ROLE OF CATEGORY STRUCTURE IN HUMAN INFORMATION PROCESSING

by

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Stephen Sempson

ABSTRACT

In many of the experiments on categories and concepts, subjects are required to learn new categories. Generally, the researcher designs pairs of categories and then has the subjects go through them until they correctly categorize them. In these experiments, the researcher decides which items are in which category, based on a rule or experimental design.

An alternative way, in which people can obtain categories, is that they can spontaneously notice that items are in a separate category. Most of us have done this when listening to music, for instance, an instrumental song that has only bass and drums, with complex rhythms. When our current categories cannot deal with encountering items, which we recognize form a coherent set, then we have identified that there is a new category. This is an example of category construction - the learning of a new category that you form on your own, without an experimenter or teacher telling you what is in the category.

This investigation will use this ability in a different way. Studies have shown that a category can create a grade structure of prototypical items. We will take a graded structure generated by a category, and see if we can recreate the category based on presenting prototypical examples in a variety of ways. Five different sampling techniques will be used to determine which one is the best for category reconstruction. Since the items themselves have bits of information about the category, the number of samples presented will also be manipulated to determine if this is a factor in determining the category.

The independent variables investigated were: sampling technique, and prompt conditions. In determining the effect of the independent variables on matching a category, the independent variables were also considered as mediating variables of each other. The method of opportunistic

sampling was used for the surveys. The main participants were undergraduate 3rd year students taking a MSci 311 course at the University of Waterloo.

Results indicate that there was no statistical significance. Fluctuations in significance levels indicate some random findings. Participants are not discriminating the samples or prompts which were given. This research is a contribution to this field because little research has been conducted in this area and implications are drawn for future research on the saliency of a category or attribute that can vary by context or knowledge.

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When we think of a category and all of its members, there tends to be a large amount of information with respect to each object in the category. When asked about a category, everyone could give a slightly different answer, but with a large amount of people, you may start to get similar answers. Questions like, list all possible birds you know, or list all possible furniture which you can think of, are open ended. If we are given that the whole of a category could be represented by the following:

Category X, thus $X = X_1 + X_2 + X_3 + \ldots X_n$

A complete category is made up of many individual components. All or part of the category may be needed by individuals to rebuild the category. If only partial category fragments are needed, is there a best or worst fragment of representation for the category?

This paper is an attempt to find out if given a sample X_n can people determine the category X. For example, if a distribution of Bird = X, then by sampling X_b from this category, would people then be able to determine the category Bird? We can ask people for a sample of a category and get a distribution. If we can, how accurately can we rebuild a category? What can effect this process? Does the better representation of the distribution of a category, mean the better we can determine the category?

We tend to interpret things and extract information. If we are presented with items, do we group them together, and can we notice subtle differences? In this study, we are also interested in typicality issues in the mind. To do this, we are going to vary the number of samples and distributions techniques which are presented to subjects.

In a general setup, how does a person think with a label versus without a label. Is the category label embedded? The two basic properties of this study: 1. Match a category based on labels, 2. Match a category based on examples (or exemplars).

An issue which can become immediately apparent would be, "what is a match?" When trying to match an item to one of three labelled categories, where the item itself is in all three categories, there is clearly no right answer, but instead one of probabilities. When dealing with category labels, we use probability to put the items in the category labels. A hummingbird, for example, is a small bird, is a fast bird, and is a bird, with different probabilities dependent on the feature a person is looking at.

How items together could define a category, an advancement of set structure, is of interest to human information processing. When trying to match an item to one of the three groups of examples, or exemplars, it is only the similarity of the item to the exemplars which causes this match. In fact, this relationship is symmetrical, each of the examples pulls on the similarities of the other items. This is in contrast with the asymmetry of a label to an item. One could see how a "small bird" label would really be pulling a hummingbird, but not a hummingbird to "small bird" label.

What is going on here? Do we default to higher level category? Realistic substitutability of labels to exemplars is not so equal. Are there fewer ways of 'misinterpretation' to the original classification by labels?

Cognitive science, has in time, changed the view of categorization. Initially, the classical view has given us well-developed biological taxonomies, such as the Linneaen Classification system. Later on, Rosch's view of prototypes and gradient typicality opened up psychological

understanding of how things are classified. Things can be classified in multiple ways, and that depends on the goals, or you as a categoriser. What has not been dealt with is the ad hoc ability to categorize two or more categories at the same time.

The patterns, attributes, and information about an item, or number of items, all play a part with things which come into the area of human information processing. Computers and information systems are prevalent in society today. How we may present this information can lead to a better understanding or transfer of knowledge to users of information systems.

This study examines variables that affect category matching through studying the underlying factors of sampling technique or degree of correspondence to typicality distributions and increasing the number of examples, or exemplars. To do so, it draws on theories of category views and basic principles by Rosch. Individuals dealing with human information processing may be interested in the results of this study.

In Chapter 2, the development of the research model along with related literature is discussed. Chapter 3 begins with the description of the experimental task, followed by explanations for the sample, measures, design, and results. The analysis and general discussion is presented in Chapter 4. Then Chapter 5 contains the implications and conclusions of the findings as well as a discussion on the areas for future research.

CHAPTER 2

DEVELOPMENT OF RESEARCH MODEL

Things and events which we interact with every day do not fit into one single category. Things might simultaneously be in one category and another. One category for an item may not be considered the only one, or the best one. Different categories for an item are relevant at any given time. Thus, items can be viewed simultaneously and equally in different categories, and at other times, a change in perspective is involved.

If items can be placed into different categories, how are these categories organized in our mind? How are these categories used? Is there a specific category we would use when we think of something?

One possible way of looking at things is with a taxonomy, or hierarchical structure. Almost anything, animate objects, inanimate objects, places, and events can be put into a taxonomic scheme. The hierarchical structure of categories is a sequence of categories in which each of the progressively larger category includes all of the previous ones. This type of organization has been determined to be an important way of organizing concepts. When people are asked under neutral settings to categorize an object, they more often than not, organize hierarchical categories.

As an example, the Linnaean taxonomy classifies things into a hierarchy. This places all things in a nested structure of divisions, from the top level down are: Domain, Kingdom, Phylum, Class, Order, Family, Genus, and Species. The following Table 2.1, shows some division examples from the Linnaean category structure.

Table 2.1 Linnaean Classification.

Ranking	Count	Classification	Common Name	Species
Domain	2	Biota, Mineralia		
Kingdom	6	Animalia, Vegetabilia, etc.		**2,400,000**

Phylum	35	Chordata, etc.		63,000
Subphylum	3	Vertebrata, etc.		58,808
Class	15	Agnatha, Chondrichthyes, Osteichthyes	Fish	29,300
		Amphibia	Amphibians	5,743
		Sauropsida	Reptiles	8,240
		Aves	Birds	9,934
		Mammalia	Mammals	5,416

Theoretically, we see this as the following, in which the higher categories are completely containing the lower categories.

Figure 1. Linnaean Cognitive Map.
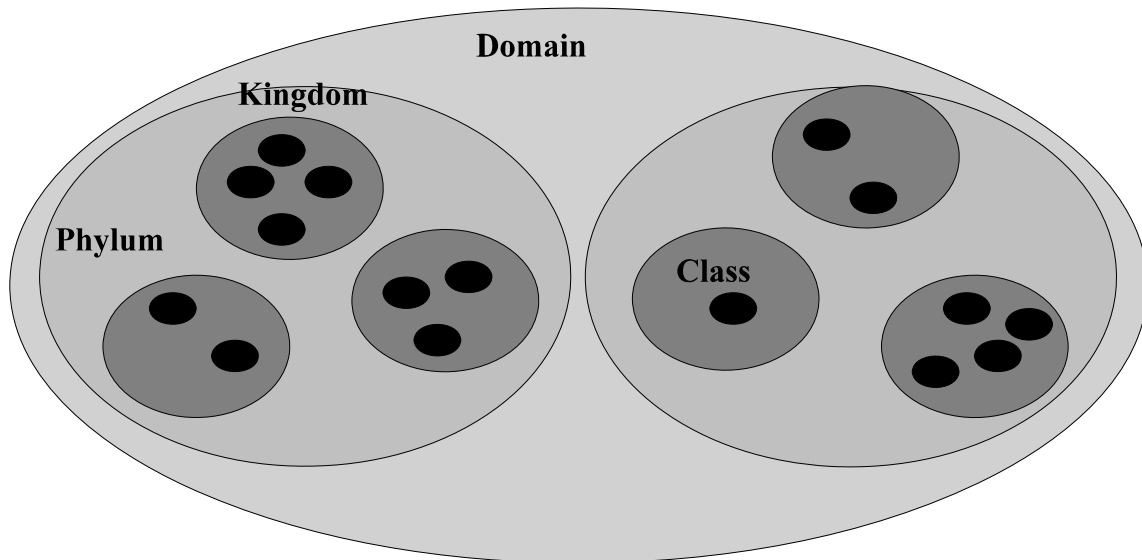
Figure 1 is a mental picture of each and every species contained within the domain. An approximate representation of the total number of levels could be viewed in a different way. Looking at the amount of information contained within each category, the Domain which is all encompassing, becomes the smallest. Categories at the edge contain the largest amount of information. Figure 2 is an approximation of the visual representation of information.

