Below is an article written by Washington Post Staff Writer, Amit R. Paley. This article describes the result of a study by the U.S. Department of Education that shows educational software has no significant impact on student performance. Please read the article carefully and answer the following two questions in English:

(1) Please write a 300-word summary (in your own words) to describe the major points mentioned in the article. (20%)

(2) Assume that you are to design a study to investigate why the educational software exerts no significant impact on student performance from the perspective of students themselves. Briefly describe what theories you may adopt to explain the phenomenon and specify the research model and all constructs in this model. (30%)

Note: Your answer must be written in English. No score will be given if your answer is written in Chinese.

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Software's Benefits On Tests In Doubt

Study Says Tools Don't Raise Scores

By Amit R. Paley
Washington Post Staff Writer
Thursday, April 5, 2007; Page A01

Educational software, a $2 billion-a-year industry that has become the darling of school systems across the country, has no significant impact on student performance, according to a study by the U.S. Department of Education. The long-awaited report amounts to a rebuke of educational technology, a business whose growth has been spurred by schools desperate for ways to meet the testing mandates of President Bush's No Child Left Behind law.

The technology -- ranging from snazzy video-game-like programs played on Sony PlayStations to more rigorous drilling exercises used on computers -- has been embraced by low-performing schools as an easy way to boost student test scores. But the industry has also been plagued by doubts over the technology's effectiveness as well as high-profile bribery scandals, including one that led to the resignation of the Prince George's County schools chief in 2005.

The study, released last night, is expected to further inflame the debate about education technology on Capitol Hill as lawmakers consider whether to renew No Child Left Behind this year. "We are concerned that the technology that we have today isn't being utilized as effectively as it can be to raise student achievement," said Katherine McLane, spokeswoman for the Department of Education.

Industry officials played down the study and attributed most of the problems to poor training and execution of the programs in classrooms. Mark Schneiderman, director of education policy at the Software and Information Industry Association, said that other research trials have proven that the technology works, although he said that those trials were not as large or rigorous as the federal government's.

"This may sound flip or like we're making excuses, but the fact is that technology is only one part of it, and the implementation of the technology is critical to success," said Schneiderman, whose group represents 150 companies that produce educational software. "We need to take every study with a grain of a salt and look at the overall body of work."

The study, mandated by Congress when it passed No Child Left Behind in 2002, evaluated 15 reading and math products used by 9,424 students in 132 schools across the country during the 2004-05 school year. It is the largest study that has compared students who received the technology with those who did not, as measured by their scores on standardized tests. There were no statistically significant differences between students who used software and those who did not.

In classrooms, the programs -- such as "iLearn Math" and "Achieve Now" -- are used in different ways, depending on teachers. Some educators use the software as a supplemental tool to drill students in particular lessons; others use it instead of textbooks to teach entire lessons.

Backers say the technology better engages students by giving them individualized instruction and prepares them for a technology-filled world. Schools use the software to teach almost every subject, although the federal study looked only at math and reading programs.

In the Washington region, the debate over educational software raged most prominently in Prince George's, where Superintendent Andre J. Hornsby resigned and was indicted on suspicion of arranging for the school system to buy $1 million worth of software from LeapFrog SchoolHouse, where his then-girlfriend was a saleswoman. The indictment says that he demanded and received kickbacks. The schools have not made any major software program purchases since.

County Superintendent John E. Deasy said the programs aren't magic bullets. "No technology adds value by itself," he said. "Just employing software is not likely to lift test scores for students." Nationally, perhaps no school system better represents the fears of industry supporters than that of Los Angeles, which spent $50 million in 2001 to buy Waterford Early Reading, distributed by software giant Pearson Digital Learning. Ronni Ephraim, a chief instructional officer for the district, said the company gave presentations that described how successful the program was for other schools. Los Angeles school administrators soon began praising it.

"Teachers loved it. Kids loved it," Ephraim said. "Waterford gave us data from their tests that showed it was working. Everyone said, 'Oh my God! The kids are doing so well.' "

But a school district evaluation found that students using Waterford were not scoring better on standardized tests than those not using it. "I'm so embarrassed to admit this," Ephraim said, "but when we heard the results we said, 'This can't be true.' " The Los Angeles system dropped the program from its regular classes but sometimes uses it for individual students. Ephraim said she blamed the school system, because teachers were not prepared or properly trained to use the technology.

Nonetheless, some experts said the software holds promise. Elliot Soloway, professor of educational technology at the University of Michigan, said that teachers need to be better trained and that administrators need to wait more than one year to see results. He said he worried that the study would scare off school districts.

"This is the last thing that we need now," he said. "It is the poor kids who will suffer, because it is their schools who will not get technology because of this study."
To persuade companies to participate in the study, researchers promised not to report the performances of particular programs. Among the businesses whose products were in the study were LeapFrog SchoolHouse, PLATO Learning, Scholastic Inc. and Pearson. (The Washington Post Co. owns Kaplan, a test preparation company that sells education software. Kaplan applied to be in the study but was not included.) Although some of the companies are now criticizing the report, many were initially eager to be studied and praised researchers.

"We are proud to be the largest commercial supporter of this important study of the effectiveness of using technology in the classroom," said John Murray, president and chief executive of PLATO, in 2004.

國立中山大學96學年度博士班招生考試試題

科目：資訊科技論文評述(一) 【資管系選考】

Read the attached paper carefully and answer the following questions.

1. Consider the web service flow graph shown in Figure 2. Assume that X_a, X_h, and X_c are 24, 12, 6 respectively, and V_a, V_h, and V_c are 4, 2, and 1 respectively. In addition, for each web service, there are some requests from other sites. Specifically, the request rates from other sites to airline, hotel, and car rental web services are 2, 1, and 1 respectively. What is the upper bound of the throughput for the travel site? (10%)
2. The example shown in the paper assumes that a web service, when invoked, will in turn invoke a fixed number of times to some other web service. For example, in Figure 2, each request to the travel agent site generates V_a, V_h, and V_c requests to the airline, hotel, and car rental web services respectively, where V_a, V_h, and V_c are constant. Now assume that V_a, V_h, and V_c are random variables following uniform distributions U(1, 8), U(1, 5), and U(1, 4) respectively. In addition, assume that there are no requests from other sites to the three web services. Let X_a, X_h, and X_c be 20, 15, and 12 respectively. What is the probability that the throughput of the travel agent web service is at least 4? (15%)
3. This paper considers four QoS measures, namely availability, security, response time, and throughput, with emphasis on throughput. Now let us consider another QoS measure *reliability* for a web service, which is defined as the probability that a request sent to the web service will be successfully completed within a reasonable period of time. For example, 95% reliability dictates that 95 out of 100 requests to the web service will be successfully completed. Now consider Figure 2. Let R_a, R_h, and R_c be the reliabilities of the airline, hotel, and car rental web services respectively. Please derive the equation for the reliability R_{TA} of the travel agent web service (15%)
4. In the left column in page 2, the author said "*To ensure that all admitted requests obtain the level of service users expect, Web service providers might need to implement priority-based admission control mechanisms.*" Please design an admission control mechanism to enforce a desired level of service. (10%)

QoS Issues in Web Services

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Traditionally, access to services offered over the World Wide Web has relied on the interaction between a browser and a Web server using the HTTP protocol. More recently, programmatic access to services over the Web, called Web services, has been the subject of intense activity and standardization efforts.[1-2]

In this new model, Web service providers use the Web Services Description Language (WSDL)[3] to describe the services they provide and how to invoke them. The service providers then register their services in a public service registry using universal description, discovery, and integration (UDDI).[4] Application programs discover services in the registry and obtain a URL for the WSDL file that describes the service. Then, the applications can invoke the services using the XML-based simple object access protocol (SOAP) in either asynchronous messaging or remote procedure call (RPC) mode.[1,5]

Figure 1 illustrates the concept of Web services and how the model differs from that of traditional access to a Web site. Traditional Web sites (Figure 1a) implement all components needed to carry out user transactions: user interface and navigation management, business logic, and access to persistent storage. Web services sites give users access to some or all of these services through programs that provide these services over the Web, as Figure 1b shows. In this case, the travel site uses Web services applications for airline booking, hotel reservation, and car rental reservation.

Issues in Web Services

Quality of service (QoS) is a combination of several qualities or properties of a service, such as:

- *Availability* is the percentage of time that a service is operating.
- *Security* properties include the existence and type of authentication mechanisms the service offers, confidentiality and data integrity of messages exchanged, nonrepudiation of requests or messages, and resilience to denial-of-service attacks.
- *Response time* is the time a service takes to respond to various types of requests. Response time is a function of load intensity, which can be measured in terms of arrival rates (such as requests per second) or number of concurrent requests. QoS takes into account not only the average response time, but also the percentile (95th percentile, for example) of the response time.
- *Throughput* is the rate at which a service can process requests. QoS measures can include the maximum throughput or a function that describes how throughput varies with load intensity.

The QoS measure is observed by Web services users. These users are not human beings but programs that send requests for services to Web service providers. QoS issues in Web services have to be evaluated from the perspective of the *providers* of Web services (such as the airline-booking Web service in Figure 1) and from the perspective of the *users* of these services (in this case, the travel agent site).

Service Provider Perspective

A service provider needs to consider many aspects of QoS. One of them is its *QoS policy*. Some Web services adopt a best-effort policy, which offers no guarantee that requests for services will be accepted (they could just be dropped in case of overload), and no guarantees on response time, throughput, or availability are provided. While this type of policy may be acceptable in some cases, it is totally unacceptable in others, especially when a Web service becomes an important part of an application composed of various Web services, as in the travel site example. In these cases, Web service providers may want longer-term relationships with users of their services. These relationships generate *service level agreements* (SLAs), legally bind-

ing contracts that establish bounds on various QoS metrics. Examples of conditions that an SLA may contain include these:

- The average response time for the `GetFlightAvailability` request should not exceed 0.5 seconds.
- Ninety-five percent of requests to the `BookFlight` service should complete in less than two seconds.
- The airline reservation Web service should be available at least 99.9 percent of the time.

It is not easy for Web service providers to manage their computational resources when the workload they see is unpredictable and exhibits high peak-to-average ratios in workload intensity. To ensure that all admitted requests obtain the level of service users expect, Web service providers might need to implement priority-based admission control mechanisms.[6] This might require rejecting low-priority requests. Web service providers might also offer multiple QoS levels differentiated by cost.

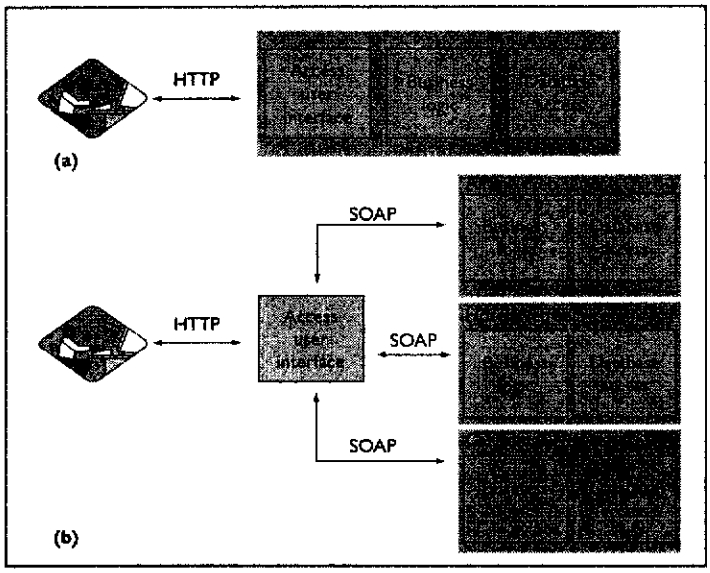

Figure 1. Implementing a site with Web services. (a) In a traditional travel site, the user accesses it through a browser, which communicates with the site via the HTTP protocol. The travel site implements the user interface, the business logic, and database access. (b) Under the Web services model, the travel site implements only the user interface, invoking airline, hotel, and car rental reservation services via SOAP.

Service User Perspective

The traditional travel site in Figure 1a did not need to rely on any third-party services to determine the quality of the services it provides to its customers. When Web services are used, as in Figure 1b, the QoS of the travel site may be strongly affected by the QoS of the various Web services it uses.

Figure 2 shows a Web service flow graph (WSFG) whose nodes are either Web sites or Web services. A directed edge between nodes a and b indicates that a uses the services of b. The label on the edge (a, b), called the *relative visit ratio*, is the average number of times node b is visited per visit to node a. So on average, each travel booking request to the travel site generates V_a requests to the airline Web service, V_h requests to the hotel Web service, and V_c requests to the car rental Web service.

