. *TESOL Quarterly, Vol.25*, 3, 431-457.

Farch, C., Kasper, G. (1986). The role of comprehension in second language learning. *Applied Linguistics 7*, 257-274.

Fisser, P., Strijer, A. (2014). Using ICT for personalized and adaptive learning, the case of Linked Data. *Proceedings of Society for Information Technology & Teacher Education International Conference 2014*, pp. 1243-1247.

Goh, C.C.M. (1998). How ESL learners with different listening abilities use comprehension strategies and tactics. *Language Teaching Research 2, 2*, pp.123-147.

Goh, C.C.M. (2000). A cognitive perspective on language learners' listening comprehension problems. *System 28(1)*, 55-75.

Goh, C.C.M. (2002). Exploring listening comprehension tactics and the interaction patterns, *System 30*, 185-206.

Goh, C.C.M. (2008). Metacognitive Instruction for Second Language Listening Development: Theory. *Practice and Research Implications. TECL Journal Vol.39 (2)*, 188-213.

Holden, R. (2004). Facilitating Listening Comprehension: Acquiring Successful Strategies. *Bulletin of Hokuriku University Vol.28*, 257-266.

Hossein B. (2013). Enhancing foreign language learning through listening strategies delivered in L1: An Experiment Study. *International Journal of Instruction, Vol.5*, No.1.

Li, H., Hasegawa, S. Improving Academic Listening Skills of Second Language Learners by Building up Strategy Object Mashups, *Proceeding of the 16th International Conference on Human-Computer Interaction (HCI)*, Greece, (12) 384-395.

Li, Y, Wang, L. (2012). College English Listening Strategy Training Model in Computer-Assisted Language Learning Environment and the Corresponding Effect Analysis. *US-China Foeign Language, Vol.10, No.11*, 1752-1758.

Mason, A. (1995). By dint of: student and lecture perceptions of lecture comprehension strategies in first term graduate study. *J.Flowerdew, (ed), Academic Listening: Research Perspectives.* 199-218.

O'Mally, J., Chamot, A. (1989). Listening Comprehension Strategies in Second Language Acquisition. *Applied Linguistics*, 10(4), 418-437.

Oxford, R., Nyikos, M. (1989). Variables Affecting Choice of Language learning Strategies by University Students. *The Modern Language Journal. Vol.73 (3)*, 291-300.

Ogata, H., Yano, Y. (2004). Knowledge awareness for a computer-assisted language learning using handhelds. *International Journal of Continuing Engineering Education and Life Long Learning, Vol.14*, 435-449.

Richards, J. (1983). Listening comprehension: Approach, design, procedure. *TESOL Quarterly, 17*, 219-239.

Smidt, E., Hegelheimer, V. (2004) Effects of online academic lectures on ESL listening comprehension, incidental vocabulary, and strategy use. *Computer Assisted Language Learning, 17*, 517-556.

Vandergrifft, L. (2004). Listening to learn or learning to listen. *Annual Review of Applied Linguistics Vol.24*, 3-25.

Wang, J., Mendori, T. (2013). An Evaluation of A Customizable Ontology-driven Language Learning Support System. *21st International Conference on Computers in Education*, pp.11-19.

Wikipedia: Blended Learning. http://en.wikipedia.org/wiki/Blended_learning.

Yang, T., Hwang, G., Chiang, T., Yang, S. (2013). A Multi-dimensional Personalization Approach to Developing Adaptive Learning Systems. *Human-Computer Interaction and Knowledge Discovery in Complex, Unstructured, Big Data Lecture Notes in Computer Science.* Volume 7947, 2013, pp.326-333.