Figure 2. Visual representation of domain levels.
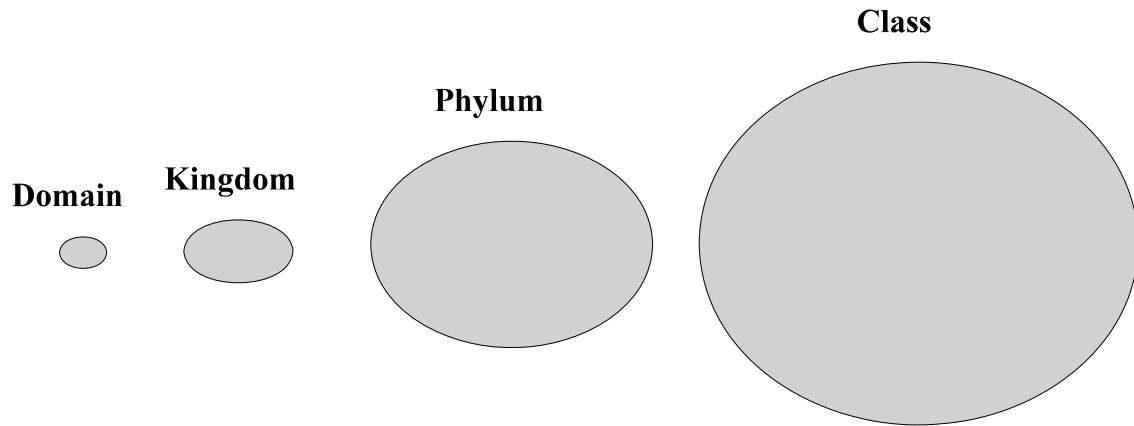
Typically, we perceive things in the following way. If one were to take birds and categorize them into small birds and fast birds, we may view them as follows in Figure 3. In this case, there is an area of overlap between small birds and fast birds.

Figure 3. Overlap within the Bird Domain.
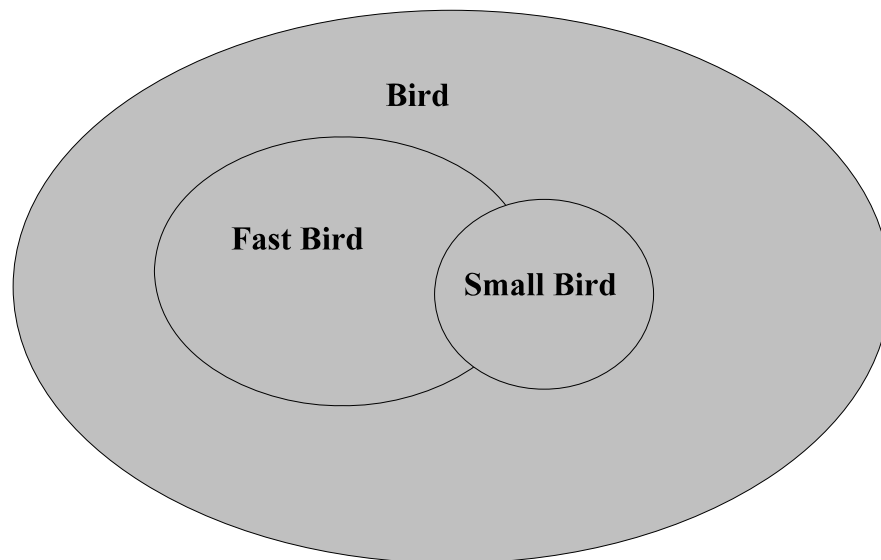
In reality, based on the amount of information, it may be perceived like Figure 4. Each category of a domain is separated, and an item is determined to be placed in a category based on

a set of features, or dimensions, of a category. Informally, some probability is determined for each category, thereby simplifying the choice, or identification, of a category.

Figure 4. Information used in making choices.
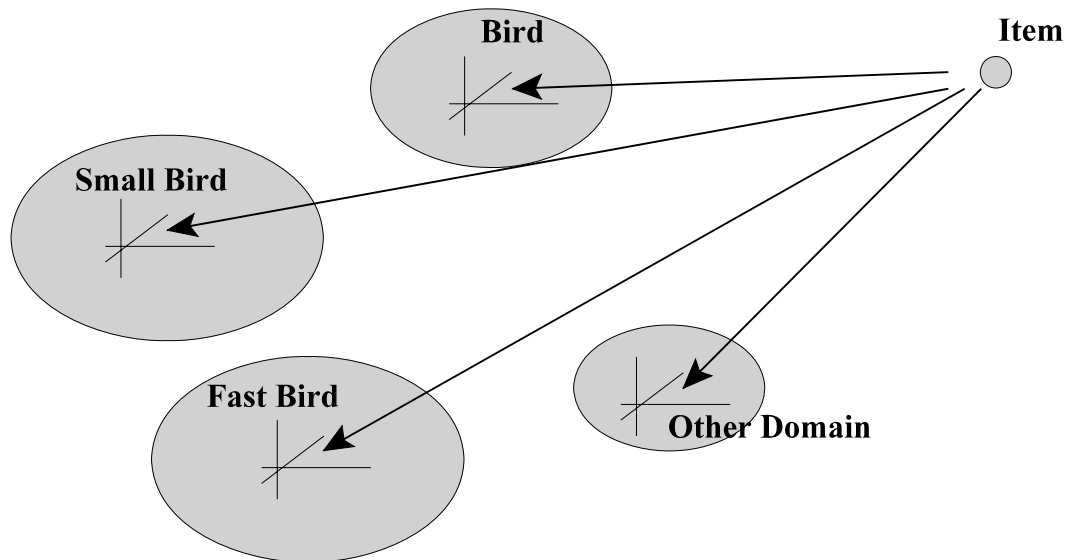
Other studies have noted that one particular level of categories is very important. The basic level of categorization has the most salient level of identification in a number of different domains.

Categories which are higher (including the previous categories) in the hierarchy are superordinate to the lower level categories. The lower level categories are subordinate to the higher level ones. For each of us, some parts of a hierarchy may be taller, while other parts may be shorter. That is to say they can have many more levels, or just a few levels.

A hierarchy can be thought of as a kind of network. The only relation between category members is set inclusion. For a network to be a hierarchy, any category member can have only one immediate superordinate. Every property which is true for category members, is true for the category's subordinate. Thus, the category relations are transitive and asymmetric.

By being able to place a category into a hierarchy, one can learn a huge amount about the

category because of the property inheritance. The transitivity of a category member leads to the transitivity of the member's data. The properties that are generally true of a category are also true of its subordinates. The more specific categories have the same features as the general categories, but with one or more additional features.

The features increase as one goes to more specific categories. One does not need to store the individual facts or features because the hierarchy provides for the inheritance of properties, a cognitive economy. Only the information that is distinctive to the specific category would be stored at the specific category node.

How is this psychologically represented? The category hierarchy could be either pre-stored or computed. If it is pre-stored, then our memory is a hierarchical network. If it is computed, then hierarchical relations are not stored in memory, but calculated based on the properties. Alternatively, one can compare category members that were more or less typical or representative of a superordinate category. People compute the typicality and are willing to draw inferences from one category to its superordinated to the degree that the similarity is high.

Thus, anything can be in a set of hierarchically organized categories, going from extremely general to very specific. Classification at the general (superordinate) level maximizes accuracy of classification, superordinate members are very distinct. Classification at the specific (subordinate) level maximizes predictive accuracy of classification, subordinate members are more informative and this information is used where distinct members cannot be isolated. In the spectrum of categories within a hierarchy to which something can belong, the middle level of specificity, the basic level, is the most natural and preferred. This level can be seen as a balance between accuracy of classification at the superordinate level and the predictive power at the

subordinate level.

Studies by Eleanor Rosch showed that the most inclusive level, with respect to common attributes, that category members exhibit is the basic level. The subordinate categories had only slightly more attributes listed. Rosch's (1976) findings indicate that members of a basic level category are similar to each other, and subordinate members are only minimally more similar.

Rosch studied subjects which were presented with a category name, and then asked them to identify a picture of an object containing visual noise within that category. The basic and subordinate level names were more helpful in identification than superordinate names. This finding indicates that subjects can construct mental images representing basic and subordinate categories. The question here arises, can we reconstruct the mental images representing basic and subordinate categories based on the category members?

The basic level of categorization can also be explained by differentiation. Informativeness and distinctiveness play a part in this differentiation. The predictive accuracy which subordinates have for classification means that they are more informative than the basic level. They are slightly more informative and thus more specific. This can make the subordinate members less distinctive. At the other end, superordinate members are very distinctive, but much less informative. It is only with the basic level of categorization that concepts are both informative and distinctive.

Differentiation gives an advantage to basic level categorization. This is an important point to make. Basic level members communicate a lot of information. The informativeness of differentiation has its restrictions. If too specific, many more concepts are needed to cover a domain. If unrestricted, everything could have its own concept. The human mind would be unable to cope with the amount of information and would lose the ability to generalize across category

members. Distinctiveness is used to limit the number of concepts in a category. Objects which are similar tend to be included in the same concept. Another question to raise, would increasing the number of similar items increase the identification of a concept?