We can now use an argument based on the Forced Flow Law[7] to establish an upper bound on the throughput X_{TA} of the travel site based on the throughputs of the three Web services it uses. For example, every request the travel site completes generates V_a requests on average to the airline Web service. The throughput X_a of the airline service therefore needs to be at least equal to $V_a \times X_{TA}$, since that service must be able to serve all requests it receives from the travel site as well as all requests coming from other sites that use its service. We can make the same kind of argument

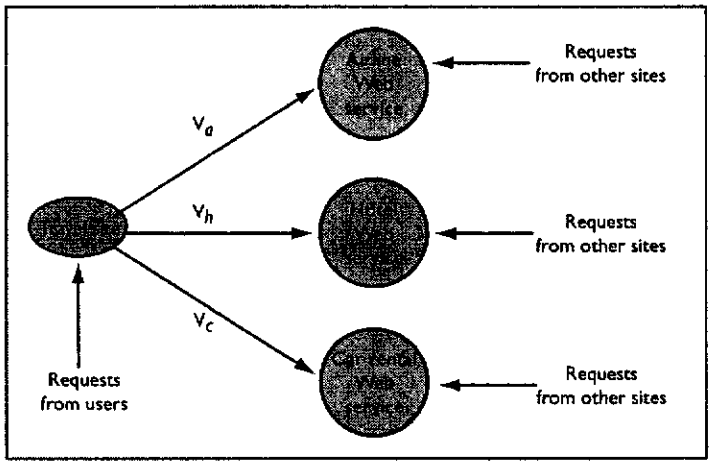

Figure 2. Web service flow graph. Arrows link the travel site to other Web services. The labels on the links indicate the average number of times a Web service is invoked per request to the travel site.

for all other Web services and write that

$$X_a \geq V_a \times X_{TA} \quad (1)$$

$$X_h \geq V_h \times X_{TA} \quad (2)$$

$$X_c \geq V_c \times X_{TA} \quad (3)$$

where X_a, X_h, and X_c represent the throughputs of

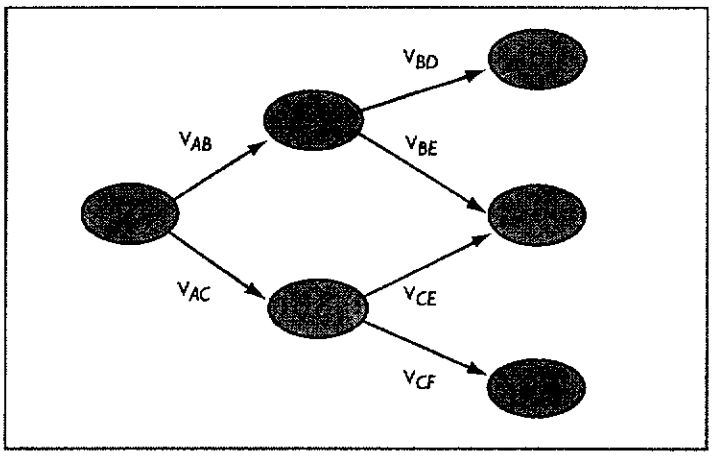

Figure 3. A more complex Web services flow graph. Web service A uses Web services B and C; B uses D and E; and C uses E and F.

the airline, hotel, and car rental Web services, respectively.

We can now combine Equations 1-3 to establish an upper bound on the throughput of the travel site:

$$X_{TA} \le \min\left\{\frac{X_a}{V_a}, \frac{X_b}{V_b}, \frac{X_c}{V_c}\right\}. \quad (4)$$

To see the usefulness of this equation, suppose that the throughput of the airline, hotel, and car rental Web services is 20 requests/sec, 15 requests/sec, and 10 requests/sec, respectively, and that on average, each travel site request will visit the airline Web service four times, the hotel Web service twice, and the car rental service only once. So, using Equation 4, we can say that

$$X_{TA} \le \min\left\{\frac{20}{4}, \frac{15}{2}, \frac{10}{1}\right\} = 5 \text{ requests/sec}. \quad (5)$$

Equation 5 says that in order for the travel site to increase the upper bound on its throughput, it would need to use a better airline Web service, because this is the Web service that limits the maximum throughput of the travel site. Alternatively, the travel site could try to reduce the number of times it has to invoke the airline Web service per transaction.

Of course, the performance of the various Web services the travel site uses depends not only on the load placed on them by the travel site, but also on the load coming from other sources.

The above computation can be generalized to any acyclic directed WSFG, such as the one in Figure 3, in which Web services B and C provide service to A. Web service B uses Web services D and E, and Web service C uses Web services E and F. An upper bound on the throughput of Web service A, in terms of the relative visit ratios and as a function of the throughputs of Web services B, C, D, E, and F, can be written as

$$X_A \le \min\left\{\frac{X_B}{V_{AB}}, \frac{X_C}{V_{AC}}, \frac{X_D}{V_{AB}V_{BD}}, \frac{X_F}{V_{AC}V_{CF}}, \frac{X_E}{V_{AB}V_{BE}+V_{AC}V_{CE}}\right\}. \quad (6)$$

Equation 6 easily generalizes to an arbitrary acyclic WSFG.

A site that uses Web services may need to consider *transactional* Web services. A transaction, in database parlance, is a sequence of actions that must be executed as a unit. For example, when a Web site sells a travel package to a customer, the site must confirm all components of the package (flights, hotels, and car rental reservations). It is common to require distributed transactions to have the ACID property in the presence of any type of site or network failures:

- *Atomicity:* Either all actions of a transaction are executed or none are.
- *Consistency:* Updates made by a transaction preserve its consistency constraints.
- *Isolation:* Concurrent transactions do not reflect the effects of a transaction until that transaction completes.
- *Durability:* The updates of committed transactions are never lost.

The two-phase commit protocol is used to guarantee the ACID property in distributed database systems. This protocol requires individual nodes to lock records while the transaction is in progress. This approach is not efficient for long-lived transactions, however, because of the inherent loss of concurrency, which degrades the QoS.

Another approach for dealing with long-lived transactions is based on *compensations*; that is, different services may commit locally, but should be ready to cancel their actions if conditions negotiated a priori require it. For example, the airline Web service may hold a seat for 48 hours and agree to accept an explicit cancellation (a compensating action) within that interval, or may decide to unilaterally cancel if a confirmation is not received within that period.[8] The hotel reservation Web service may reserve a room but accept cancellations up to 24 hours prior to the reserved date, afterward automatically charging for a first night.

Various organizations have proposed protocols to handle the demands of different kinds of transactions. The business transaction protocol, created by the Organization for the Advancement of Structured Information Systems, allows for two types of transactions: ACID (which it calls atoms) and non-ACID (which it calls cohesions).[8] IBM, Microsoft, and BEA systems just released a draft framework called WS-Coordination,[9] which provides protocols that coordinate the action of distributed applications. They also released WS-Transaction,[10] which offers two coordination types based on WS-Coordination: Atomic Transaction (AT) and Business Activities (BA). ATs are useful for short-lived transactions and BAs for long-lived ones.

Common Issues

Many providers compete to offer the same Web services, meaning that users can decide to select providers on the basis of the QoS to which they can commit. This implies that users and providers need to be able to engage in QoS negotiation.

The interaction between users and Web service providers occurs via XML-based SOAP messages. Therefore, messages tend to be longer than they would be otherwise and require XML parsers for interpretation at both sides. These two factors reduce the performance of third-party services.

Providers must monitor the load they receive from users and check whether the service they provide to them meets the agreed-upon SLAs. Users must also check on the quality of the service they obtain. QoS monitoring may be outsourced to QoS monitoring services such as the ones that monitor Web sites (such as www.keynote.com). ◻

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國立中山大學96學年度博士班招生考試試題

科目：資訊科技論文評述(二) 【資管系選考】

Read the attached paper carefully and answer the following questions.

1. What are the main contributions of the research in this paper? (5%)
2. Draw the system architecture as detail as possible based on the descriptions of the paper, and then describe how the system architecture works. (10%)
3. According to the paper, what is the HTN? Explain further how it is constructed and give a simple example to illustrate how it works. (10%)
4. Describe the algorithm used in HTN. Think of some other algorithms and describe how they can be used for the same purpose. (10 %)
5. What kinds of information techniques have been applied to the system presented in this work? How are they used? (7.5%)
6. How can this system be improved? (7.5%)

Character-Based Interactive Storytelling

Marc Cavazza, Fred Charles, and Steven J. Mead, *University of Teesside, UK*

Interactive storytelling is a privileged application of intelligent virtual-actors technology. The authors introduce their character-based interactive storytelling prototype that uses Hierarchical Task Network planning techniques, which support story generation and anytime user intervention.

Interactive storytelling promises to be an important evolution of computer entertainment, introducing better narrative content into computer games and potentially supporting the convergence of traditional and interactive media. Previous work has described several paradigms for interactive storytelling,[1–3] each differing on various dimensions such as user involvement and relations between the character and plot. Our approach is character-based and essentially follows Michael Young's proposal[2] that autonomous actors, whose roles are implemented using real-time planning systems, should dynamically interact to generate the story.

Within the many possible implementations of interactive storytelling, we target a specific kind of application: letting users interfere, at any time, with a predefined storyline's progression. Furthermore, rather than give instructions, users can alter the environment by stealing an object or influence other characters by offering advice. The consequences of this intervention then affect the characters' behavior and alter the course of action, creating new dramatic situations and eventually leading to different story endings.

System overview

We developed our prototype using the Unreal Tournament game engine as a development environment (see www.unrealtournament.com). The interactive story appears as a real-time 3D interactive animation with subtitles corresponding to the characters' dialogue or important events. Users can physically interact with the characters and navigate through their environment using normal game controls, or they can verbally interact with them using a speech recognition system.

The test scenario we have been using is inspired by the popular US television sitcom *Friends* (www.nbc.com/Friends).[4] We chose a sitcom because, in this genre, the story ending and intermediate situations are equally relevant, which provides a more appropriate testbed for story generation. Furthermore, when developing the system, we defined various roles for each feature character and formalized these roles as plans; when the system executes a plan, it generates character behavior at runtime. Decomposing a plan into subgoals reflects an action's different stages, while the lower layers of the plan decomposition correspond to various ways to achieve these goals. For example, if the character Ross wants to ask out Rachel, then he must acquire information about her, gain her friendship, find a way to talk to her in private, and so forth. He faces several possibilities at each stage—for example, to gain information, he could steal her diary, talk to one of her friends, or phone her mother. These various possibilities correspond to subgoals in the description of Ross's plan, which can be further refined in the plan representation until they can be described in terms of terminal actions (that is, elementary actions carried out by the characters). The system then plays the actions in the virtual environment using standard Unreal animation sequences or additional animations that have been imported into the system.

One particularity of this character-based approach is how it uses the same basic mechanisms to support both story variability and interaction. Plan-based roles for the various characters are dynamically combined to generate multiple variants of an initial storyline.

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In the absence of any user intervention, this mechanism will produce a variety of plot instantiations. At the same time, user interaction can interfere with the characters' plans (for example, causing action failure) and trigger a replanning that varies the plot.

In our system prototype, we modeled the graphic environment using the game's level editor and modeled additional objects using 3d studio max and textures from several online resources. We imported the characters from online repositories (Brian Collins created the Ross character, "Austin" created Rachel, and Roger Bacon created Phoebe and Monica). We implemented the AI layer in C++ and integrated it in Unreal as a set of dynamic link libraries. UnrealScript defines all the functions that interface with Unreal's events—that is, those functions dealing with object interactions. We also fully integrated communication into Unreal using a speech recognition system (Babel Technologies' Automatic Speech Recognition (ASR) software development kit).

Planning techniques for character performance

A wide range of AI techniques has been proposed to support interactive storytelling systems, including planning techniques[1,2,4,5] and techniques for augmented truth-maintenance systems.[3] The technique used often depends on the interactive storytelling paradigm being implemented. However, there is no direct correlation between a given AI technique and a storytelling paradigm. For instance, Young has used planning to control the narrative rather than just the behavior of individual autonomous characters;[2] William Swartout and his colleagues have used planning for autonomous characters, but they also rely on causal narrative representations.[5]

We are mainly interested in the emergence of story variants from the interaction of autonomous actors, so our emphasis has been on the actors' behavior rather than on explicit plot representation or narrative control. Character-based systems provide a unified principle for story generation and interactivity. As such, they allow anytime interaction, whereas plot-based systems tend to restrict user intervention to selected key points in the plot representation. However, we still needed our planning formalism to accommodate the authoring aspects of the baseline narrative.

These knowledge-representation requirements led us to investigate planning techniques that we could use in knowledge-intensive domains, and we eventually opted for Hierarchical Task Networks planning.[6] We picked HTN planning because it is generally considered appropriate for knowledge-rich domains, which can provide domain-specific knowledge to assist the planning process.[7] It also appeared that we could naturally represent the characters' roles, which serve as a basis for our narrative descriptions, as HTNs in which the main characters' goals are decomposed into alternative actions.

Hierarchical Task Networks

A single HTN corresponds to several possible decompositions for the main task—in other words, we can view HTNs as an implicit representation for the set of possible solutions.[8]

Character-based systems provide a unified principle for story generation and interactivity. As such, they allow anytime interaction.

In the present context, each ordered decomposition constitutes the basis for a character's plan, and each HTN associated with an artificial actor contains the set of all possible roles for that character across story instantiations.

Although the set of all roles is sufficient, the set of story instantiations is at least an order of magnitude larger, because the story is composed of situations that are the cross-product of the actors' roles. This also provides a principled fashion for authoring these story variants, because that goal node in the network can subsume several ways of solving a narrative goal. For instance, if Ross needs to talk to Rachel in private, he can isolate Rachel from her friends by calling her aside, attracting her attention, asking her friends to leave, and so forth. This makes it easy to refine potential variants by adding extra options at authoring time. As representations, HTNs can capture essential properties of a character's role through the actions the agent takes toward its goals and the choices it faces.

There is a further need to categorize these actions according to narrative criteria. These categories should represent properties bearing relevance for intercharacter relationships, which we can match to the various actors' personalities. For instance, actions targeting other actors can be classified as "friendly," "rude," and so forth. If, when faced with the task of talking to Rachel in private, Ross interrupts her previous conversation and sends her friends away, we would tag the corresponding option in the HTN as "rude." In a similar fashion, we can categorize single actors' occupations according to their degree of sociability—for example, "lonely" or "sociable."

To some extent, these categories are part of an ontology of intercharacter relationships and can help determine how other characters will react to the actions taken. Intercharacter relationships, although obviously important in a *Friends* context, are a generic problem in interactive storytelling. The contents of the HTN are determined by considering each actors' role in the baseline story in isolation. These roles can be refined by providing additional options (this refine process is naturally supported by the HTN formalism). The search mechanisms associated with HTN planning also makes them a useful tool for debugging. Because HTNs are searched from the root node, which is also the main goal, it is easier to gain access to the corresponding state of the world. One additional reason for selecting HTNs as a formalism is that their graphic nature seems more supportive of the authoring phase than STRIPS-like planning formalisms. However, we have not yet been able to test this assumption with professional scriptwriters.

Figure 1 gives an overview of a typical HTN for a character. Pre- and postconditions for the various tasks (not explicitly represented in the figure) are associated with each task node. Preconditions for the lowest-level operators are constituted by the conjunction of executability conditions for their associated terminal actions (those actually acted in the 3D environment). For instance, if Ross wants to read information from Rachel's diary, the diary should be at its initial location, not in use by another agent or near any witnesses. Some of these conditions are obviously subject to change in a dynamic environment, so they become a main vehicle for interaction. The system directly implements postconditions through the effects of terminal actions, which are rolled back to the highest-level task node subsuming these actions.