Investigations into subordinate categories have not been dealt with the same magnitude as basic level categories. Subordinate categories are more informative, but less distinctive than basic categories. It has been stated that there is slightly more specific information contained in subordinate categories. They share much of the same form and function, but provide specific details of additional information. The addition tends to be a modification in some attribute that is reflected in a minor modification of function (e.g., a comfortable chair permits extended sitting).

Unless the information needed in the subordinate level is relevant, people will use the basic category level. It is the specifics of this additional detail that is used when it is relevant. If a domain contains a large number of members of a basic level category that needs to be differentiated, subordinate labels are used. This study will attempt to see if subjects can make fine distinctions between basic level and subordinate categories by matching category members.

THEORETICAL FRAMEWORK

Earlier, probability was introduced as a way of categorizing an item when dealing with matching to a category label. What are the influences to this process? "Individuals examine a subset of possible alternatives rather than all available options when making decisions. They satisfice; that is they accept satisfactory or 'good enough' choices rather than insist on optimal choices," (Gordon, 1999). It seems that we pick up information from an item that is transformed into probabilities and this in turn is used to categorize things.

The information that comes from an item is also influenced by the goals and the person doing the categorization. "Perception refers to the active process of sensing reality and organizing it into meaningful views or understandings," (Gordon, 1999). People act based on their perception. When people are put in different positions, they focus on different aspects of the situation. The experience of an event, their perception, changes from situation to situation. This perception can be thought of as a two-part process, one of attention and organization.

People tend to screen out many sensations and attend to selected characteristics of a situation. "We tend to focus on only selected and limited features in any situation," (Gordon, 1999). "This process of filtering information received by our senses is called selective attention," (McShane, 2001). The perceiver's attention is focussed on people, objects, and events that are larger, more intense, in motion, repetitive, either novel or very familiar, or that contrast with their background. "... selective attention is also influenced by the context in which the target is perceived," (McShane, 2001). Stimuli that are overlooked tends to be smaller, less intense, stationary, or that blends with the background. People will remember information which is homogeneous with their attitudes and will tend to ignore information that is inappropriate.

Once the perceiver's attention has selected relevant information, they categorize and organized it to make sense of this new material. There are certain perceptual laws which our brains apply in seeking physical patterns. "Gestalt effect refers to the form-forming capability of our senses, particularly with respect to the visual recognition of figures and whole forms instead of just a collection of simple lines and curves," (Wikipedia, 2006a). The typical Gestalt laws: figure-ground, similarity, proximity, closure, continuation, and simplicity.

At the same time, people will use schemas, or cognitive frameworks, which include

descriptions of the characteristic features of other people, situations or objects obtained through experience. These schemas help to organize the information by grouping objects, individuals, and situations in thought processes. This can be done with prototypes, by using types of characteristics. Schemas that organize with exemplars would be represented by a concrete example, as opposed to general characteristics. People can also organize information based on their present situation and past experiences.

At this point, let us take a quick look at several different category views. Classical, Prototype, Exemplar, and Knowledge view each have something to contribute to this discussion.

Types of Category Views

Classical View

"Categories are equivalent classes of different entities and categorization is the ability to form such categories and treat discriminable entities as members of an equivalence class," (Sloutsky, 2003). The Classical view of categories is that concepts are mentally represented as definitions. These definitions determine the characteristics that are necessary and sufficient for membership. Every object defined in this way is either in a category or not. There cannot be an in-between object. As with the biological example given earlier, this type of classification is mutually exclusive. Unfortunately, there is more and more in-between, or fuzziness in exploring category domains. In real life, the classical view's neatness is unable to cope with human concepts.

Further evidence of problems with the classical view, is the inability to distinguish typical category membership, those that are good examples, or ones which you generally offer when asked, with those which are atypical.

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Prototype View

The prototype view of category representation is best described as a summary representation which is a description of the category as a whole. This representation is information rich in comparison to a single best example. Murphy (2002), describes the family-resemblance view, as the concept which is represented as features that are usually found in the category members, but some features are more important than others. This list of features can include contradictory features with their associated weights.

Later seminal work by Eleanor Rosch discovered that reliability of typicality ratings for 10 categories was extremely high. Items most often offered as a response for a category were the items rated as typical. Other studies with artificial categories indicated that learning is faster with typical items rather than atypical items.

A typicality gradient, is common in the reviewed literature. There tends to be a graded structure in going from a category to an item. In this thesis, we are looking at going from an item to a category. Given an item, what category is it a part of? Does the fact of an existing priority in a category, or typicality gradient, have an effect on putting together, or how we put together, a category? This leads to the first hypothesis of this study, to be stated at this time.

1-H_A: The main effects of sampling technique (degree of correspondence to typicality distribution), (which best approximates the category distribution), will lead to positive effects on matching.

Similar to how Rosch showed a distribution with items, or a typicality gradient, this thesis will show how items more prototypical will convey more information about a category. The result

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of having more information will allow participants to identify categories and increase matching specific items to those categories.

The exemplar view, which is a subset of the prototype view, is another main opinion of category representation. A person's concept of some item, is the set of all items that the person remembers. Some memories of category members may be fresh in one's mind while other memories will be fuzzy or incomplete. All of these complete and incomplete images are conjured up when making decisions about category membership. "...at the very initial stages of learning, it seems that any theory would have to agree that you remember the individual exemplars, or else you would have no basis on which to form generalizations," (Murphy, 2002). Thus, the exemplar model requires one to actually categorize these memories, explicit encoding is a requirement.

Classification Difficulties

Categorization with prototype or exemplar views may be done by a similarity computation. Either by an additive function of matching and mismatching features, or by a multiplicative rule. Identification of shared or differing aspects between two items is required for the additive rule. Problems encountered with this type of view are that mismatching features actively lower similarity scores with the multiplication rule. Therefore similarity will be greatest with overlap of a few items, rather than moderate overlap of many items.

These are important implications for prototype models and the exemplar models. Both of these theories need to indicate how items are counted up, and how many features, or exemplars have been viewed. "...empirical results suggest that it is encounters with objects that are most important, rather than the objects themselves," (Murphy, 2001).

Knowledge View

The prototype and exemplar models were designed to account for the problems which the classical view exhibited. The next model, the knowledge approach, builds on the two models. The knowledge approach views concepts as coming from prior knowledge rather than learning concepts in psychology experiments. The influence is like a feedback loop. New concepts can change accumulated knowledge. "The knowledge approach emphasizes that concepts are part and parcel of your general knowledge of the world, and so there is pressure for concepts to be consistent with whatever else you know. In order to maintain such consistency, part of categorization and other conceptual processes may be a reasoning process that infers properties or constructs explanations from general knowledge," (Murphy, 2001).

"There are bi-directional relationships between categorization and knowledge: (a) knowing that an animal shares properties with members of the category 'cats' enables us to categorize this animal as a cat; and (b) knowing that an animal is a cat enables us to predict that the animal has the properties of cats," (Sloutsky, 2003).

In order to learn a new category, or decide which category something already belongs, people use prior knowledge to reason about that example. Within the knowledge approach, people do not learn concepts by simple observation or features. Instead, people will pay attention to features which prior knowledge indicates is important. "They make inferences and add information that is not actually observed in the item itself," (Murphy, 2001). The more information people have, the better their ability to reasonably determine the category. This leads to the second hypothesis of this study.

2-H$_A$: The main effects of prompt conditions, (increasing number of prompts), will lead to positive effects on matching.

How do we determine that more information will increase matching an item to the category? This thesis will show that increasing the number of prompts, will give more information, which can be used to identify categories and increase matching specific items to those categories. If items are embedded with information, the more items which can be controlled in increasing levels, the better will be the participants' ability to match items to a category.

Rosch Influences

Cognitive science has changed the view of categorization. Rosch's view of prototypes and gradient typicality opened up psychological understandings. Rosch has much to contribute to this paper, as can be evidenced by the preceding. To be briefly described, and of importance to this study, are the following: Natural Categories, Prototypicality, Focal Colour, Context, Culture, and three of Rosch's basic principles. The first principle Vertical dimension, deals with basic level objects. The horizontal dimension, or internal structure of categories, is the second principle of Rosch's focused on prototypes. The last principle is the role of context in basic-level objects and prototypes.

Natural Categories

In dealing with a literature review in this arena, the most voluminous and analytical research of prototypes and categories, has been done by the psychologist, Eleanor Rosch. Earlier

work with colours indicated generalization for focal, or prototypical exemplars, rather than arbitrary category boundaries. Later exploration indicated that there are many natural categories, or perceptions labelled by words in natural languages, as opposed to artificial categories. Psychologists typically use artificial categories such as differing sequences of letters or arrangement of dots in studies of concept formulation and learning.

Prototypicality

Natural category investigations by Rosch asked subjects to rate items as good or bad examples of a category. Items were then listed according to increasing or decreasing degree of membership in a category like birds, fruit, furniture, etc. Taylor (1995), stated that Rosch reported the order in which the items were listed as highly reliable statistically. "Rosch showed that degree of membership in a category, far from being meaningless, is in fact a psychologically very real notion," (Taylor, 1995).