Furthermore, we can compare HTNs to other forms of knowledge representation proposed in interactive storytelling. In particular, there is a formal equivalence between

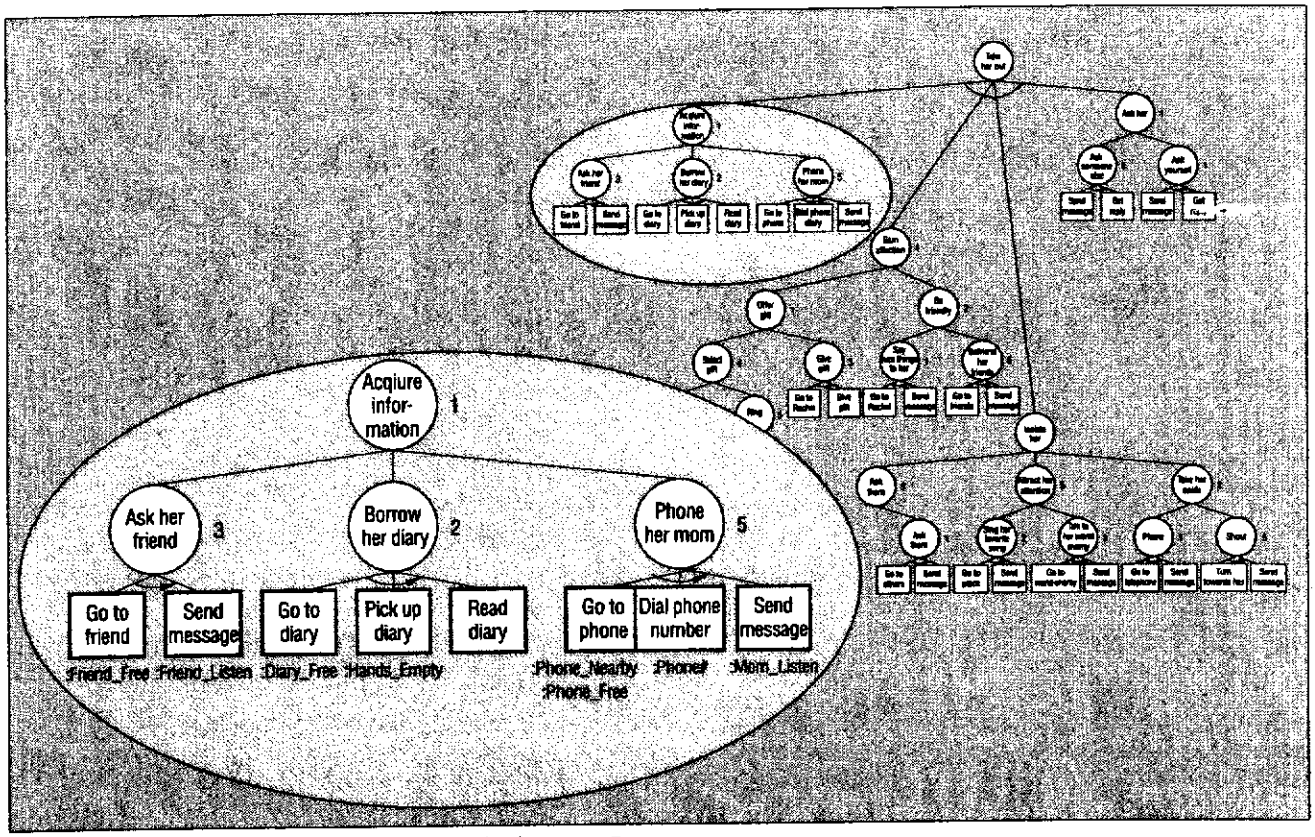

Figure 1. A Hierarchical Task Network for the main character, Ross.

subtasks of the HTN and narrative functions described in narratology that stand for key narrative actions seen from a given character's perspective. The difference lies in the fact that the *agentive* (or predicative) structure for the equivalent narrative functions lies outside the corresponding portion of the HTN, in the interaction with narrative objects and other characters filling up the roles for that narrative function. For instance, when seeking information about Rachel, Ross could talk to her friend Phoebe. If he talks to Phoebe, she will complement the agentive role of the corresponding narrative function. Also, whenever multiple characters interact, they potentially instantiate narrative functions "bottom-up" through the conjunction of activities from their respective HTNs.

HTN planning

Interactive storytelling requires interleaving planning and execution.[2] We have thus devised a search algorithm to produce a suitable plan from the HTN. Exploiting our total ordering assumption and subtask independence, the algorithm searches the HTN depth-first and left-to-right and executes any primitive action it encounters in the process. It allows backtracking when primitive actions fail (such as following competition for action resources by other agents, or user intervention). In addition, it attaches heuristic values to the various subtasks, so forward search can use these values to select a subtask decomposition (this is similar to the use of heuristics that Peter Weyhrauch described to "bias" a story instantiation[9]).

An essential aspect of HTN planning is that it is based on forward search while being goal-directed at the same time, because the top-level task is the main goal. (Other recent forward-search planning systems, such as the Heuristic Search Planner[10] or MinMin,[11] search forward from the initial state to the goal.) Consequently, because the system is planning forward from the initial state and expands the subtasks left-to-right, the current state of the world is always known (in this case, the current state reached by the plot).

When initially describing the roles, we chose to adopt total ordering of subtasks. Total-order HTN planning precludes the possibility of interleaving subtasks from different primitive tasks, thus eliminating task interaction to a large extent.[6] In the case of storytelling, the subtasks are largely independent because they represent the story's stages. Decomposability of the problem space derives from the inherent decomposition of the story into various stages or scenes—a classical representation for stories. Our use of HTN is currently associated with substantial simplifications of the associated planning problems, such as subgoal independence, empty delete lists, and total ordering of subtasks at AND nodes. However, this approach to planning seems consistent with the knowledge-intensive nature of interactive storytelling and some of its inherent properties, such as the temporal ordering of various scenes. Other planning techniques—ones more oriented toward a problem-solving approach, for example—could be used, such as one that manages resources and orders actions (see, for instance, D. Weld's "dinner date" example, which describes planning in a domain similar to our sitcom example[12]). However, it is still unclear under which conditions a more generic approach will benefit interactive storytelling.

In addition to their top-down plans, characters also react to specific events. For exam-

Figure 2. The emergence of situations: Ross meets Rachel by accident while still in the early phase of his plan.

ple, Rachel might become jealous whenever she sees Ross talking alone to another female character, or she might be upset if he is rude to one of her friends. These reactions dynamically update "mood" values that affect the other characters' plans. There is thus more to authoring than just describing the various subtasks for each actor's role in an HTN. It is also necessary to describe the character's reactions to various generic situations, mostly arising from the conjunction of actions from the characters' respective plans.

Interactive story generation

One main challenge in generating a story using a character-based approach is achieving story variability while preserving a well-defined story genre. In other words, in the course of various plot instantiations, different situations occur that generate different endings. However, these situations should generally fall in line with the sitcom genre. Having a consistent genre helps the user understand the course of events and decide whether to intervene and in what fashion.

Story generation results from dynamic interaction between the main characters' plans,[4] which correspond to a top-down approach, because characters' behavior is generated from their predefined HTNs. However, in the course of the action, situations might emerge that do not form part of the initial plans. The interaction between characters' plans results in random onstage encounters between agents that have the potential to create situations of narrative relevance. These interactions constitute a bottom-up approach (because plan-based behaviors don't account for these situations) and thus create a need for two specific mechanisms: *situated reasoning* and *action repair*.

Situated reasoning in plan-based actors' behaviors[13] originates from the discrepancy between an agent's expectations and action preconditions. One defining aspect of situated reasoning is that it is oriented toward obtaining a specific resulting state in a given situation.[13] Situated reasoning should include avoiding an undesirable result. One such example in interactive storytelling consists of reacting to situations that emerge from the spatial interactions of artificial actors. The system randomly positions the characters on the set before the story begins. Consequently, although characters will try to follow their independent plans, they might find themselves in situations that are not (and cannot be) explicitly represented as part of their plan—and the system can't ignore these situations.

One example is Ross meeting Rachel by accident while he is still at the early phase of his plan (see Figure 2). He can choose to talk to her or hide from her, but he can't, from a narrative perspective, walk past her without any interaction. One option that situated reasoning offers is to hide from her, and a user can implement this action by interrupting Ross' current action. Ross could also resume his initial plan: If his current action is to meet Phoebe, he can return to her after Rachel passes (not noticing him). In this specific case, hiding from Rachel does not impair subplan continuation.

Consider a similar case, where Ross wants to talk to Phoebe without Rachel knowing because he's afraid Rachel might get jealous (a feature actually implemented in the system). He might wait, but unlike the diary, Phoebe can in the meantime move to another location or engage in other activities, causing the initial intended action to fail. The interruption caused by situated reasoning can thus have an irreversible impact on the initial plan whenever time and duration or location constraints appear. However, even in this case, situated reasoning (hiding from Rachel) preserves the plot's relevance and coherence, because it is properly dramatized and constitutes a part of the story.

One of the main causes for action failure is not satisfying executability conditions. Consider the case where other agent behaviors affect the executability conditions.[11] One example is Ross needing to access Rachel's diary early in the story. This action can fail in several cases (corresponding to different contexts): the user hides the diary, Rachel is writing in it, Ross' sister Monica is in the same room so he cannot steal it, and so forth. The first case imposes replanning, because action repair cannot be applied to the user's nondeterministic behavior (for example, the user likely won't return the diary). The second situation can be a target for action repair, because Ross could simply wait until Rachel has finished her task. More interestingly, the latter case offers the widest range of options. Ross can choose another source of information about Rachel, wait for Monica to leave the room and resume his initial plan, or try to influence Monica so that he can still carry on his original action.

There is sometimes a fine line between action repair and situated reasoning. Strictly speaking, action repair should be dedicated to recovering from action failure. However, in our storytelling context, action failure is most often due to not satisfying executability conditions due to external factors. For instance, Ross cannot read Rachel's diary because it is missing, Rachel is using it, or Monica is in the same room. In other words, action repair is dedicated to restoring executability conditions or reaching the same final state as the original action, whereas situated reasoning essentially consists of inter-

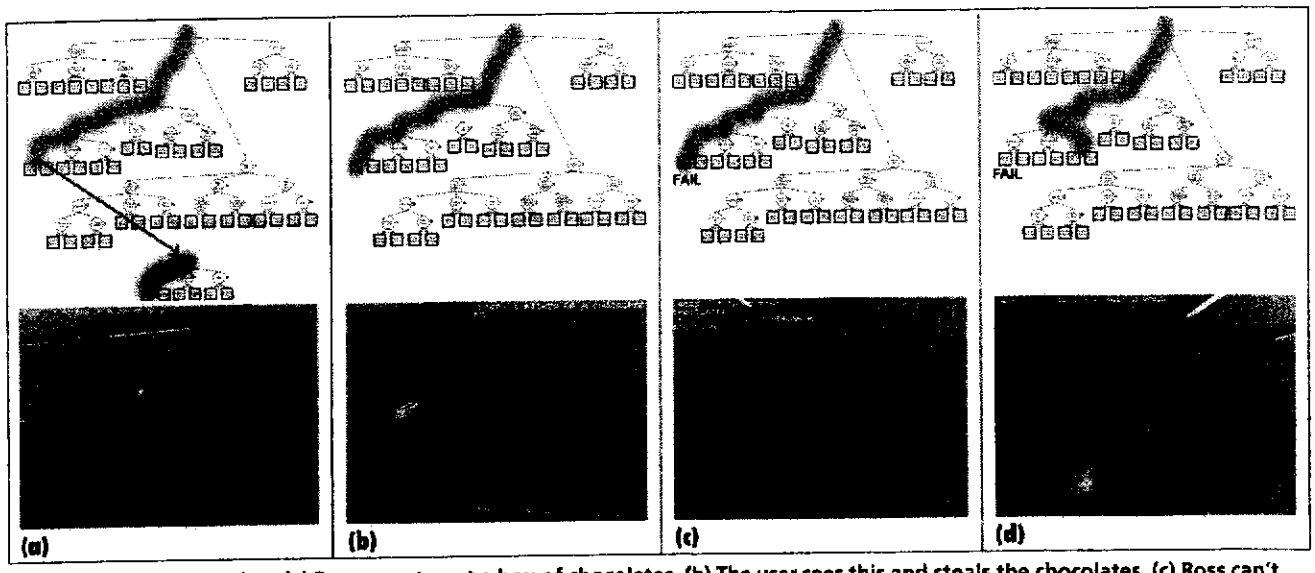

Figure 3. User intervention: (a) Ross goes to get a box of chocolates. (b) The user sees this and steals the chocolates. (c) Ross can't find them, so he (d) replans and gets roses instead.

rupting the current plan and dealing with a specific situation. It hence does so more from the dramatization perspective than from the planning perspective.

Although the basic elements of actors' behaviors are deterministic, several factors contribute to make the action nonpredictable from the user's perspective:

- The actors' initial positions on stage
- The interaction between actors' plans—the various characters essentially competing for resources for action (whether narrative objects or other characters)
- The random output of some terminal actions
- The characters' mood status
- User intervention

For instance, the initial positions on stage strongly influence the emerging situations. Depending on their positions and activities, Ross might not be able to acquire information from Phoebe before she leaves the apartment to go shopping. Consequently, similar conditions or user interventions might not always produce the same results.

User intervention and plot variation

The user watches the story as a spectator. He or she can follow the story from any character's perspective or navigate the virtual set while the action is in progress. Then, depending on the situation, the user can choose whether to interfere with the characters' goals. Characters' actions are dramatized through the timing of appropriate animations. Because the actors are playing a role rather than improvising, their actions are always narratively meaningful. Hence, if a character moves toward a given object, it likely bears significance on the story and can be a target for user intervention (for instance, if the user sees Ross moving toward Rachel's diary, he or she can steal or hide the diary).

Users can intervene any time—they don't need to wait for key situations or for the system to prompt them. However, it is important that they understand the story. Thus, users should be aware from the onset of the overall dramatic situation—namely, Ross' interest in Rachel. The system can best convey this using an opening full-motion video sequence, generated with the game engine.

A user can intervene by either acting on physical objects onstage that bear narrative relevance or by advising the characters using speech recognition. The possibility for physical intervention is based on the notion of narrative objects. These objects act as *dispatchers*—that is, they bear narrative significance because they are the compulsory objects of key narrative functions. Dispatchers naturally arise from the current course of action: when Ross seeks a gift for Rachel, objects such as flowers, chocolates, or jewelry become explicit potential targets for user interaction. These objects, now resources for actions, can force the character into replanning or action repair, thus creating a new course for the plot. The user simply uses the Unreal Tournament's ordinary "player" features to navigate in the virtual set to steal or hide narrative objects (the user, however, is not embodied through a character and thus maintains spectator status).

In Figure 3, a user steals the chocolate box, so Ross must offer Rachel roses (which happens to be a favorable gift). This situation can correspond to various sorts of user interventions, depending on the user's understanding of the plot. The user could have realized that Phoebe lied about Rachel's preferences and tried to help Ross. Or, the initial intention might have been to interfere with Ross' plan, in which case the user involuntarily helped him. Dispatchers crystallize choices both from the characters' perspective and from the user standpoint, the latter having to decide whether to interfere. We do not resort to the traditional notion of affordance nor to its implementation in current computer games, where potentially reactive objects are often signaled as such. Rather, we intend to use the same kind of narrative cues as traditional media, such as camera close-ups in films.

The other mode of interaction consists of influencing actors using speech recognition. Speech intervention is the most natural way of influencing the characters and is ideally suited to the interactive storytelling paradigm of user-as-spectator. Several interactive storytelling systems have reported the use of linguistic interaction,[1,5] essentially in the form of user–agent dialogue. The rationale being that, in these systems, the user is a member of the cast and acts by engaging in conver-

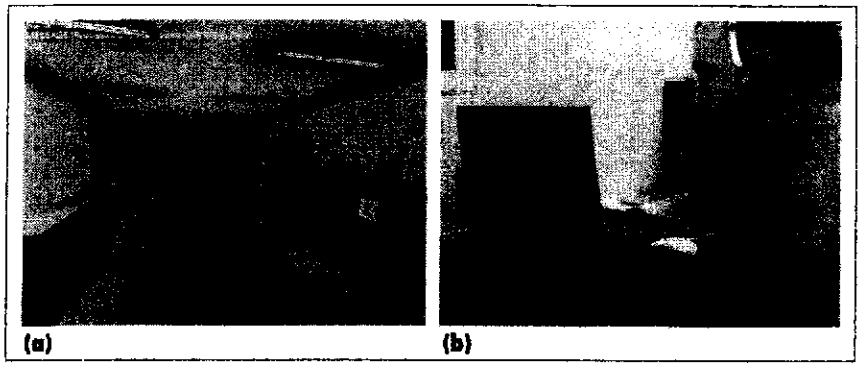

Figure 4. Giving spoken advice to characters: (a) Ross heads toward Rachel's room to read her diary; (b) the user warns him that Rachel is in the room.

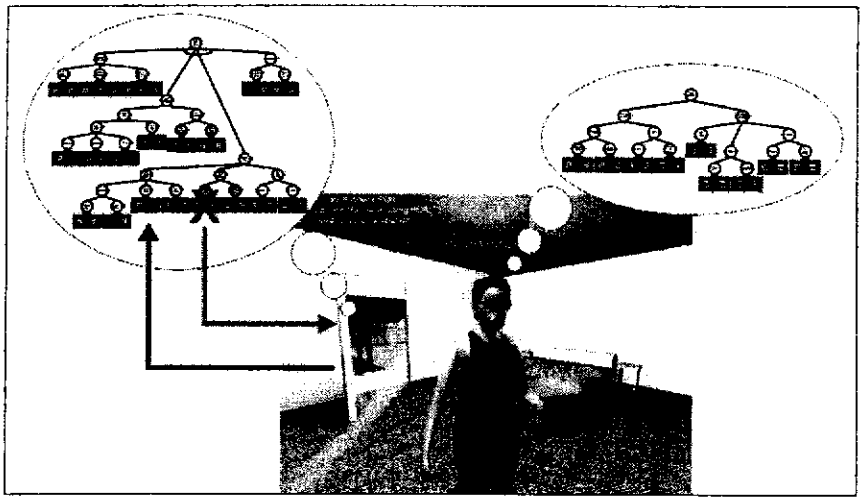

Figure 5. Character interaction and replanning.

sation with the virtual actors.

However, to be in line with our interaction paradigm, spoken input should not take the form of direct commands; otherwise, the user's role would shift from spectator to director. We designed our speech interface to analyze user advice in the form of isolated utterances, whose average length is between seven and 10 words. The grammar we defined for the ASR speech recognition system determines the linguistic coverage for user input. We designed this grammar using habitability principles—that is, syntactic and lexical variants that provide sufficient flexibility without requiring the user to memorize specific commands. We encoded the recognition grammar as flexible templates, which include optional sequences; we've encoded 90 such grammar rules into the system thus far. These provide sufficient coverage for an experimental system but would have to be greatly enhanced for a complete application. We performed a second level of template matching on the output from the speech recognition system, which associates semantic features with the recognized words. The resulting templates correspond to the semantic content of the user utterance, which influences the character's plan.

Giving advice rather than instructions assumes information of a more implicit nature (see Figure 4): for instance, when Ross heads toward Rachel's room to read her diary, the user might warn him that Rachel is in her room. To correctly process such advise, the system must recognize it as a speech act. We can prepare the system for this by using a semantic approach that maps the speech act's contents onto the tasks' preconditions (or the executability conditions of terminal actions for these tasks).[4] This approach also provides a unified principle for recognizing the speech act and computing its effects—in this case, for anticipating action failure and triggering the appropriate replanning. This approach seems well adapted to recognizing speech acts that affect specific tasks in an agent's plan, because it could identify them by mapping an utterance's semantic content to descriptors associated with a task (see Figure 5).

Other forms of advice exist, such as the "doctrine statements" Bonnie Webber and her colleagues have introduced.[13] These statements prescribe generic rules of behavior that only become active when relevant situations occur: for example, advising Ross to "be nice to Phoebe" will determine whether he interrupts a conversation between Phoebe and Monica when trying to gain information from Phoebe. This advice could keep Phoebe from lying to Ross about Rachel's preferences.

Finally, the user can directly provide information that will solve a subtask's goal. This is the case if the user tells Ross about Rachel's preferences (such as "Rachel really likes flowers"), solving the initial task of gaining information about Rachel and causing Ross' plan to proceed forward with this task solved. In this instance, the user can provide helpful information, or lie to him, and observe the consequences on the unfolding story. From an implementation perspective, subgoals in the HTN are labeled according to different categories, such as `information_goals`. When these goals are active, the system checks them against new information input from the natural language interface and marks them as solved if the corresponding information matches the subgoal content. In that sense, the system can recognize the speech act and compute its effect by mapping the semantic content of the natural language input to the semantic atoms occurring in some HTN's operators' pre- or postconditions.

Currently, our system can generate complete stories up to three minutes in duration. The dramatic action appears from Ross' perspective, although the user can switch viewpoints to another character or freely explore the stage while the plot unfolds. The action progresses until Ross asks Rachel out, and the story concludes with Rachel's answer. Figure 6 shows a sample story that the system produced.

Figure 6. An example of story instantiation: (a) Ross goes to Rachel's bedroom to find her PDA. (b) Phoebe, who is preparing some coffee, doesn't see him. (c) The user discovers Ross' intentions and decides to steal Rachel's PDA (by removing it from the virtual environment). (d) Ross reaches the PDA's original location, unaware of user intervention and (e) can't find it. (f) Ross decides to ask Phoebe for information about Rachel. (g) He awkwardly interrupts Phoebe in her activities. (h) Upset by the intrusion, Phoebe lies about Rachel's preferences and tells Ross to give her a box of chocolates. (If Ross had been more careful when asking Phoebe, she would have responded sincerely to his request and told him to offer Rachel roses.) (i) After obtaining information from Phoebe, Ross leaves and (j) goes to a shop to buy chocolates. (k) He buys the box of chocolates and (l) leaves the store. (m) He returns to the apartment to offer the chocolates to Rachel. (n) He finds her alone and asks her out. (o) Unimpressed by his gift, she says no.

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We now need to develop evaluation methods that can measure a system's potential to generate stories and the narrative relevance of such stories.[2] At this time, we can only quantify our system's generative potential: A story instance consists of the conjunction of a set of terminal actions for each actor's plan. Assuming that the system synchronizes these actions in each scene, an order of magnitude for the number of stories is given by the sum across scenes of the product of individual characters' actions. For an average branching factor of three, this amounts to several hundred story variants, and for a branching factor of four, a few thousand. This order of magnitude does not evaluate the actual interest or dramatic value of the story variants: different actions carried by secondary characters, while formally contributing to a story variant, might have no real impact on the overall story.

However, character-based approaches have good potential for story generation. Despite the deterministic nature of their underlying techniques, many different factors contribute to the unfolding plot's unpredictability from the user's perspective. Future work will have to evaluate the approach's scalability: we plan to extend our prototype to develop more complex storylines and use multiple plans for each character to increase their interactions.

In the long term, our simplifying assumptions, such as decomposability and total ordering, will most certainly face limitations. All but the simplest stories involve intertwined plots and dependencies between actions taken. This would lead to investigating more generic, possibly domain-independent, planning techniques such as search-based planning.[10] However, in our current implementation, using knowledge-intensive planning techniques such as HTN planning simplified the narrative control problem, because narrative control was partly compiled in the representations. This might no longer be the case with generic planning techniques, which should be associated with narrative control mechanisms. As a first step in exploring these issues, we will study heuristic search planning in story improvisation, where only situational aspects are relevant—for instance, in cartoons. ■

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國立中山大學96學年度博士班招生考試試題

科目：資訊管理論文評述(二) 【資管系選考】

閱讀所附論文並回答下列問題：

1. 第一階段前測依「涉入程度分佈較爲平均」的原則來決定實驗商品，如表 2。這個原則的道理爲何？若選擇其他商品，如眼鏡，對實驗會有什麼影響？這些影響有什麼方法可以克服？(7.5)
2. 表 4 中的參與者特性，除二分法的特性外，有的分爲 3 等分，如年齡；有的分爲七等分，如平均每週花在 WWW 上的時間。由表 4 的劃分法和數據提出可能的問題和改善方法。(5)
3. 由圖 2 來解釋表 10 中假說 1 的結論。(5)
4. 本研究三個假說都獲得支持，然圖 2(b)和圖 4(b)仍略有不同。考量實驗的過程中有許多無法完全排除或控制的影響因素，圖 2 和圖 4 何者推論假說檢定結果，即假說獲得支持，的論證較強？爲什麼？(7.5)
5. 若將圖 1 修改爲，涉入程度爲自變數，引導效果爲調節變數，廣告態度爲依變數，其餘省略。寫下要檢定的假說並論述其意義。(15)
6. 依個人的網路使用經驗對此論文探討的主題和結果提出評論。(10)

線上環境中廣告情境呈現與執行手法對廣告效果的影響：廣告變化、訊息訴求與導引效果

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摘要

網際網路的快速成長，使得線上媒體除了資訊整合的呈現之外，也成為另一種廣告與交易媒合的平台。本研究透過實驗室實驗法的設計，探討在線上廣告環境中廣告情境呈現、執行手法、消費者商品涉入程度、以及其間交互作用對於廣告效果的影響。研究結果發現，在不同的消費者涉入程度下，廣告變化與訊息訴求等廣告情境呈現方式，以及導引效果的執行手法，均會產生 ELM 中周邊與中央線索的效果。本研究以參考學域的觀點，結合認知心理學以及行銷學的基礎，探討在電子商務的線上廣告情境中消費者行為與反應，實際呈現了在線上環境中進行廣告行為時，實務上應考量的因素與可行作法，並以研究成果為基礎，提出對後續研究方向的建議。

關鍵字：網路廣告、廣告變化、訊息訴求、導引效果、廣告態度

壹、緒論

網際網路起源於 1969 年美國國防部的 ARPANET 計畫，然而自從 1991 年 NSF 開放其商業化的限制以來，網際網路才快速地成長，並帶動相關商業模式的形成。其中，線上廣告的存在即企業期望透過消費者的瀏覽或點選(click)動作，達到刺激消費者的印象，進一步吸引消費者進行消費或達到其它宣傳目的。

在線上環境進行廣告活動時，最重要的便是其效果是否發生，以及哪些是可能影響廣告效果的因素。關於這一點，可以由「個人互動」(person interactivity)與「機器互動」(machine interactivity) (Hoffman and Novak, 1996)的角度加以思考。「個人互動」主要是指消費者本身與媒體的溝通過程，其特點是受到消費者資訊處理特性的影響，因為資訊處理特性除影響消費者對於廣告資訊處理的方式與偏好，並將進而影響到廣告效果的發揮。在行銷領域中，消費者商品涉入程度是常被提及的一項影響資訊處理行為的重要特性，其中 Petty et al. (1983)與 Petty and Cacioppo (1984)的「思考可能性模式」(Elaboration Likelihood Model; ELM)最常被應用於解釋不同涉入程度消費者所採取的資訊處理方式與差異性。涉入程度影響消費者資訊處理方式，如對於特定類型的廣告設計、呈現方式、或廣告標語訴求會表現出較高的興趣與接受度。過去相關研究中以「思考可能性模式」為基礎所累積的研究結果，亦使得消費者的資訊處理行為能夠更有系統地被描述，同時更具可預測性。

在「機器互動」方面，則有關於線上廣告呈現的機制，透過廣告情境的設計對個人產生影響，本研究欲引用認知心理學領域中導引效果(priming effects)的觀點。導引效果意指個人在資訊處理行為上，會受到外在刺激(stimuli)以致於影響資訊處理的偏好或優先次序，進一步影響其決策判斷與行為，早先被應用於認知心理學（如 Jones and Panitch (1971); Higgins et al. (1977); Scrull and Wyer (1980); Sherman et al. (1978); Snyder and Swann (1978); Herr et al. (1983); Herr (1986)），其後亦被引用至行銷領域的相關研究（如 Herr (1989); Meyers-Levy (1989); Yi (1990a; 1990b; 1993); Shrum et al. (1998); Mandel and Johnson (1999)）。