A second perspective developed by Rosch's study found that similar kinds of prototype effect showed up on each of the categories investigated. These effects were indifferent to peculiarities, which sometimes were made, between natural and nominal kind categories. A natural kind like a bird or fruit, is a real world event, whose design or architecture determines the range of things in a category. This type is not expected to have degrees of membership in a category, but instead clear boundaries. Nominal kind like furniture or vehicle are definable typically in analytic terms. Statements in the analytical sense, to specify attributes for membership in a category, could be presumed to have clear boundaries/memberships. It was found that natural and nominal kind categories did have degrees of category membership, or typicality gradients. The expectation, or

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presumption, of clear boundaries were not evident in any type of category uncovered by Rosch.

"In addition to establishing degree of category membership as a psychologically valid notion, Rosch also showed degree of category membership to be a relevant variable in a number of experimental paradigms," (Taylor, 1995). This degree of category membership affects verification time for statements, to interacting with the effects of priming. It has also been recognized that the correlation between this degree of category membership, and the rank, or frequency and order, with which people tend to name the category members. When people are asked to give examples of a category, or exemplars, they generally mention the more prototypical members first. "Rosch's questionnaire technique, whereby subjects are required to indicate the extent to which exemplars belong in a category, has been applied many times, with a range of category names, and the same kind of graded responses have been obtained, " (Taylor, 1995).

"When category names are learned, they tend to become attached first to the salient stimuli (only later generalizing to other instances), and by this means "natural prototypes" become foci of organization for categories," (Rosch, 1973).

Rosch (1973) states that this differs from earlier artificial category learning in the following ways. It is easier to learn a category when the natural prototype is central than when it is a peripheral member of that category. Whether or not the natural prototype is central, this type tends to be learned first over a distortion of that prototype. People will tend to define the category as a set of variation on the natural prototype even when it is not central.

The ability to discern the best representation of a category based on sampling technique is precisely what our first stated hypothesis is about. 1-H_A: The main effects of sampling technique will have a positive effect on matching items to a category. Further, those sampling techniques that

are the best representation of a category will have the greatest influence on matching. Distorted sampling techniques will have a reduced influence on matching.

Focal Colour

This is similar to the findings of Berlin and Kay who were studying the focal reference of basic colour terms. Within ninety-eight languages the basic colour terms came from as few as eleven focal colours. This finding was not random with regards to selecting colours from this small inventory. "If a language has only two colour terms, these will be selected as focal black and focal white. The fourth term will be either yellow or green, while the fifth will be the other member of the pair yellow and green. The sixth term will be blue, and the seventh, brown. The remaining four colours (grey, orange, purple, and pink) do not show any special ordering," (Taylor, 1995).

This finding was confirmed in earlier works of Eleanor Rosch under the former name, Eleanor Heider. The stability of focal colours across eleven different languages contained a high degree of correspondence concerning which colours were selected. A second experiment with twenty-three language backgrounds found that focal colours were named quicker, and the names of these colours contained fewer letters than the non-focal colours. "This strongly suggests that focal colours are perceptually and cognitively more salient than non-focal colours," (Taylor, 1995).

The differences in the speeds of naming focal colours had also been documented. Black was the quickest of all to state. Following this, with increased times, were: yellow, white, purple, blue, red, pink, brown, green, and orange. Colour is just one example of the influences of underlying perceptual and cognitive elements on the design and meaning of categories.

Colours were found to be natural categories in Rosch's 1973 study. "Focal colours themselves and sets in which focal colours are central will be learned faster than non-focal colours and than unnaturally structured sets," (Rosch, 1973). In this study, Rosch also found that central members which are easy to learn allowed the category to be easy to learn, as opposed to a category whose central members were difficult to learn.

Focal colour has been shown to have a high degree of correspondence, even in several different languages. Further, these focal colours are learned faster when occurring in natural structured sets. An extension of this finding is that typicality gradients are indicators of focal members. Taking the most typical members, one would assume to be a natural set, which is the most representative of a category. Further, these natural sets of most typical members would be the fastest, and possibly easiest, way to learn a category. Again, underlining the previously stated by the first hypothesis.

1-H_A: The main effects of sampling technique (degree of correspondence to typicality distribution), (which best approximates the category distribution), will lead to positive effects on matching.

In this thesis, we will be presenting various sampling techniques on a list of prototypical items. One technique will use the "Top" one, two, or four items in a distribution list of prototypical members. It is assumed that these would be the most representative of the category, and thus central members that would be easiest to learn. Alternatively, a distorted, or unnatural sampling of the distribution, like range (most representative and least representative), or random selection, may give the participants difficulty in determining the category as a whole.

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This same study by Rosch also dealt with form stimuli based on Gestalt psychology. These form categories displayed the same influence by natural categories as colour categories demonstrated. "Similar perceptual influence may well exist for many other domains," (Rosch, 1973).

Rosch (1973) finalizes her discussion stating that the structure and learning of categories in her study will have implications for other domains organized into natural categories. She extends this into artificial and non-perceptual, theorizing that once developed, they too will exhibit similar effects as demonstrated in natural categories.

This study will attempt to find out if the structure and learning of categories are true in determining a category based on items. Two differing category domains are going to be used. One category domain will deal specifically with "Birds" and the other will deal specifically with "Furniture." The natural category of "Birds" will be compared with the results of "Furniture."

Context

Context of the category, or even word translation of differing languages can also change, or shift the graded responses. A later study replicating Rosch's investigation of the category furniture, was done with German subjects. The German students were asked to assign the degree of membership in a category translated from furniture, of some fifty-five household items. There were differences with Rosch's goodness of example ratings for sixty members from the category of furniture. See Table 1 for reproduction of furniture goodness of example ratings. The researcher suggested that his subjects may have been determining category membership based on a student's room furnishings, while the American subjects in Rosch's study could have been

visualizing their parent's place.

Insert Table 1 about here

The comprehensive aspect of a word's meaning can be seen in how many words' meanings make sense only in the context of a background of understanding and custom that is shared within a community. "... even when verbs seem to be well defined by a listing of simple semantic features, they often can only be used properly when it is understood what kind of a situation they were intended to apply in," (Murphy, 2004).

Essentially, by adding information, one would tend to change the concept. We plan to test this idea in the following way. Consider three differing sampling distributions, Top N, Quartile, and Range. Each of these distributions would have the same "first" category member selected from the list. By going from one to two items, in differing ways, such as most representative and least representative, we would change the context of the single item alone. This context may bring into focus the identification of the category for matching. This is formally stated in the fourth hypotheses of this study.

4-H$_A$: Changing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will lead to positive effects on matching.

Information will be controlled by the sampling techniques and by the number of prompts given to a participant. If an item has information, which can be modified by other items presented, then simply varying one of the items should produce results which can be identified.

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Culture

How people categorize is embedded in a particular civilization at a particular time. All the knowledge and values shared by a society are cognitively represented by the artifacts of categorization. This can lead to misunderstanding, depending on what we are using to communicate with to another. Linguistic barriers can obfuscate understanding the colour white. Pointing at a rabbit to a tribesman could indicate food.

"...human categorization should not be considered the arbitrary product of historical accident or of whimsy but rather the result of psychological principles of categorization, which are subject to investigation," (Rosch, 1978).

Issues of categorization, as stated by Rosch (1978), are more to do with explaining categories found in a culture, by the language of the culture at a particular moment in time. Earlier Table 1 showed a difference in goodness of example ratings for American and German subjects. Replicating Rosch's study with the same culture may have produced stronger correlation. Simply put, an opportunistic study of third year students as in this research, could validate findings that might otherwise be missed.

Rosch Basic Principles

Rosch has felt that there are two general and basic principles which are used when forming categories. "The task of a category system is to provide maximum information with the least cognitive effort; the structure of the information so provided and asserts that the perceived world comes as structured information rather than as arbitrary or unpredictable attributes," (Rosch, 1978).

To obtain the maximum information with least cognitive effort, Rosch has proposed a type of cognitive economy. "It is to the organism's advantage not to differentiate one stimulus from others when that differentiation is irrelevant to the purposes at hand," (Rosch, 1978). Instead of understanding and knowing all differences of all members, which nears infinite, limit oneself to just that which is behavioural and cognitively usable portions. "This ability to overlook differences for the sake of generality is important for several reasons. First, it is more resource efficient to incorporate a potentially infinite number of individual entities into a substantially smaller number of classes. Second, this ability supports organization of knowledge, such as enabling the creation of taxonomies by including smaller classes into larger ones. Third, the ability to form categories supports induction, because members of the same class are assumed to share many unobserved properties," (Sloutsky, 2003).

Rosch has described the perceived world structure as many things in our environment that are perceived to exhibit a high correlation framework. "There are multiple correlations in the environment and that humans have perceptual and attentional mechanisms capable of extracting these regularities and establishing correspondences among correlated structures," (Sloutsky, 2003).

"What attributes will be perceived given the ability to perceive them is undoubtedly determined by many factors having to do with the functional needs of the knower interacting with the physical and social environment. One influence on how attributes will be defined by humans is clearly the category system already existent in the culture at a given time," (Rosch, 1978).

"These two basic principles of categorization, a drive toward cognitive economy combined with structure in the perceived world, have implications for the level of abstraction of categories

formed in a culture and for the internal structure of those categories once formed," (Rosch, 1978).

Further thought, by Rosch on category structures, has identified vertical and horizontal dimensions. "The vertical 0dimension concerns the level of inclusiveness of the category - the dimension along which the terms collie, dog, mammal, animal, and living thing vary. The horizontal dimension concerns the segmentation of categories at the same level of inclusiveness - the dimension on which dog, cat, bus, chair, and sofa vary," (Rosch, 1978).

"The implication of the two principles of categorization for the vertical dimension is that not all possible levels of categorization are equally good or useful; rather, the most basic level of categorization will be the most inclusive (abstract) level at which the categories can mirror the structure of attributes perceived in the world," (Rosch, 1978).

"The implication of the principles of categorization for the horizontal dimension is that to increase the distinctiveness and flexibility of categories, categories tend to become defined in terms of prototypes or prototypical instances that contain the attributes most representative of items inside and least representative of items outside the category," (Rosch, 1978).

Vertical dimension of categories: basic level objects

The research of Rosch on basic objects has two working assumptions "(1) in the perceived world, information-rich bundles of perceptual and functional attributes occur that form natural boundaries, and that (2) basic cuts in categorization are made at these discontinuities," (Rosch, 1978). If we can give differing information-rich bundles in a variety of ways, would we find a difference in the ability to identify a category. Say we take a graded structure and choose the boundary items, versus the most prototypical items. The information would create distorted natural

boundaries,which emphases the first hypothesis of this study.

1-H$_A$: The main effects of sampling technique (degree of correspondence to typicality distribution), (which best approximates the category distribution), will lead to positive effects on matching.

Common attributes, as suggested by ethno-biologist, of the folk genus was the level of classification where organisms had groups of attributes in common with the maximum discontinuity between these classes. Rosch (1978), hypothesizes that basic level objects are the most inclusive level of classification at which objects have numbers of attributes in common, and was tested at three levels of abstraction. Table 2 is a reproduction of Rosch's research.

Insert Table 2 about here

"Subjects received sets of words taken from these nine taxonomies; the subject's task was to list all of the attributes he could think of that were true of the items included in the class of things designated by each object name. Thus, for the purposes of this study, attributes were defined operationally as whatever subjects agreed them to be with no implications for whether such analysis of an object could or could not be perceptually considered prior to knowledge of the object itself," (Rosch, 1978).

"Very few attributes were listed for the superordinate categories, a significantly greater number listed for the supposed basic-level objects, and not significantly more attributes listed for subordinate-level objects than for basic-level," (Rosch, 1978).

"The single unpredicted result was that for the three biological taxonomies, the basic level,

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as defined by numbers of attributes in common, did not occur at the level of the folk generic but appeared at the level we had originally expected to be superordinate (e.g., tree rather than oak)," (Rosch, 1978).

The horizontal dimension: internal structure of categories: prototypes

"Another way to achieve separateness and clarity of actually continuous categories is by conceiving of each category in terms of its clear cases rather than its boundaries," (Rosch, 1978). Within the manipulation of sampling techniques in this study, selection of the most prototypical would be favoured by a random weighted by prototypicality. Alternatively, a selection of the most prototypical, or top N would be another means by which the participants in this study could obtain the clear exemplars of the categories for the purposes of matching items. If boundaries are to have a reduced impact, we may see that a sampling technique which uses the range of a category, most typical to least typical, would give reduced results in matching, confirming Rosch's previous statement.

"Categories can be viewed in terms of their clear cases if the perceiver places emphasis on the correlational structure of perceived attributes such that the categories are represented by their most structured portions," (Rosch, 1978). The clearest cases can be brought out by introducing more category members. The correlational structure is dependent on the sampling technique, or degree of correspondence to the typicality distribution. As with focal colours, the set of members that are more central will contain a higher degree of correspondence and will be learned faster. Unnaturally structured, or distorted sets will be difficult to learn and have limited correlational structures. Thus, varying the sampling technique and number of prompts will lead

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to the best representation of a category by matching category members. This leads to our third hypothesis of the thesis.

3-H$_A$: Increasing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will lead to positive effects on matching.

That is to say, that increasing prompts, within a sampling technique, will lead to an increasing in matching. Whether a sampling technique is a good representation of the category or not, increasing samples within that technique will produce a greater ability to match a category. The facility to categorize will be strengthened by increasing the number of prompts.

The start of this study brought in typicality gradients for several categories. It is assumed that the most prototypical members are those with the highest typicality numbers. "By prototypes of categories we have generally meant the clearest cases of category membership defined operationally by people's judgments of goodness of membership in the category," (Rosch, 1978).

Using an opportunistic study of third year students increases the likelihood of the participants understanding the categories created by persons of equal standing. "For categories of concrete objects, a reasonable hypothesis is that prototypes develop through the same principles such as maximization of cue validity and maximization of category resemblance as those principles governing the formation of the categories themselves," (Rosch, 1978).

Using these principles, we can be guided to finding some of the more prototypical members of the categories. Central members are easier to learn, and may be fastest to recollect. "The more prototypical of a category a member is rated, the more attributes it has in common with

other members of the category and the fewer attributes in common with members of the contrasting categories," (Rosch, 1978).

"In short, prototypes appear to be just those members of a category that most reflect the redundancy structure of the category as a whole," (Rosch, 1978). It is assumed in this study that introducing sampling techniques with the most prototypical category members would have positive effects on matching. Taking the top two or four prototypical members would increase the information or redundancy of the category structure for reconstruction, as opposed to a random selection of members from a gradient typicality distribution.

Earlier work of Rosch in 1976 with respect to order and probability of item output, showed that "the most prototypical items were the first and most frequently produced items when subjects were asked to list the members of the category," (Rosch, 1978). With effect of advanced information on performance, "the degree of prototypicality determines whether advance information about the category name facilitates or inhibits responses in a matching task," (Rosch, 1978).

"The pervasiveness of prototypes in the real-world categories and of prototypicality as a variable indicates that prototypes must have some place in psychological theories of representation, processing, and learning. However, prototypes themselves do not constitute any particular model of processes, representations, or learning," (Rosch, 1978). We can use prototypes as a tool. A hammer is not a process, but building something with it could be, if part of a set order of doing things. Utilizing prototypes as part of a model would lead to a good predictor, or variable within a model. "Prototypes only constrain but do not specify representation and process models," (Rosch, 1978).

The role of context in basic-level Objects and prototypes

"Interest in context is only beginning, it is not yet clear just what experimentally defined contexts will affect what dependent variables for what categories. But it is predetermined that there will be context effects for both the level of abstraction at which an object is considered and for which items are named, learned, listed, or expected in a category," (Rosch, 1978).

"Turning first to natural categories, we note that people are known to use their pre-experimental knowledge with nearly kaleidoscopic variety," (Yang & Lewandowsky, 2003). This variety can change or even reverse between contexts with respect to people's typicality views. "For example, when judging the pair-wise similarity between black, gray, and white, participants considered black and gray to be more similar than white and gray in the context of clouds, but this judgement was reversed in the context of hair colour," (Yang & Lewandowsky, 2003). People use context to separate their knowledge, and when they do, Yang & Lewandowsky found that each bit of knowledge is used as if the other bits of knowledge do not exist.

"When a context is not specified in an experiment, people must contribute their own context . . . Indeed, it seems likely that, in the absence of a specified context, subjects assume what they consider the normal context or situation for occurrence of that object," (Rosch, 1978).

If context can change pair-wise similarities, as given above, then manipulating a typicality distribution while increasing items will create an effect which can be recognized. This can be summed up by our final hypothesis of this study.

4-H$_A$: Changing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will lead to positive effects on matching.

Research Questions/Hypotheses

As Chapter 1 proposes, the ad hoc ability to categorize two or more categories at the same time will be studied by matching different categories based on exemplars and then by labels. Rosch has shown that a category can produce a graded structure of prototypical items. This study intends to find the reverse: can prototypical items reproduce a category?

The key hypotheses of this study are: Main effect of prompt conditions, and Main effect of sampling technique.

1-H_O: The main effects of sampling technique (degree of correspondence to typicality distribution), will result in no change on matching.

2-H_O: The main effects of prompt conditions, will result in no change on matching. Which will be tested against the alternative:

1-H_A: The main effects of sampling technique (degree of correspondence to typicality distribution), (which best approximates the category distribution), will lead to positive effects on matching.

2-H_A: The main effects of prompt conditions, (increasing number of prompts), will lead to positive effects on matching.

Trochim (2005), indicates an interaction effect exists when differences on one factor depend on the level you are on another factor. With respect to this study, we would state that there's an interaction between prompt conditions and random sampling technique. "...factorial designs are the only effective way to examine interaction effects," (Trochim, 2005). The focus is on the main effects in this thesis. It is understood that there are interaction effects but are beyond

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the scope of the study here.

3-H_O: Increasing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will result in no change on matching. Which will be tested against the alternative:

3-H_A: Increasing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will lead to positive effects on matching.