除了代表廣告執行策略的實現方式之一，本研究選擇探討導引效果的另一個原因，乃是基於線上媒體的角色越來越重要，且其與傳統大眾媒體間的界線逐漸模糊，就廣告策略執行的角度而言，線上媒體與傳統媒體的結合甚至已成為整合行銷活動的重要環節。在這樣的情況下，亦不能忽視了消費者在真實情境中接觸不同媒體資訊來源所產生的影響，而導引效果在此情況下具有何種影響力（或是如何影響），則是值得探討的重要議題。

本研究以參考學域(reference discipline)的觀點，結合行銷學與認知心理學的基礎，探討在線上廣告環境中廣告情境呈現與執行手法，以及消費者特性的影響，主要研究問題為「在線上廣告環境中，如何透過廣告情境呈現以及執行手法的設計，達到提昇廣告效果的目的？」本研究並試圖透過實徵研究的進行，達到以下目的：

1. 探討在線上廣告環境中，消費者商品涉入程度對於消費者處理廣告資訊行為的影響；

2. 考慮在線上廣告環境中所採用的廣告情境呈現策略（廣告變化以及訊息訴求），探討其與消費者涉入程度所形成的互動關係對廣告效果的影響；

3. 探討在線上廣告環境中，不同媒體資訊來源接觸對於消費者所形成導引效果，是否影響線上環境的廣告效果；

4. 探討在線上環境中，廣告效果發生的影響因素，並對於線上廣告情境的設計有進一步瞭解。

本研究後續章節安排如下：第貳節為文獻探討，蒐集整理過去學者的相關研究成果，同時輔以適當的說明與彙整；第參節根據相關理論基礎逐步推導出本研究之研究假說，並提出本研究之研究模型；第肆節說明本研究所採用之研究設計、研究方法與進行程序；第伍節則針對本研究資料進行分析，並對研究假說進行檢驗；第陸節針對資料分析結果進行綜合討論，第柒節則說明本研究之管理意涵、後續研究方向與本研究之研究限制。

貳、文獻探討

一、思考可能性模式

根據「思考可能性模式」(Petty et al., 1983; Petty and Cacioppo, 1984)的觀點，個人對於接收資訊所進行「思考」程度的不同，將形成如光譜帶的差異，一端為對於議題相關資訊完全不加以思考，另一端則為對於議題中所有論點(argument)仔細思考並將之整合進個人的態度綱要(attitude schema)中。「思考光譜」(elaboration continuum)並被進一步簡化為兩個極端，分別代表中央路徑(central route)以及周邊路徑(peripheral route)的資訊處理方式(Petty and Cacioppo, 1986)。中央路徑發生於個人同時具有較高的能力以及動機針對議題相關資訊進行仔細思考與比較時，而周邊路徑則發生於動機以及能力相對較弱，因此態度主要由情境中的情感性線索決定，而非關於訊息論點的思考。

「思考可能性模式」的觀點，亦被用以由消費者本身涉入程度的差異解釋不同的資訊處理方式。當消費者涉入程度高時，會傾向於採用中央路徑的資訊處理模式，亦即根據資訊的內容，經過審慎的推理與思考而做出決策。然而，當消費者涉入程度低時，將會傾向於根據產品或服務的周邊屬性，如顏色、交易環境、品牌印象、產品代言人等線索進行決策。

二、廣告情境呈現

（一）廣告變化

在廣告的進行上，透過廣告重複出現以提高曝光率是一項常用策略。廣告的重複

被視為廣告給予消費者資訊輸入的元件之一，將進一步觸發消費者的回應(Vakratsas and Ambler, 1999)。Rethans et al. (1986)指出，廣告重複出現的效果在於隨著廣告重複出現的頻率增加，消費者的回憶能力也隨之增強。Singh and Rothschild (1983)則指出商業廣告的重複效果有助於消費者對於資訊的學習。

儘管廣告的重複有助於加強消費者對於廣告資訊的思考以及回憶，但當重複程度超過特定臨界值時，該正向效果將會逐漸衰退。亦即，廣告重複性以及消費者對於廣告的感受係呈現一 ∩ 型的關係(Calder and Sternthal, 1980; Kirmani, 1997)，主要是由於消費者不斷地重複接受相同資訊而感到厭煩或無聊。因此，若能在重複的廣告呈現中加入一些「變化」，將可避免因過早到達臨界點反使得廣告效果降低（甚至轉為負向）。

Schumann et al. (1990)針對過去文獻中缺乏關於廣告的變化策略，以涉入觀點為基礎，將廣告內容的變化策略分為「實質性變化」(substantive variation)以及「裝飾性變化」(cosmetic variation)兩種，探討對於廣告效果的影響。Schumann et al. (1990)的研究結果與「思考可能性模式」觀點一致，亦即當消費者處理廣告資訊的動機較低時，裝飾性變化的策略對於消費者態度有較大的影響，但當消費者動機強烈時，實質性變化的策略則會有較大的影響。

（二）訊息訴求

訊息訴求主要指在廣告內容中所採用的主要焦點。所有的廣告均可被定位於兩端分別代表資訊性(informational)以及情感性(emotional)的一條光譜帶上(Singh and Dalal, 1999)，當消費者接觸到訊息時，即會對於該訊息的理性或感性程度做出推論(Zeitlin and Westwood, 1986)。Johar and Sirgy (1991)則指出，廣告的訴求應與產品本身特性一致。另外，Liebermann and Flint-Goor (1996)亦指出，廣告訊息訴求的選擇，應依廣告所代表主體的特性決定，亦即廣告訊息訴求以及產品特性之間，具有適配(matching)關係的存在。

對於廣告訊息訴求，Petty et al. (1983)以及 Petty and Cacioppo (1984)由消費者對於產品涉入程度的高低，指出在資訊處理形態上的差異。另外，亦有研究根據產品特性的差異，指出應搭配不同訊息訴求的廣告（如 Johar and Sirgy, 1991）。對於不同性質的產品而言，廣告的內容訴求應依產品特性不同，配合採取不同的訴求內容，方能發揮效果。

三、導引效果

導引效果的影響，係由於個人在接受某項導引刺激(prime)之後，提高了該項刺激或屬性在個人進行決策或行為時被擷取的機率(Scrull and Wyer, 1980; Yi, 1990a; Yi, 1990b)。亦即，經過某項特定類型的刺激之後，個人在後續的相關事件中，會傾向於採用與先前刺激相關的屬性進行評估(Higgins et al., 1977; Scrull and Wyer, 1980)。

導引效果的發生，除了由於特定資訊內容所給予的影響之外，亦可能來自於資訊呈現的方式。Holbrook and Moore (1981)指出，即使給予相同的產品屬性，但由於以圖

形或口語方式呈現產品資訊的差異，消費者對於產品屬性亦表現出不同的評價。Mandel and Johnson (1999)則以全球資訊網中不同的網頁背景（分別以藍天白雲以及錢幣為主題），發現消費者在產品屬性評估的偏好上，會因瀏覽網頁背景不同而有所差異。

Herr (1989)指出，導引效果的主要特性係在於其「被動」的性質。此被動特性意指在接觸到後續的刺激時，個人未必會「特意地」(consciously)將之與先前所經歷的刺激類型相比較，甚至可能並未察覺到該屬性類型已存在的事實；在非特意的情況下，個人卻自然而然地以該屬性類型作為比較的基礎。其顯示的結果是，個人往往因為未察覺到該屬性類型影響力的存在，因而並未表現抗拒心態，但在後續決策或行為上卻受到影響或牽引。

因此，就廣告主的觀點而言，導引效果應是一項值得深思的策略。透過不同廣告情境的設計，廣告主可以藉由導引效果影響消費者在進行廣告評估或商品選擇時的相對權重，進而達到廣告宣傳與吸引消費者的目的。Herr (1989)與 Yi (1990a; 1990b; 1993)的研究結果即指出結合導引效果以及廣告情境的操弄，對於消費者處理廣告商品資訊時的影響。

四、廣告態度

廣告態度係指「在特定情境下接觸廣告刺激，所產生正向或負向回應的傾向」(Lutz, 1985)。消費者此項受廣告所引發的態度可進一步分為兩方面，分別是「認知」(cognition)以及「情感」(affect)，亦分別代表了「思考」(thinking)以及「感覺」(feeling)的構面(Vakratsas and Ambler, 1999)。

針對廣告影響消費者購物意圖的過程，Lutz et al. (1983)提出了四種以廣告態度為中介的模型。在四種模型中，學者的研究結果支持了「雙重中介假說」的觀點(Lutz et al., 1983; MacKenzie et al., 1986; Homer, 1990; Miniard et al., 1990; Brown and Stayman, 1992)。「雙重中介假說」顯示的意涵是：對消費者而言，消費者對於訊息來源（廣告）的感覺，將會形成關於訊息來源的態度（廣告態度），進而影響關於訊息內容（廣告品牌）的認知與情感反應(MacKenzie et al., 1986)。

廣告對於消費者的刺激不僅僅來自於廣告標的物的特徵（如汽車性能、印表機列印速度與效果），亦可能來自於廣告本身給予消費者的感覺（如 Scott et al., 1990）、以及整體廣告呈現的情境等。亦即，消費者廣告或品牌態度的形成，未必完全根據產品或品牌屬性的特性所決定，在消費者接觸廣告時所被引發的情感亦是可能影響消費者態度的重要因素(Batra and Ray, 1986; Brown and Stayman, 1992; Smith, 1993)。

參、研究假說與研究架構

一、廣告變化與商品涉入程度的調節效果

由於廣告變化策略可能影響消費者所感受到「與產品相關資訊」的多寡，或在重複接收的過程中誘使消費者將焦點著重在廣告的特定部份(Haugtvedt et al., 1994)，因此針對消費者的特性或偏好，不同的廣告變化策略將可產生不同的廣告效果。Haugtvedt et al. (1994)即指出，消費者在不同程度的動機下，傾向於以不同角度自廣告中形成關於該廣告商品的評價或判斷。因此，對於不同的消費者，透過廣告變化策略的適當運用將可有效地達到傳遞廣告訊息的效果，並加深消費者對於廣告商品的正面印象。

換句話說，若能針對消費者的特性提供適配的廣告變化策略，一方面不僅可透過重複以及變化的廣告資訊達到加深印象之目的，另一方面也由於這樣的變化策略為消費者所接受與歡迎（因與消費者之廣告資訊處理習性適配），因此應可達到較佳的廣告效果。例如，Schumann et al. (1990)指出過去關於廣告重複性可加強說服效果的研究，部份是由於消費者對於廣告商品實質內容的處理較多，而部份則是由於消費者對於廣告正面線索（如具吸引力的商品代言人）接觸較多所導致，即不同類型的廣告策略對於不同消費者產生的效果亦有所差異。

根據「思考可能性模式」的觀點，就廣告呈現方式而言，透過不同的過程或途徑均可形成正面的廣告說服效果：中央線索的運用使消費者對於商品屬性有較深的思考或推理；周邊線索的運用則使消費者將廣告所提供的感覺或線索與自身的態度及感受結合。至於中央或周邊線索適用的情況，則視消費者對於該廣告商品的涉入程度高低而定：高涉入者配合中央線索的提供，以及低涉入者配合周邊線索的提供，均會使廣告產生正面的效果。

以「思考可能性模式」觀點為基礎思考廣告變化實作與呈現方式，實質性與裝飾性的變化分別即如中央以及周邊線索(Schumann et al., 1990)，隨著消費者對於商品涉入程度高低或處理資訊的動機強弱，而會有不同的效果。[1] 當消費者對於特定商品屬於高涉入族群，顯示該消費者具有較高的動機且具有能力思考廣告中的商品相關訊息，此時若給予實質性的廣告變化呈現，消費者將會透過對於產品優劣的思考而形成購買決策。對於低涉入族群的消費者而言，由於對於廣告商品加以思考判斷的能力、意願與動機均較低，因此購買決策反易受到廣告呈現情境的影響，如產品代言人(Petty et al., 1983; Singh and Dalal, 1999)或背景音樂(Park and Young, 1986)等。

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1 實質性的廣告變化意指廣告實質內容的變化，透過多次的變化以呈現更豐富且與廣告商品直接相關的資訊內容；裝飾性變化則指針對廣告呈現情境與設計元素加以變化，係以吸引消費者注意為主要目的。

亦即，若針對消費者廣告資訊處理特性加以設計廣告呈現策略，將可預期因廣告呈現與消費者資訊處理特性的適配，因而呈現出較佳的廣告效果(Schumann et al., 1990; Haugtvedt et al., 1994)。針對具有高商品涉入程度的消費者給予中央路徑（實質性變化）的廣告呈現方式，以及針對低商品涉入程度的消費者給予周邊路徑（裝飾性變化）的廣告呈現方式，均會因該則廣告所提供的資訊滿足了消費者資訊處理的需求，使得廣告對消費者而言產生較佳的廣告效果（如 Schumann et al., 1990），因此本研究提出假說 1：

【假說 1】消費者商品涉入程度與廣告變化策略之間，對於廣告效果具有調節性的影響關係。

二、訊息訴求與商品涉入程度的調節效果

Singh and Dalal (1999)探討以 WWW 首頁作為一種廣告媒介時指出，廣告包含的訊息將影響消費者對於該廣告所推斷產生的信念(inferred belief)。同時，所有的廣告均可因其訊息訴求的不同，而被視為位於兩端分別為「資訊性主導」(predominately informational)以及「情感性主導」(predominately emotional)的一條光譜帶上。透過強調資訊性或情感性的廣告訴求，廣告將可由不同途徑達到告知或說服效果，使消費者對於廣告本身、廣告商品或廣告廠商產生較深的印象，因而達到廣告目的。