4-H_O: Changing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will result in no change on matching. Which will be tested against the alternative:

4-H_A: Changing the information by sampling technique (degree of correspondence to typicality distribution) and prompt condition, will lead to positive effects on matching.

The four hypotheses that were discussed are portrayed in the model in Figure 5. In the model, degree of correspondence and conditions are moderating variables because they also influence the relationship between the dependent variable, matching, and of the other independent variables.

Figure 5. Hypothesis Model.
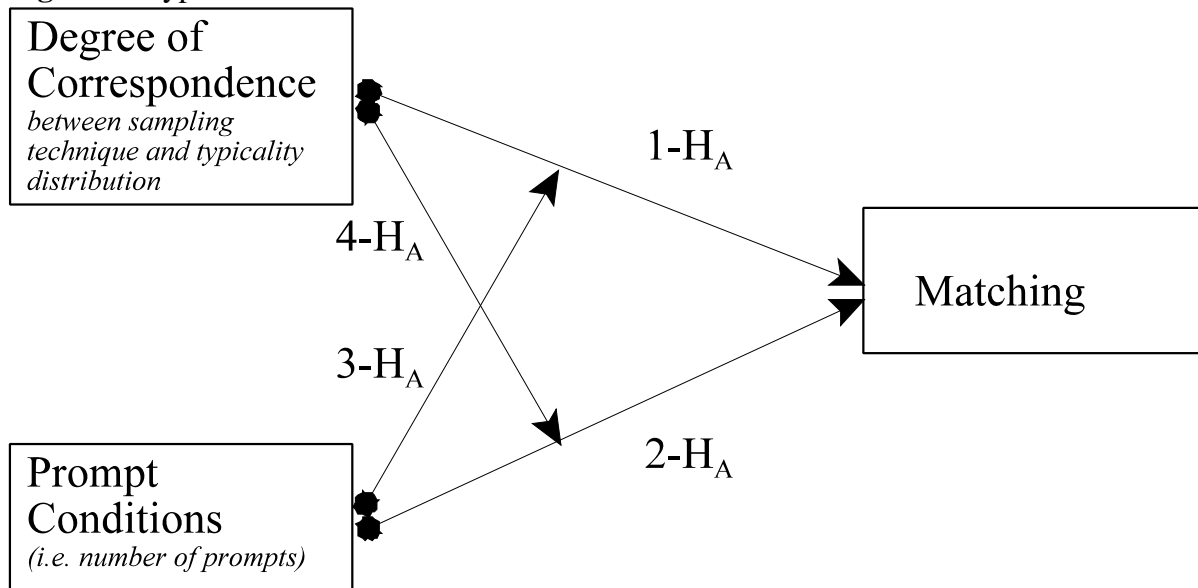
The objective of the study described next is to examine the factors that effect the matching of categories through the underlying factors of degree of correspondence and conditions. There are other factors that may contribute to the matching of categories but were not included in this model because of its focus on the manipulation of categories.

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Chapter 3

Research Approach

Previous Study

Shared data from a previous study, undertaken by another Graduate Student with MSci 311 student participants during the Fall 2004 term, was used to seed the categories to be used in this investigation. There were five groups of 25 (group two had 26) students, for a total of 126 students. Each student was asked four questions of differing types of categories and subordinate categories. Some of these subordinate categories were used in this study. See Appendix Table 4 for details of these categories and Appendix Table 5 for example answers from the students.

Insert Table 4 about here

Insert Table 5 about here

The data similar to Appendix Table 5 were modified into an SPSS 14.0 for Windows (SPSS) data file. The data were then cleaned with a recode script containing 1786 lines. Most of the recoding involved changing words from plural to singular and upper-case to lower-case. Thus, "Beds" was recoded into "bed." Some changes also involved spelling mistakes. A sample of the SPSS recode script for the Fall 2004 survey data is given in Appendix A.

Current Study

A randomized experimental design was used to survey undergraduate students. Data from a previous study was used to seed the two sets of three test categories. These categories would be

used to test the students' ability to match items from the same list and to labelled categories. The first group of labelled categories related to the general theme of birds: Birds, Small Birds, and Fast Birds. The second group of labelled categories related to the general theme of furniture: Furniture, Small Furniture, and Comfortable Furniture. Each of these labelled categories was ordered into decreasing counts of items, which in essence created typicality gradients with discrete probability distributions. Tables 3.1 and 3.2 itemizes each of the typicality gradients.

Table 3.1 Three Bird categories' typicality gradients.

Item	Bird	Fast	Small
bluejay	66		8
eagle	64	14	
chicken	46	1	3
duck	46		2
robin	45	2	5
seagull	41	2	2
pigeon	39	2	6
hawk	38	9	
ostrich	35	3	
sparrow	35	3	7
crow	33	5	4
goose	33		
penguin	32		5
parrot	28	2	2
cardinal	26		5
turkey	25		
owl	22	1	
hummingbird	21	6	8
swan	19		
dove	17		5
pelican	14		
vulture	14		
woodpecker	14		
flamingo	13		
chickadee	12		3
falcon	12	9	
peacock	11		
budgie	10		2
oriole	8		3
canary	7		3
emu	7		
finch	7		2
canada goose	5		
condor	5		
hen	5		
lovebird	5		3

Table 3.2 Three Furniture categories' typicality gradients.

Item	Furniture	Comfortable	Small
chair	123	8	11
bed	112	20	
table	108	2	
desk	94		2
sofa	74	13	
couch	57	12	
dresser	34		
lamp	32		12
coffee table	27		5
stool	25		8
armoire	24		
cabinet	23		
dining-room table	23		
night-table	20		4
tv-stand	19		2
bookshelf	18		
drawers	17		
shelf	17		
closet	16		
loveseat	14	3	
television	14		
cupboard	13		
rug	13		
armchair	11	4	
light	11		
ottoman	10		2
futon	9	4	
mirror	9		
rocking chair	9	2	
shoe-rack	8		
wardrobe	8		
bench	7		2
bookcase	7		
counter	7		
end table	6		2
fridge	6		

rooster	5		
albatross	4		
blackbird	4		3
bluebird	4		3
heron	4		
loon	4		
mockingbird	4		
parakeet	4		
raven	4		
swallow	4	1	
cockatoo	3		
kingfisher	3	1	
stork	3		
cormorant	2		
dodo	2		
kiwi	2		
macau	2		
peregrine-falcon	2		
red bird	2		
swift	2		
quail			2
road-runner		1	
Grand Total	**924**	**62**	**86**

coat-hanger/rack	5		
lazyboy-chair	5	9	
bedside table	4		3
blackboard/whiteboard	4		
chest	4		
mattress	4		
oven	4		
side-table	4		2
stereo	4		
blinds	3		
chest of drawers	3		
china-cabinet	3		
credenza	3		
entertainment set	3		
pillow	3	3	
podium	3		
projector	3		
beanbag chair	2	3	
box	2		
buffet-table	2		
computer	2		
curtains	2		
dvd player	2		
footrest	2		
footstool	2		2
guitar stand	2		
hammock	2		
hutch	2		
pictures	2		
recliner	2	4	
wall-unit	2		
washing-machine	2		
cushion		4	
cushioned chair		2	
lamp-stand			2
leather couch		4	
vase			2
vibrating-chair		3	
water-bed		3	
Grand Total	**1117**	**103**	**61**

The data could now be selected from the typicality gradients in a variety of ways. Five methods of selection used in this study were: Random, Weighted Random, Top N, Quartile, and Range. The approximation of the original six typicality gradients is different for each of these five selection methods.

Random was selection through a random function, and each item in a list had an equal

chance of being selected. Weighted random was a selection based on the probability distributions of the lists, thus closely matching the typicality gradient. Top N was a selection of only the top, or highest probability members, with the next highest probability member following when needed. That is to say that Top N only selects the "n" most typical members. Quartile cut the distribution of the list in half, taking the top item, and the median item. Alternatively, this selection also cut the list in quarters, taking the first item, then subsequent 25 percentile, 50 percentile, and 75 percentile members in the list. This selection corresponds to an extremely modified (or coarse) typicality gradient. Range was used to select the top most items, and the bottom most items for selection of maximum separation by members in the lists.

Methodology

A four-part questionnaire was used (see Appendix D). In part one, a series of category members was created to represent each of the three categories, for example: Bird, Small Bird, and Fast Bird. The series, representing visual prompts for the students, would have one, two, or four members from the selected labelled list. The prompts would be selected based upon one of the five methods listed earlier. The prompts are labelled "Group 1," "Group 2," and "Group 3."

A list of nine items was presented to the student for matching to one of the groups, labelled by the prompts. The nine items were selected by choosing three random items from each of the three categories for Bird. The student only had to indicate category matching by choosing "1," "2," or "3" for each of the presented items.

In the second of four, exactly the same procedures were followed as with the first of four. The difference with the second part, is that the prompts were not labelled as "Group 1," "Group

2," and "Group 3". Each of the three categories is now indicated by their corresponding label "Bird," "Small Bird," "Fast Bird."

The third and fourth part are exactly the same setups as the previous two. Prompts are initially labelled generically, and then specifically. The difference at this point is changing from thee Bird categories to the three Furniture categories.

Sample

Participants were undergraduate students enrolled in the Management Sciences course MSci 311 for the Fall 2004, Winter 2005 and Fall 2005 terms. It is assumed that these students represent typical human subjects.

On average, study participants were 18 to 21 years old undergraduate students (average education level = 3rd year university). Winter 2005 term had 197 out of 215 (91.6%) submissions. There were 66.2% males and 33.8% females from a sample of 148 (68.8%) of the original class list of 215 students. Fall 2005 term had 128 out of 142 (90.1%) submissions. There were 64.4% males and 34.6% females from a sample of 103 (72.5%) of the original class list of 142 students. Combined total of Winter and Fall 2005 term is 325 out of 357 (91.0%) submissions. Thus, the actual sampling fraction is f=n/N=0.034 or 3.4%.

Measures

All of the measures used, were developed specifically for this study. This is a 9-item scale that uses a 3-point response format where 1 = "Group 1," 2 = "Group 2," and 3 = "Group 3" for the first two measures. Bird was the category for the first measure and Furniture was the category

for the second measure. Each of the student test groups was randomly assigned to sampling technique and prompt conditions. A sample of the student file containing this data is given in Appendix B. The final nine items were selected randomly from a pool of original category items.

The last two measures also use a 9-item scale, with a 3-point response format. These final measures have the format where the category label is now indicated. For section 3, page 1 of 2, the format of the scale is 1 = "Small Birds," 2 = "Fast Birds," and 3 = "Birds." For section 3, page 2 of 2, the format of the scale is 1 = "Small Furniture," 2 = "Comfortable Furniture," and 3 = "Furniture." Each of the prompts for the labelled categories was determined by the random sampling technique and prompt conditions, given in Appendix B. The entire instrument used in this study is provided in Appendix D.

Design

A post-test-only randomized experimental design was used in the survey. The symbolic representation is given by:

R X_{ij} O   where: R = the groups were assigned randomly

X_{ij} = random sampling technique and prompt conditions

O = the measures (i.e., Appendix D)

In a factorial design, a factor is a major independent variable. In this study we have two factors to consider, random sampling technique and prompt condition. The random sampling technique has five category sampling procedures, while the prompt had three conditions. The random sampling techniques are: Random, Weighted Random, Top N, Quartile, and Range. The prompt conditions are: one prompt, two prompts, and four prompts.

Table 3.3 Legend of thirteen T.C test groups: T - sampling technique (degree of correspondence to typicality distribution), C - prompt conditions.

Distribution/Condition	1	2	4
Random	1.1	1.2	1.4
Weighted Random	2.1	2.2	2.4
Top N	3.1	3.2	3.4
Quartile		4.2	4.4
Range		5.2	5.4

This is a modified two-factor, 5 x 3 hybrid design, where each group is a relative comparison group. This is also known as an incomplete factorial design. Some of the combinations may not make sense, and Trochim (2005), further advises, in this case, you may decide to implement an incomplete design. There are only thirteen groups, with X41 and X51 not included due to mutual exclusiveness with respect to the type of random selection.

Randomized experimental design is generally strong in internal validity. Trochim (2005), indicates threats of history, maturation, testing, instrumentation, mortality and selection interactions can be ruled out. There are also potential problems that result from reactions of participants and administrators to knowledge of the varying experimental conditions. In general, this is a strong survey with respect to internal validity.

Procedure

Each subject was individually tested by an on-line web survey. The experiment consisted of several parts, called tasks, for this study. Before starting, the subjects received instructions, which are given in Appendix C, as an example of what was seen by the students in the Winter 2005 term. The survey was expanded at the time to include data that could be used in future academic research. This thesis is limited to sections two and three of the web survey.

In the second section, the student was presented with three groups, each with one or more

examples. The student's task was to identify nine similar items as belonging to one of the groups.

In the third section, the student was presented with three labelled groups. The student's task was to identify nine similar items as belonging to one of the groups.

The students were offered one bonus mark towards their course grade as compensation for taking the survey. After reading the instructions with the consent form, the students could log onto a password authenticated web page to take the student survey.

At this point, a computer program, which was written in Perl version 5.005_03 for Sun4-Solaris, automates the process of finding the user's information which predetermines the sampling technique and prompt condition, as given already in Appendix B. The web pages seen in Appendix D, which are the stimuli for this experiment, were created via this web program. The computer program, provide for automated recording of each student's response, and also emails the student upon successful completion. The complete program is given in Appendix E.

Results

There were 325 participants in the final sample for this study. There were only 18 dropouts from the Winter 2005 term and 14 dropouts out from the Fall 2005 term, giving a total of 197 and 128 from whom the relative comparison post tests were obtained.

Students from each of the Winter 2005 and Fall 2005 terms were randomly assigned to one of thirteen possible groups. The matrix of assignment was based on sampling technique (Random, Weighted Random, Top N, Quartile, and Range) and on prompt condition (one, two, or four prompts). The distribution of students is given in Table 3.4.

Table 3.4 Distribution of participants in Winter 2005.

Test	Condition			
	1	2	4	Grand Total
Random	18	21	16	55
Weighted Random	13	21	17	51
Top N	12	9	11	32
Quartile 50/25		22	10	32
Range		17	10	27
Grand Total	43	90	64	197

After finishing this part of the study, an error was found to exist with respect to duplication of prompts with items in the list to match. Both of questions seven and eight exhibited this error. Table 3.5 and Table 3.6 details the frequency of this problem.

Table 3.5 Survey 1, Question 7, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Duplicate Case	251	7.819315	7.81931464174	7.81931464174
Primary Case	2959	92.18069	92.1806853583	100
Total	3210	100	100	

Table 3.6 Survey 1, Question 8, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Duplicate Case	171	5.327103	5.32710280374	5.32710280374
Primary Case	3039	94.6729	94.6728971963	100
Total	3210	100	100	

Although the numbers are low, each student was given a list of nine items to match, if one of the items was duplicated, we could remove the whole record of the student's answer. This would drastically reduce available results as Table 3.7 and Table 3.8 details.

Table 3.7 Survey 1, Question 7, Non Duplicates.

Non Duplicates	Condition			
	1	2	4	Grand Total
Random	13	7	1	21
Weighted Random	7	9	0	16
Top N	6	3	1	10
Quartile 50/25		5	0	5
Range		4	0	4

Grand Total	26	28	2	56

Table 3.8 Survey 1, Question 8, Non Duplicates.

Non Duplicates	Condition			
	1	2	4	Grand Total
Random	11	8	7	26
Weighted Random	9	14	1	24
Top N	9	5	1	15
Quartile 50/25		9	1	10
Range		10	14	14
Grand Total	29	46	14	89

Due to the outcome of the above results, a second survey was undertaken which could do two things. First, the error which was causing the duplication was found and fixed in the computer program. Secondly, we could balance the distribution of randomly assigned students. The following four tables show the balance of students to be populated in the second run followed by the totals for both of questions seven and eight.

Table 3.9 Survey 2, Question 7 distribution of randomly assigned students.

Second Run	Condition			
	1	2	4	Grand Total
Random		6	14	20
Weighted Random	8	6	15	29
Top N	9	11	13	33
Quartile 50/25		10	14	24
Range		10	12	22
Grand Total	17	43	68	128

Table 3.10 Total distribution for Question 7.

Total	Condition			
	1	2	4	Grand Total
Random	13	13	15	41
Weighted Random	15	15	15	45
Top N	15	14	14	43
Quartile 50/25		15	14	29
Range		14	12	26

Grand Total	43	71	70	184

Table 3.11 Survey 2, Question 8 distribution of randomly assigned students.

Second Run	Condition			
	1	2	4	Grand Total
Random	2	9	11	22
Weighted Random	7	4	16	27
Top N	8	12	16	36
Quartile 50/25		9	16	25
Range		7	11	18
Grand Total	17	41	70	128

Table 3.12 Total distribution for Question 8.

Total	Condition	Condition	Condition	
	1	2	4	Grand Total
Random	13	17	18	48
Weighted Random	16	18	17	51
Top N	17	17	17	51
Quartile 50/25		18	17	35
Range		17	25	42
Grand Total	46	87	94	227

This resulted in a favourable outcome. The second survey did not have any duplicates as the following two tables indicate.

Table 3.13 Survey 2, Question 7, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Primary Case	2277	100	100	100

Table 3.14 Survey 2, Question 8, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Primary Case	2289	100	100	100

In fact, the overall number of duplicates did go up by grouping the first and second surveys. This was due to one student who had taken the class twice. The records for this student were identified and not considered for subsequent analyses. Percent of duplicates go down from 7.8% to 4.6% for Question 7 and 5.3% to 3.3% for Question 8 as Tables 3.15 and 3.16 show.

Table 3.15 Question 7, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Duplicate Case	254	4.6291234	4.6291234	4.6291234
Primary Case	5233	95.370877	95.370877	100
Total	5487	100	100	

Table 3.16 Question 8, Valid indicator of each last matching case as Primary.