資訊性訴求強調廣告訊息所提供的資訊內容，包含細節、規格以及相關數據。相對地，情感性訴求則試圖將商品的購買以及使用決策與潛在購買者的心理需求形成連結(Liebermann and Flint-Goor, 1996)。當然，針對資訊性或情感性的廣告訴求而言，兩者並非優劣比較的關係，呈現出的廣告效果也有所差異，兩種訴求的效果須視實際在廣告情境中的搭配而定（如 Goldberg and Gorn, 1987; Cutler and Javalgi, 1993; Stafford and Day, 1995; Liebermann and Fling-Goor, 1996），故須進一步指出不同的廣告訊息訴求在何種情況下方能發揮效果。

根據「思考可能性模式」的觀點，高涉入的消費者具有較高的「思考可能性」(elaboration likelihood)，亦即在資訊處理上傾向於採用中央路徑的線索，會針對訊息本身進行相關資訊的搜尋、比對、以及分析，並投入相對較多認知資源(cognitive resources)進行訊息或資訊的處理。相對地，對低涉入的消費者而言，其處理廣告資訊的動機與能力較低，因此在處理資訊的過程中投入認知資源較低（或被用於其他用途(Liebermann and Flint-Goor, 1996)），此時對於廣告資訊的處理往往透過代言人(Petty et al., 1983; Schumann et al., 1990)、廣告的版面、字形與顏色(Schumann et al., 1990)、廣告中包含的圖片(Miniard et al., 1991)、以及圖片的吸引力(Miniard et al., 1992)等周邊性線索進行。

因此，就廣告資訊提供以及消費者資訊處理之間的關係而言，針對對於廣告商品具有較高涉入程度的消費者，資訊性的訊息訴求由於具有消費者進行資訊處理所需的商品性能、價格、商品描述、數據、商品評比等資訊，因此較能滿足高涉入消費者對於廣告資訊的需求。相較於情感性的訴求，在此情況下高涉入消費者應會產生較佳的

廣告態度。

相對地，若消費者對於商品涉入程度較低，此時消費者會傾向於透過周邊路線的廣告情境、代言人、版面設計、個人偏好等因素進行資訊處理。因此，此時資訊性訴求對於消費者而言並無法產生吸引力，反而經過特意設計的情感性訴求較易與消費者產生共鳴，吸引消費者注意其中提供的各種周邊性線索，亦即對低涉入消費者而言，情感性訴求應會較資訊性訴求能產生較佳的廣告效果。根據以上論點，本研究提出假說 2：

【假說 2】消費者商品涉入程度與廣告訊息訴求之間，對於廣告效果具有調節性的影響關係。

三、導引效果與商品涉入程度的調節效果

基於導引效果的性質，在廣告上應用導引策略的目的即是期望在消費者「未特別意識到」的情況下，使其順利地接收廣告所欲傳遞的訊息，並進一步影響消費者的後續購買決策或偏好。

關於導引效果的運用，根據廣告情境的差異也會有不同的效果。「認知性導引」(cognitive priming)係在廣告情境中，針對特定商品屬性進行刺激以提高消費者對於這些屬性的擷取能力(accessibility)，因而達到影響消費者商品或品牌評價的目的；「情感性導引」(affective priming)則是透過引發消費者正面或負面的情感反應，使消費者將這樣的情緒轉移至對於廣告以及商品的態度(Yi, 1990a)。儘管同樣是導引效果的運用，但認知性導引以及情感性導引分別針對消費者在接觸廣告時所注重的不同特性進行導引效果的引發：認知性導引主要針對商品功能與配備等有助於消費者思考商品優劣的屬性，而情感性導引則是針對整體廣告給予消費者的感覺進行導引。

然而，在廣告情境中應用導引策略，並不代表必然發生預期的影響效果，導引效果發生作用或被忽略，須視廣告訊息接收者的特性而定(Yi, 1993)。就兩種導引效果而言，認知性以及情感性導引在設計上，係針對商品本身或廣告呈現方式加以刺激，在執行上若能分別針對著重商品性能屬性的消費者（認知性導引）、以及著重廣告整體感覺與版面設計感覺的消費者（情感性導引）予以適當導引效果的刺激，應會由於導引效果與消費者的廣告資訊接收偏好一致，而產生較佳的廣告效果。

就導引效果的運用與消費者資訊處理特性而言，認知性導引針對商品主要屬性進行刺激，因此亦增加了這些屬性在消費者後續資訊處理過程中的被擷取機率(Scrull and Wyer, 1980; Yi, 1990a; Yi, 1990b)。對高涉入的消費者來說，由於這些具較高擷取機率的屬性正巧為其廣告資訊處理特性所需，因此在形成廣告態度以及關於廣告訊息的記憶時，易與先前的導引刺激產生相容性，亦即因導引策略而產生較佳的廣告效果。相對地，對低涉入消費者而言，由於其廣告資訊處理偏向廣告的周邊屬性，因此先前被施予的導引刺激持續轉移至廣告資訊處理的機率較低，亦即此時較不易透過導引效果的運用影響廣告效果。

反之，若消費者事先被施予情感性導引，來自於廣告周邊屬性的導引刺激將經由

情感轉移(Erevelles, 1998; Yi, 1990a)的過程，影響低涉入消費者對於廣告資訊的處理。在此過程中，導引的情緒被轉移至廣告情境中，且由於兩種情境的相容性，較易激起低涉入消費者對於廣告中周邊屬性的注意力，因而增進消費者關於該廣告的廣告態度以及較佳的記憶效果。對高涉入消費者而言，由於導引刺激階段的周邊屬性並非其在廣告情境中資訊處理所必須，因此對高涉入消費者較不易透過情感性導引增進廣告效果。

根據以上關於導引效果以及「思考可能性模式」中消費者涉入程度的討論，本研究因而提出研究假說 3：

【假說 3】消費者商品涉入程度與導引策略之間，對於廣告效果具有調節性的影響關係。

四、研究架構

根據前一節中所討論的研究假說，本研究主要研究構念間關係如圖 1 所示：

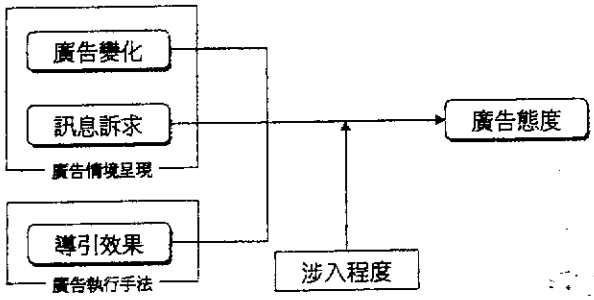

圖 1：研究架構

在圖 1 的架構中，消費者商品涉入程度為調節變數的角色，對廣告變化、訊息訴求以及導引效果三者與廣告態度間的關係產生調節作用影響。其中，廣告變化與訊息訴求即為線上廣告情境呈現的設計方式，前者分為實質性以及裝飾性變化，後者則分為資訊性以及情感性訴求；導引效果則為廣告執行手法的運用，意指給予消費者資訊性或情感性導引效果的刺激。研究架構中各構念的詳細操作化說明以及研究的設計與進行，將在第肆節中說明。

肆、研究方法

一、構念操作化定義

本研究中所採用各變項之定義與操作化方式如表 1 所示：

表 1：變項定義與操作化方式

構念	定義與操作化方式
涉入程度	個人基於內在需求、價值、以及興趣所感受到關於特定物件的相關性(Zaichkowsky, 1985)，根據 Zaichkowsky (1994)發展出簡化之 PII 量表。(α=0.94)
廣告變化	「實質性變化」意指在不同的廣告呈現中，針對相關產品屬性的呈現或廣告訊息的實質內容加以變化；「裝飾性變化」則指針對廣告中非訊息內容部份，如代言人、字形、版面安排、顏色等進行變化，但訊息內容本身並未改變(Schumann et al., 1990)。 由動態 GIF 圖檔在橫幅廣告中以「翻頁」的方式呈現實質性變化與裝飾性變化的效果
訊息訴求	「資訊性訴求」意謂廣告資訊中提供如提供商品屬性與優點、價格、保證期等與廣告商品相關的客觀細節、事實、或數據，使消費者得以據此思考或比較不同商品優劣(Laskey et al., 1989; Stafford and Day, 1995; Liebermann and Flint-Goor, 1996)；「情感性訴求」則指廣告訊息中包含較多主觀的屬性，以期吸引消費者在心理上產生正面的感覺(Stafford and Day, 1995; Liebermann and Flint-Goor, 1996; Singh and Dalal, 1999)。
導引效果	「認知性導引」指在廣告情境中針對商品的實質屬性進行導引的刺激（如商品性能或價格等因素），以引導消費者對於商品與廣告資訊的評估；「情感性導引」則指透過廣告情境引發消費者正面或負面的情感反應，並將這樣的情緒反應轉移至對於廣告的態度(Yi, 1990a)。
廣告態度	根據 Yi (1990a)以及 Coulter and Punj (1999)，分別以五點 Likert 尺度的語意差異題目：《好的-壞的》(good-bad)、《有趣的-無趣的》(interesting-uninteresting)、《喜歡-不喜歡》(like-dislike)、以及《可接受的-不可接受的》(favorable-unfavorable)，以加總得分作為廣告態度分數。(α=0.74)

二、研究設計

本研究共分二階段進行前測，第一階段前測透過對於數種商品涉入程度的調查，選擇適當的廣告商品；第二階段前測則針對第一階段選擇的廣告商品挑選出適當的訊息訴求標語，以及選擇適當的平面廣告作為實驗中導引效果的來源。

（一）第一階段前測：廣告商品

本階段前測欲透過個人涉入量表(Personal Involvement Inventory; PII)選出容易區別出消費者高、低涉入程度的中性商品。在個人涉入量表中，共列出花束、旅遊百科、電腦喇叭、眼鏡、原子筆、電腦遊戲、以及電視遊樂器等七種商品，並針對 107 位大學生進行商品涉入的前測。

為避免受測的參與者(participants)猜測問卷填答目的而影響答卷可靠性，作者在填答問卷之前的說明中，僅告知是關於了解消費者對於所列商品印象的研究。其中，部分前測參與者因來自於本文作者授課班級，故問卷改以另一位資管系博士班研究生的名義進行，以避免參與者基於授課師生的關係影響填答。商品涉入程度前測的結果如表 2 所示，就高、低涉入的參與者人數比例而言，電視遊樂器是七項商品中分布較平均者，故本研究選擇電視遊樂器為實驗商品。

表 2：商品涉入程度前測結果

	花束	旅遊百科	電腦喇叭	眼鏡	原子筆	電腦遊戲	電視遊樂器
低涉入	31	23	13	22	27	37	45
高涉入	76	84	94	85	80	70	62

（二）第二階段前測：訊息訴求標語與導引效果

第二階段前測共招募 34 名參與者，來源為某國立大學資管系研究生。作者分別列出十則資訊性以及十則情感性訴求的廣告標語，且事先製作四則平面廣告（廣告標語與平面廣告均以第一階段前測所決定的電視遊樂器為主題），以之進行訊息訴求與導引效果的前測。

訊息訴求

作者首先提供關於資訊性與情感性訴求廣告標語的定義與說明（由於篇幅所限，可與作者聯絡取得），接著給予文字性敘述，請其回答問卷問題。在訊息訴求的問卷中，對應二十則廣告標語各有一題問項：

> 請根據說明文件的【說明一】，評估下面所列的數則廣告標語與這兩項定義的符合程度，並在適當的程度上點選：
>
> （廣告標語置於此處）
>
> 資訊性訴求 □□□□□□□ 情感性訴求

資訊性以及情感性訴求的廣告標語被交錯安排，以避免參與者連續面對相同類型訴求可能形成填答上的偏差。上述問項分別給予 7 分（資訊性）至 1 分（情感性），每則標語並被詢問「您覺得這個標語與電視遊樂器相關程度如何？」，依相關性高低由 5 至 1 分計分。

對每則標語而言，計算其「符合程度」與「相關性」分數的加權乘積。乘積最高的三則被選擇為資訊性訴求標語；情感性訴求標語則是將符合程度視為負向計分(reverse-scored)，並同樣選擇加權乘積後最高的三則，結果如下表 3。

表 3：資訊性以及情感性訴求廣告標語

資訊性訴求
• 數位訊號處理器、杜比音響解碼、USB 控制器、乙太網路控制器，想試試新一代電視遊樂器嗎？
• 4 個搖桿埠，3 個記憶體插槽，56K 數據機介面
• 採用與 Xbox 同級 MCPX 動畫晶片，可同時處理高階聲光效果並支援寬頻上網
情感性訴求
• 從 5 歲到 50 歲都無法抗拒的吸引力
• 歡樂與夢想的饗宴
• 淋漓盡致的美術場景，引發內心最深的感動…

導引效果

作者事先製作強調認知性以及情感性導引效果的平面廣告各兩則，認知性導引廣告強調廣告商品的性能如速度、擴充性、價格等可供消費者思考與比較的屬性，情感性導引廣告則強調廣告所能引發消費者情緒上的反應，因此較著重廣告的設計技巧，如圖形搭配、版面設計等。

前測參與者除四則平面廣告之外，並被給予關於認知性導引以及情感性導引的定義以及說明（可與作者聯絡取得）。參與者瀏覽所給予的四則廣告，並根據廣告給予其的整體感覺，評估各則廣告所能引發認知性導引以及情感性導引的程度，針對各則廣告回答下列問題：

> 請根據說明文件的【說明二】，評估您所手中所拿到的平面廣告較能提供哪一種導引效果，並在適當的程度上點選：
>
> 認知性導引 □□□□□□□ 情感性導引

同樣地，為避免參與者受到情緒連續性的影響，兩類導引效果的問項亦被安排交錯出現。問項以 7（認知性導引）至 1 分（情感性導引）計分，並挑選出四則廣告中的最高分與最低分（以所有參與者對該則廣告的給分加總），將用於實驗階段中分別代表認知性以及情感性的導引來源。兩則挑選出的平面廣告如附錄所示。

三、實驗進行

為避免在同一實驗過程中，商品涉入程度的衡量可能造成另一種來源的導引效果，因而影響後續實驗進行的嚴謹性，參與者被要求至少一週前事先上網報名並挑選欲參加的時段。在報名過程中，另需填寫一份包含電視遊樂器以及其它兩樣填充商品（旅遊資訊、網路花店）的涉入問卷。加入填充商品的目的是為了避免參與者猜測實驗目的，而採兩階段進行報名與實驗的目的係期望透過時間的區隔，減低「衡量」本身可能對於參與者所產生的導引效果。組別分配則依報名順序隨機分配之。

為達到導引效果的影響，實驗進行程序分為二個階段。在第一階段中，參與者被引導進入實驗場所，並被告知由於前一位尚未完成實驗（由另一位指導員假扮使用系

統)，需請其稍待數分鐘。於等待一至二分鐘之後，指導者告知另有一與廣告相關的研究，請其在等待的時間內順便協助填答該研究的問卷。

在取得參與者同意後，指導員先給予在第二階段前測中挑選出的二則平面廣告之一（依組別給予認知性或情感性廣告），請其對該則廣告設計提供意見。為加強導引效果的實施，指導員並請參與者填寫一份問卷，而該問卷針對不同導引效果的廣告有兩個版本：提供認知性導引的問卷著重商品屬性的思考，例如詢問廣告所提供之資訊是否有助其了解商品性能、廣告是否提供足夠資訊使其進行類似產品的比較等；情感性導引的問卷則詢問其對於廣告的整體感覺，例如廣告是否能使其感受到電視遊樂器的娛樂效果、廣告版面色彩安排是否恰當等。參與者填答完問卷後，指導員收集問卷，假扮前一位系統使用者的指導員並適時結束，接著由問卷指導員引導參與者進入與使用實驗系統。

參與者共將瀏覽 4 頁網頁。在搭配的網頁主題方面，為避免干擾，選擇與表 2 所列商品均無關的健康資訊作為網頁主題。網頁內容的來源為經正式授權後，轉載自美商美國安泰人壽台灣分公司元氣早安健康生活網(http://www.ohayo.com.tw/)中的健康資訊文章（授權書的詳細授權內容以及授權範圍可與作者連絡取得）。

每頁網頁搭配一橫幅廣告，橫幅廣告中所使用的訊息訴求以及變化策略視參與者事先被分配之組別而定。為避免網頁中僅出現電視遊樂器廣告可能使參與者產生好奇或其它情緒反應，網頁中除電視遊樂器之外並使用三則填充廣告，填充廣告主題分別為網路花店、共同基金以及旅遊資訊。

參與者於瀏覽完網頁之後，進行問卷填答。問卷中除包括本研究應變項衡量之外，並包括關於曾瀏覽的填充廣告、網頁設計、網頁內容等問項以避免其猜測實驗目的，但答案不列入後續資料分析。填答完問卷之後，由實驗指導員表示謝意，並提供參與者參加實驗之小禮品，至此該參與者的實驗結束。

伍、資料分析

一、參與者基本資料分析

本研究共招募 101 名參與者，男女各為 45 人與 56 人。其中，參與者主要集中於 18 至 20 歲(56.4%)，但 21 至 25 歲亦佔超過三成的比例。年齡集中的主要原因係由於在學校環境中招募，以學生參與者居多。在 101 名參與者中，有近六成具有 4 年以上網際網路使用經驗，僅有 1.0%的使用經驗少於 6 個月，加上有 85.1%表示每日使用 WWW 數次，因此實驗參與者對於 WWW 的使用應屬熟練。

就使用電視遊樂器的經驗而言，具半年以上經驗者佔近七成，半年以下經驗者佔 31.7%。對於電視遊樂器的涉入程度高低各佔約 41.6%與 58.4%，在涉入分數方面，高低涉入的平均分數則分別為 39.07 與 21.71。

表 4：參與者基本資料

參與者特性		人數/分數	百分比(%)	累積百分比(%)
性別	男	45	44.6%	44.6%
	女	56	55.4%	100.0%
年齡	18~20歲	57	56.4%	56.4%
	21~25歲	34	33.7%	90.1%
	26~30歲	10	9.9%	100.0%
網際網路使用經驗	少於 6 個月	1	1.0%	1.0%
	6 至 12 個月	3	3.0%	4.0%
	1 至 3 年	39	38.6%	42.6%
	4 至 6 年	53	52.5%	95.0%
	7 年以上	5	5.0%	100.0%
WWW 瀏覽器使用頻率	每天 9 次以上	23	22.8%	22.8%
	每天 5 至 8 次	29	28.7%	51.5%
	每天 1 至 4 次	34	33.7%	85.1%
	每週數次	14	13.9%	99.0%
	每週 1 次	1	1.0%	100.0%
平均每週花在 WWW 上的時間	0 至 1 小時	4	4.0%	4.0%
	2 至 4 小時	29	28.7%	32.7%
	5 至 6 小時	19	18.8%	51.5%
	7 至 9 小時	13	12.9%	64.4%
	10 至 20 小時	17	16.8%	81.2%
	21 至 40 小時	11	10.9%	92.1%
	超過 40 小時	8	7.9%	100.0%
使用電視遊樂器的經驗	半年以下	32	31.7%	31.7%
	半年至一年	8	7.9%	39.6%
	一年至兩年	12	11.9%	51.5%
	兩年至三年	8	7.9%	59.4%
	三年以上	41	40.6%	100.0%
對電視遊樂器的商品涉入程度	低涉入	59	58.4%	58.4%
	高涉入	42	41.6%	100.0%
涉入分數	低涉入	21.71		
	高涉入	39.07		

二、構念效度檢測

表 5 為相關構念因素分析結果。由於涉入程度與廣告態度之間應被視為獨立因素，因此進行因素分析時，以主成份分析法(Principal Components Analysis)萃取因素，並採 VARIMAX 的轉軸方式。由表中可以看出，在關於涉入程度與廣告態度的因素分析結果上，所擷取出的兩個因素累積解釋變異量達 62.31%。另外，表 5 中第一欄的標示即表問卷題項，而由題項以及因素之間的關係可以發現，各題項所形成的因素分析結果，即為該題項所欲衡量的構念，故兩個因素即分別依「涉入程度」與「廣告態度」命名之。

表 5：涉入程度以及廣告態度因素分析結果

	因素一（涉入程度）	因素二（廣告態度）
Inv1	**0.885**	0.137
Inv2	**0.762**	0.193
Inv3	**0.872**	0.082
Inv4	**0.776**	0.333
Inv5	**0.863**	0.070
Inv6	**0.778**	0.182
Inv7	**0.820**	0.108
Inv8	**0.743**	-0.026
Inv9	**0.739**	-0.049
Inv10	**0.844**	0.073
Aad1	0.099	**0.760**
Aad2	-0.029	**0.680**
Aad3	0.027	**0.840**
Aad4	0.192	**0.489**
Aad5	0.107	**0.715**
特徵值	6.929	2.417
解釋變異量	46.19%	16.12%
累積解釋變異量(%)	46.19%	62.31%

在後續的資料分析中，對於電視遊樂器的商品涉入程度、消費者的廣告態度均是採加總分數進行分析。其中，商品涉入程度的平均值為 28.93，極接近涉入量表的中點 30 分，顯示在參與者對於電視遊樂器的商品涉入程度方面，本研究並未呈現偏高或偏低的傾向，亦顯示前測的進行有其必要性與效果。

三、假說檢定

為確保本研究蒐集所得資料符合變異數分析的基本假設，本研究在進行資料分析之前進行檢驗。檢驗結果顯示皆符合基本假設，故作者據此繼續進行後續假說檢定與資料分析。由於篇幅所限，詳細檢驗過程並未列出，可與作者連絡取得。

（一）廣告變化與商品涉入程度的調節效果

假說 1 欲探討在線上環境中運用不同的廣告變化策略時，具不同商品涉入程度之消費者所反映出的廣告態度是否有所差異。表 6 為 2-Way ANOVA 檢定結果：

表 6：廣告變化的調節作用變異數分析結果

		Sum of Squares	df	Mean Square	F	p
廣告態度	涉入	33.604	1	33.604	5.752	0.018**
	廣告變化	0.415	1	0.415	0.071	0.790
	涉入×廣告變化	35.935	1	35.935	6.152	0.015**

(*: p<0.1; **: p<0.05; ***: p<0.01)

表 6 的變異數分析結果顯示，涉入程度與廣告變化的運用之間，的確顯示出統計上顯著的調節效果。為進一步瞭解廣告變化策略的運用與消費者商品涉入程度之間的調節效果關係，本研究接著進行均數差檢定（如表 7 所示），圖 2 則為商品涉入程度與廣告變化之調節作用圖。檢定結果顯示，調節效果的發生，使高涉入的消費者與廣告變化策略之間，以及在實質性變化下，高低涉入消費者所表現出的廣告態度有顯著不同，此結果使假說 1 得到支持。

表 7：商品涉入程度與廣告變化之調節作用均數差檢定結果

	實質性變化	裝飾性變化	均數差檢定 p 值
高涉入	19.00	17.65	0.035**
低涉入	16.61	17.69	0.127
均數差檢定 p 值	0.002***	0.953	

(*: p<0.1; **: p<0.05; ***: p<0.01)

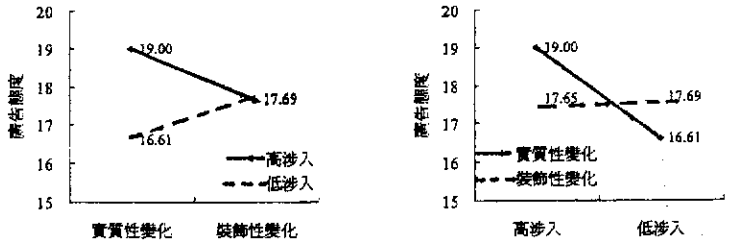

圖 2：商品涉入程度與廣告變化之調節作用圖

（二）訊息訴求與商品涉入程度的調節效果

假說 2 亦是基於「思考可能性模式」，探討訊息訴求策略與消費者商品涉入程度間的調節效果關係，表 8 則支持了假說 2 的調節效果。

表 8：訊息訴求的調節作用變異數分析結果

		Sum of Squares	df	Mean Square	F	p
廣告態度	涉入	39.925	1	39.925	6.642	0.011**
	訊息訴求	0.941	1	0.941	0.157	0.693
	涉入×訊息訴求	19.571	1	19.571	3.256	0.074*

(*: p<0.1; **: p<0.05; ***: p<0.01)

表 8 的檢定結果顯示，對於不同商品涉入程度的消費者而言，給予不同的廣告訊息訴求，將對廣告態度產生調節的影響效果，亦即兩者間具有適配(fit)的關係存在。如表 9 的均數差檢定與圖 3 所示，則可進一步看出廣告訊息訴求與消費者商品涉入之間調節關係形式。

表 9：商品涉入程度與訊息訴求之調節作用均數差檢定結果

	資訊性訴求	情感性訴求	均數差檢定 p 值
高涉入	18.89	17.79	0.092*
低涉入	16.70	17.40	0.325
均數差檢定 p 值	0.000***	0.617	

(*: p<0.1; **: p<0.05; ***: p<0.01)

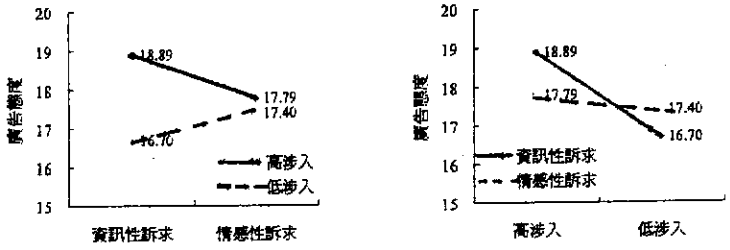

圖 3：商品涉入程度與訊息訴求之調節作用圖

（三）導引效果與商品涉入程度的調節效果

本節針對假說 3 中導引效果與消費者商品涉入程度的調節效果進行檢定，檢定結果如表 10 所示，顯示假說 3 獲得支持。

表 10：導引效果的調節作用變異數分析結果

		Sum of Squares	df	Mean Square	F	p
廣告態度	涉入	39.595	1	39.595	6.812	0.010**
	導引效果	19.087	1	19.087	3.284	0.073*
	涉入×導引效果	25.926	1	25.926	4.460	0.037**

(*: p<0.1; **: p<0.05; ***: p<0.01)

表 10 顯示在不同的導引策略下，對消費者廣告態度產生調節作用。進一步透過均數差檢定（如表 11）則可發現，在商品涉入以及導引效果的交互作用下，使高涉入的消費者與導引效果之間，以及在認知性導引下，高低涉入消費者所表現出的廣告態度有顯著不同，支持假說 3 的觀點。圖 4 所示則為商品涉入程度與導引效果之調節作用圖。

表 9：商品涉入程度與訊息訴求之調節作用均數差檢定結果

	認知性導引	情感性導引	均數差檢定 p 值
高涉入	19.32	17.39	0.002***
低涉入	17.00	17.15	0.839
均數差檢定 p 值	0.008***	0.676	

(*: p<0.1; **: p<0.05; ***: p<0.01)

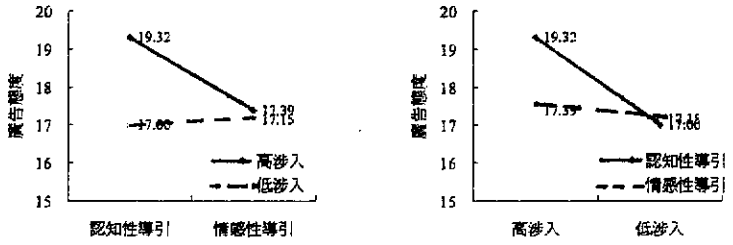

圖 4：商品涉入程度與導引效果之調節作用圖

四、小結

本節針對第 3 節中所提出的三項假說進行檢定，檢定結果三項假說均得到支持，彙整於表 10：

表 10：研究假說檢定結果彙整

研究假說	檢定結果
【假說 1】消費者商品涉入程度與廣告變化策略之間，對於廣告效果具有調節性的影響關係。	支持
【假說 2】消費者商品涉入程度與廣告訊息訴求之間，對於廣告效果具有調節性的影響關係。	支持
【假說 3】消費者商品涉入程度與導引策略之間，對於廣告效果具有調節性的影響關係。	支持

假說 1 與假說 2 係針對「思考可能性模式」在線上環境中的應用進行檢驗，而 2-Way ANOVA 的檢定結果亦顯示該項調節效果確實存在，對於將「思考可能性模式」應用於線上媒體環境中，提供正面的支持。

更重要的是，本研究將認知心理學領域的「導引效果」納入探討，目的在更進一步結合資訊管理參考學域的觀點，探討在線上廣告情境中廣告執行手法的影響。資料分析結果亦顯示，對於不同涉入程度消費者而言，導引策略的運用確如假說 3 所推論，對廣告效果的發生會具有預期的調節效果。

陸、討論

「思考可能性模式」是在行銷領域中受到相當重視的一個理論架構，許多對個人資訊處理行為的研究，均也以此為基礎而發展。然而，在線上環境中，由於網路瀏覽行為與傳統媒體的差異性，卻使得在線上媒體中進行行銷廣告活動的困難度增加，因為在此環境中牽涉的因素更形複雜。例如，線上環境的一項特點便是「多媒體」與「超連結」的整合特性（傳統媒體無），且消費者不再被動地接收資訊，線上環境的互動性使消費者亦具有選擇如何與媒體接觸及互動的能力。

在這樣的情況下，當消費者由過去一（媒體）對多（消費者）的大眾媒體溝通模式轉移至線上環境中的超媒體電腦媒介環境(Hypermedia Computer-Mediated Environment; Hypermedia CME)[2] 時，如何透過「流暢狀態」(flow state)的形成，使消費者在瀏覽情境中保持最佳的心理經驗與狀態(Csikszentmihalyi and LeFevre, 1989; Hoffman and Novak, 1996)，以使廣告資訊與消費者間能形成共鳴，進而提高廣告效果，便是廣告主進行廣告活動設計時所必須考量的，而非僅僅將大眾媒體中行之有年的廣告模式複製至線上媒體中。

亦即，在探討線上環境中廣告效果的影響因素時，除了消費者特質之外，亦不能忽略媒體特性的影響，方能較有效且綜觀地瞭解線上廣告效果的影響來源。在消費者特質方面，本研究除了以消費者的商品涉入程度作為探討主軸，並考慮在線上環境中廣告情境呈現策略與執行手法的操弄下，如何影響其消費者資訊處理行為，並進一步影響廣告效果的產生。

一、廣告情境呈現方式與商品涉入程度的調節關係

本研究在「思考可能性模式」的理論基礎下，分別探討線上廣告情境中廣告變化與訊息訴求的效果，發現消費者的商品涉入程度高低確實具有預期的調節效果。亦即，對於高涉入的消費者而言，採取實質性的廣告變化或資訊性的廣告訊息訴求；以及對於低涉入的消費者採取裝飾性的廣告變化或情感性的訊息訴求將會採生較佳的廣告效果。

此部分研究結果提供的主要意義，是延伸了「思考可能性模式」在線上環境中的應用與解釋力。「思考可能性模式」原本係用以處理在說服性溝通情境(persuasive communication)下的個人態度改變(Petty and Cacioppo, 1986a)，但其原則卻已成為個人行為層次一個重要且通用的理論模型。然而，在過去主要行銷媒體均受限於傳統大眾媒體的情況下，該模型的觀點是否在線上環境中亦具有相同的解釋能力，隨著網際網路的重要性提高，亦成為有待探討的問題之一。本研究假說 1 與假說 2 的分析結果則

2 Hoffman and Novak (1996)將之定義為：「一個動態的分散網路，可能具有全球性的規模，具有可存取網路的軟硬體，並使消費者或企業間得以(1)以互動的方式存取超媒體內容(hypermedia content)，以及(2)透過媒體進行溝通」(p. 53)。

顯示正面的證據，同時更進一步探討在線上情境中，如何進一步透過導引效果對消費者產生心理層面的廣告效果影響。

二、廣告執行手法與商品涉入程度的調節關係

本研究將導引效果的觀點納入研究架構之中，係基於兩個觀點。首先，是參考學域(reference disciplines)的觀念。事實上，就以探討資訊科技應用為主的資訊管理學域而言，原本即是一門應用性的學科，也因其領域的特性，因此必須結合其它包括行銷、經濟、管理與心理學等參考學域(Keen, 1980)。就資訊科技的應用而言，也因參考學域的融合，使得對於現象的觀察與解釋，得以有更全面性的觀點，而非單純地以資訊科技的角度解釋個人在應用情境中的行為與反應。

在線上廣告情境中納入導引效果的觀點，即是結合了認知心理學以及行銷學的參考學域觀點，探討在電子商務的線上廣告情境中消費者行為與反應，以藉此建構出最佳的廣告效果情境。亦即，本研究結果對於線上廣告的執行面而言，提供了具體的操作化指引。如同文獻中所指出，導引效果的特性在使個人於「未特別意識到」的情況下，接收特定刺激並使資訊處理行為朝向與該刺激相容的方向發展。然而，導引效果發生作用或被忽略，亦須視消費者對於廣告訊息接收的特性而定(Yi, 1993)，本研究由消費者的商品涉入程度為切入點，探討結合消費者涉入程度與導引效果的廣告策略，進一步釐清了導引效果在實際執行時，如何發揮具體的預期效果。

其次，是探討了在網路瀏覽情境中，以導引效果實現「流暢狀態」(Csikszentmihalyi, 1977; Csikszentmihalyi and LeFevre, 1989)的可能性。Hoffman and Novak (1996)進一步指出，所謂流暢狀態係指在電腦媒介環境中(Computer-Mediated Environment; CME)瀏覽時的一種心理狀態，來自於與電腦媒介間一連串的順暢互動，使個人內心感到愉悅，自我感知能力(self-consciousness)逐漸消褪，且該狀態會逐漸增強(self-enforcing)的心理狀況。本文所探討之廣告效果即是在線上廣告情境中，結合「個人互動」（消費者涉入）與「機器互動」（導引效果）的結果，藉由流暢狀態的形成，針對不同商品涉入程度消費者進行「導引」的廣告策略，以得到最佳的廣告效果。亦即，導引效果可被視為在線上環境中，實現並善用流暢狀態的執行策略。

柒、結論

透過實驗室環境的設計與操弄，本研究共招募 101 名參與者進行實驗。在研究假說的檢驗方面，除支持了「思考可能性假說」在線上環境中的應用之外，並以導引效果的設計為廣告執行手法，探討對於消費者廣告態度的影響。本研究的三項研究假說均獲得支持，更進一步顯示出線上媒體相對於傳統媒體的特殊性，以及在線上廣告情境中，掌握並試圖操弄消費者瀏覽時的心理狀態，以達最佳廣告效果的可能性。

亦即，對於廣告商品具不同涉入程度的消費者而言，給予適當的廣告情境呈現設計（包含廣告變化與廣告標語之訊息訴求），或透過導引效果的執行手法，將可有效提

昇廣告效果，使消費者具較佳的廣告態度，進一步加深對於該廣告商品的印象。

一、管理意涵

相較於傳統傳播媒體，線上環境的特性使得網際網路不再只是資訊傳播媒介，所形成的是線上的互動社群。在這樣的環境中，廣告資訊的傳遞如何達到效果，除了過去以傳統媒體為主的行銷與廣告研究所提供的觀點之外，廣告主更應考慮消費者特性在過程中所扮演的角色。本研究指出，針對消費者商品涉入的差異性，若能在線上廣告呈現策略上分別採用不同的廣告變化與訊息訴求策略，並根據消費者商品涉入的差異，給予中央或周邊式的廣告線索刺激，則會產生較佳的廣告效果。欲達到此目的，其中關鍵便是對於消費者涉入這項特性的掌握。

關於消費者特性的掌握，常見的方式是透過註冊資料、消費者瀏覽記錄、或歷次消費記錄等方式掌握消費者特性，得到的效果卻往往因瀏覽器設定，或非經常性消費，而使效果受到限制。事實上，廣告主若能對廣告推出的線上情境（即網站類型與主題設計）有所了解，則可針對該情境下潛在消費者的特性設計出有效的廣告策略。例如，以一般專業性網站（如汽車網站）而言，大多數瀏覽者應屬高涉入族群，此時消費者在特性上較易受到中央式線索的影響；而未具特定主題的網站（如交友網站），消費者較易受到的影響來源則為周邊式線索的運用。掌握此項特性，廣告主方能更進一步達到一對一行銷的目標。

由於現有技術的輔助，在線上情境中更易因應消費者特性，而呈現出適當的廣告變化與訊息訴求。以傳統雜誌為例，若欲呈現出同樣的效果，往往必須透過篇幅的增加，以連續劇的方式連續呈現，卻也因此必須付出較高的廣告成本。然而，線上情境中透過如最被廣為應用的動態 GIF 圖檔，或透過 Java、JavaScript、VBScript、Flash 等技術，均可輕易地達到動態呈現的目的。線上情境所提供的便利性更有助於廣告主設計出較有利的廣告變化與訊息訴求呈現，例如電腦遊戲廣告以 Flash 製作動畫的方式呈現，以達到吸引消費者以及廣告變化的目的，或透過不同橫幅廣告標語的程式化控制，達到資訊性或情感性的廣告訴求，均是可能的做法。

另外，本研究指出除消費者特性的掌握之外，另一項同樣具有效果的便是導引效果的應用。導引效果亦可視為另一種增加廣告與消費者接觸(exposure)的機會。儘管消費者未必能感受到這樣的差異，然而在此狀況下造成廣告效果的增進，卻是導引效果運用的價值所在。

因此，就實務上而言，線上討論區、線上遊戲（如拼圖或猜謎）、搭配廣告的網頁主題與內容、資訊呈現方式（圖形、色調、文字等）等，均是可資用來引發導引效果的元素。例如，幼兒健康食品的線上廣告可透過相關醫學報導的提供，引導消費者特別注意（與該食品所添加營養素有關的）幼兒可能疾病，或汽車廣告可透過「限時通關」的線上遊戲，針對該車型強調的「速度」性能進行導引。透過線上環境中導引策略的實施，配合前述廣告情境呈現的設計，更能發揮較原先單純提供廣告資訊為佳的廣告效果。

二、未來研究方向

以本研究為基礎，在此提供數個可能延伸的研究方向，供後續研究者參考：

（一）商品類型的影響

持久性商品（如汽車或傢具電器）一般均包含最多廣告資訊，而非持久性商品（如食物、飲料、煙草等）廣告所含資訊則相對較少(Engel et al., 1995; Abernethy and Franke, 1996)。亦即，不同商品類型的廣告在廣告設計上便會有所差異。延伸而言，消費者面對不同的廣告時，即可能因商品類型差異而有不同的資訊處理方式。例如，比較汽車與一般民生用品的廣告，當消費者面對汽車廣告時，由於商品本身特性所致，因此資訊判斷的需求相對較強；但面對一般民生用品時，其日常生活經驗便形成其購買決策，因此資訊判斷需求相對會較低。

由於將商品類型納入研究架構後，將使實驗組別的設計更為複雜且超出可控制範圍，因此本研究將商品類型視為控制變項，但建議後續研究者可針對此主題進一步探討，以對線上廣告效果與消費者資訊處理行為間的關係有更深入瞭解。

（二）廣告效果的操作化

基於實驗法控制組數的限制，本研究對廣告效果的操作化係以廣告態度加以衡量，建議後續研究者亦可針對其它方式進行廣告效果的操作化，如記憶效果、購買意願或舊用戶是否願意轉換商品品牌（品牌忠誠度的影響）等。部份操作化方式雖未必具有學術上的嚴謹性，但就實務界而言，將是有意義的廣告效果指標。

（三）其它廣告形式的研究

本研究係以最常見的橫幅廣告為研究對象，但目前在線上環境中所應用的廣告亦有其它形式，如跳出式視窗(pop-up windows)、浮水印廣告(watermark ads)、互動式廣告等。針對不同廣告類型，廣告情境以及適當的導引策略的設計是否有所不同？例如，橫幅廣告可透過與網頁主題的搭配達到導引的目的，而互動式廣告則可透過線上遊戲（如拼圖、猜謎、或尋寶）的過程中達到導引的目的，且兩種廣告在整體情境的設計上又因呈現空間的差異而有所不同。針對不同線上廣告的形式，研究者或可針對其間的差異進一步探討。

（四）網站類型的比較

本研究以消費者上網目的探討線上廣告運用策略與廣告效果的關係，並提及面對不同網站類型時，消費者可能因網站主題而有不同的上網目的。針對網站類型的影響，亦是值得進一步探討的主題，可對於線上社群經營以及廣告策略的運用提供具有實用價值的資訊。

三、研究限制

本研究採實驗室實驗法進行，在過程中為避免受到不必要的干擾，因此必須對於眾多非實驗因素進行操控。遵循此精神，本研究透過前測的進行以及在實驗過程中的嚴謹控制，以求避免非實驗因素影響實驗過程。然而，在力求嚴謹性的情況下，仍有數項研究限制，必須在此指出：

（一）線上廣告形態的選擇

在實驗資源有限的情況下，本研究以橫幅廣告為研究對象。事實上，不同形式的線上廣告，亦代表了不同的刺激以及影響。在研究資源的限制下，本研究並未能針對目前線上環境中所見的各種廣告形式進行探討，因此一般化的範圍主要限制於橫幅廣告。

（二）導引策略的劑量

在導引效果的設計上，本研究係設計以平面廣告閱讀作為導引刺激的來源。儘管事先透過前測挑選出分別代表認知性以及情感性導引的兩則平面廣告，但由於在「劑量」上無法量測，因此實驗結果可能受到劑量強弱的影響。然而，在實驗室環境中受到控制的情況下（參與者均接受相同的導引刺激），整體而言，該項影響應相對較小，即實驗結果可在相同的劑量水準下進行探討。

（三）參與者自我選擇(self-selection)的影響

本研究的參與者包括事先招募與透過授課教師協助取得，各佔約一半的比例。儘管在各實驗組的分配上，本研究採取依報名時間先後順序以達到各組參與者隨機分配的設計，但透過招募取得的來源，整體而言仍具有自我選擇的影響，在此應特別指出。

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