	Frequency	Percent	Valid Percent	Cumulative Percent
Duplicate Case	180	3.2733224	3.2733224	3.2733224
Primary Case	5319	96.726678	96.726678	100
Total	5499	100	100	

The data was then imported into SPSS. The data file contained 48,373 records of data for the whole survey. This file was then reduce down to 28,536 records of data for questions seven through 10. Aggregate counts of each of the data items for the thirteen groups in each of questions seven and eight across each of the three choices. This was done to obtain the relative ratios for each of the items which the students had to identify.

Table 3.17 Question 7, example ratio calculation.

		Choice				Ratio		
T.C	Item	1	2	3		1	2	3
		Count	Count	Count	Sum			
1.1	albatross	1	1	0	2	0.5	0.5	0
1.1	blackbird	1	3	0	1.1	1	0.75	0
1.1	bluebird	1	4	1	6	0.1667	0.6667	0.1667
1.1	budgie	0	2	1	3	0	0.6667	0.3333
1.1	canary	0	0	1	1	0	0	1
1.1	cardinal	1	2	0	3	0.3333	0.6667	0
1.1	chickadee	0	1	1	2	0	0.5	0.5
1.1	chicken	2	1	4	7	0.2857	0.1429	0.5714
	...							
1.2	chicken	3	3	0	1.2	3	0.5	0
1.4	chicken	2	2	0	4	0.5	0.5	0
2.1	chicken	2	2	5	9	0.2222	0.2222	0.5556
2.2	chicken	2	4	1	7	0.2857	0.5714	0.1429
2.4	chicken	0	1	1	2	0	0.5	0.5
3.1	chicken	1	1	4	6	0.1667	0.1667	0.6667
3.2	chicken	0	2	0	2	0	1	0
3.4	chicken	1	0	2	3	0.3333	0	0.6667
4.2	chicken	0	3	3	6	0	0.5	0.5
4.4	chicken	0	2	2	4	0	0.5	0.5
5.2	chicken	1	1	4	6	0.1667	0.1667	0.6667
5.4	chicken	1	0	3	4	0.25	0	0.75

Table 3.18 Question 8, example ratio calculation.

T.C	Item	Choice				Ratio		
		1	2	3		1	2	3
		Count	Count	Count	Sum			
1.1	armchair	0	2	0	2	0	1	0
1.1	armoire	1	0	0	1	1	0	0
1.1	beanbag chair	1	1	2	4	0.25	0.25	0.5
1.1	bedside table	0	1	2	3	0	0.3333	0.6667
1.1	bench	1	0	3	4	0.25	0	0.75
1.1	bookcase	1	0	0	1	1	0	0
1.1	bookshelf	2	0	0	2	1	0	0
1.1	box	0	0	1	1	0	0	1
	...							
1.2	bench	1	1	1	3	0.3333	0.3333	0.3333
1.4	bench	2	4	1	7	0.2857	0.5714	0.1429
2.1	bench	1	2	0	3	0.3333	0.6667	0
2.2	bench	0	4	0	4	0	1	0
2.4	bench	4	2	0	6	0.6667	0.3333	0
3.1	bench	0	5	1	6	0	0.8333	0.1667
3.2	bench	1	2	4	7	0.1429	0.2857	0.5714
3.4	bench	2	2	1	5	0.4	0.4	0.2
4.2	bench	1	3	1	5	0.2	0.6	0.2
4.4	bench	2	4	0	6	0.3333	0.6667	0
5.2	bench	1	1	3	5	0.2	0.2	0.6
5.4	bench	5	3	1	9	0.5556	0.3333	0.1111

Questions nine and 10 were to be used as a comparison group, or base line for the study. Aggregate counts of each of the data items across the three choices was taken. This was done to obtain the relative ratios for each of the items which the students had to identify based on the label given to the student in those questions. Since all of the thirteen groups were presented with the same labels to match items, there would not be a need to segregate the results into division by the group. Instead, the ratios of each item in question nine and 10 become the relative comparison group for questions seven and eight.

Thus, each of the thirteen groups from question seven with data items and relative ratios were combined with question nine as a comparison group with data items and relative ratios. This new file was then imported into SPSS. The data was further manipulated to match items in each of the thirteen groups from question seven with those from question nine. The "Data/Identify

Duplicates" function was used in SPSS for this task. In total 661 records for thirteen groups were compared directly with question nine across items was created. Similarly, for question eight, the data was manipulated down to 782 records for thirteen groups were compared directly with question 10.

Table 3.19 Question 7, example comparison ratio.

T.C	Item	Data_num	$Fast_7$	$Small_7$	$Birds_7$	$Fast_9$	$Small_9$	$Birds_8$
1.1	albatross	1	0.5	0.5	0	0	0.4	0.6
1.1	blackbird	2	0.25	0.75	0	0.4237	0.2373	0.339
1.1	bluebird	3	0.1667	0.6667	0.1667	0.623	0.1475	0.2295
1.1	budgie	5	0	0.6667	0.3333	0.6897	0.069	0.2414
1.1	canary	7	0	0	1	0.8209	0.0448	0.1343
1.1	cardinal	8	0.3333	0.6667	0	0.7097	0.0968	0.1935
1.1	chickadee	9	0	0.5	0.5	0.9155	0.0282	0.0563
1.1	chicken	10	0.2857	0.1429	0.5714	0.1393	0.0492	0.8115
	...							
1.2	chicken	10	0.5	0.5	0	0.1393	0.0492	0.8115
1.4	chicken	10	0.5	0.5	0	0.1393	0.0492	0.8115
2.1	chicken	10	0.2222	0.2222	0.5556	0.1393	0.0492	0.8115
2.2	chicken	10	0.2857	0.5714	0.1429	0.1393	0.0492	0.8115
2.4	chicken	10	0	0.5	0.5	0.1393	0.0492	0.8115
3.1	chicken	10	0.1667	0.1667	0.6667	0.1393	0.0492	0.8115
3.2	chicken	10	0	1	0	0.1393	0.0492	0.8115
3.4	chicken	10	0.3333	0	0.6667	0.1393	0.0492	0.8115
4.2	chicken	10	0	0.5	0.5	0.1393	0.0492	0.8115
4.4	chicken	10	0	0.5	0.5	0.1393	0.0492	0.8115
5.2	chicken	10	0.1667	0.1667	0.6667	0.1393	0.0492	0.8115
5.4	chicken	10	0.25	0	0.75	0.1393	0.0492	0.8115

Table 3.20 Question 8, example comparison ratio.

T.C	Item	Data_num	$Small_8$	$Comfort_8$	$Furniture_8$	$Small_{10}$	$Comfort_{10}$	$Furniture_{10}$
1.1	armchair	1	0	1	0	0.0303	0.8636	0.1061
1.1	armoire	2	1	0	0	0.1429	0.1429	0.7143
1.1	beanbag chair	3	0.25	0.25	0.5	0.0617	0.8765	0.0617
1.1	bedside table	5	0	0.3333	0.6667	0.7727	0.0227	0.2045
1.1	bench	6	0.25	0	0.75	0.1266	0.0759	0.7975
1.1	bookcase	9	1	0	0	0.2727	0	0.7273
1.1	bookshelf	10	1	0	0	0.0556	0	0.9444
1.1	box	11	0	0	1	0.6364	0	0.3636
	...							
1.2	bench	6	0.3333	0.3333	0.3333	0.1266	0.0759	0.7975
1.4	bench	6	0.2857	0.5714	0.1429	0.1266	0.0759	0.7975
2.1	bench	6	0.3333	0.6667	0	0.1266	0.0759	0.7975
2.2	bench	6	0	1	0	0.1266	0.0759	0.7975
2.4	bench	6	0.6667	0.3333	0	0.1266	0.0759	0.7975
3.1	bench	6	0	0.8333	0.1667	0.1266	0.0759	0.7975
3.2	bench	6	0.1429	0.2857	0.5714	0.1266	0.0759	0.7975
3.4	bench	6	0.4	0.4	0.2	0.1266	0.0759	0.7975
4.2	bench	6	0.2	0.6	0.2	0.1266	0.0759	0.7975

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4.4 bench	6	0.3333	0.6667	0	0.1266	0.0759	0.7975
5.2 bench	6	0.2	0.2	0.6	0.1266	0.0759	0.7975
5.4 bench	6	0.5556	0.3333	0.1111	0.1266	0.0759	0.7975

Chapter 4

Results and Discussions

Aggregate data for each item within each of the thirteen study groups had been taken with the relative ratio across the three dimensions for question seven (or 8) and merged with the relative ratio across the three dimensions for question nine (or 10). The three dimensions are fast, small, and birds for question seven. Within question eight, the dimensions are small, comfortable and furniture. The ratio becomes a unit of measure in a coordinate system. At this point, we could use the distance measure, in three dimensional space, to graphically show how the data is represented in question seven (or 8) to how the relative comparison data is represented it in question nine (or 10).

To help in understanding how the three dimensions are interacting, a three-dimensional plot was done for each of the questions using all of the available data undifferentiated by test group. The data point plotted are the relative ratios, but do not take into consideration the quantity of each data point. Figure 6 is a plot of all data from question seven in a concept space, based on the dimensions of fast, small, and birds.

Figure 6 Question 7 graphical representation of data in 3D.
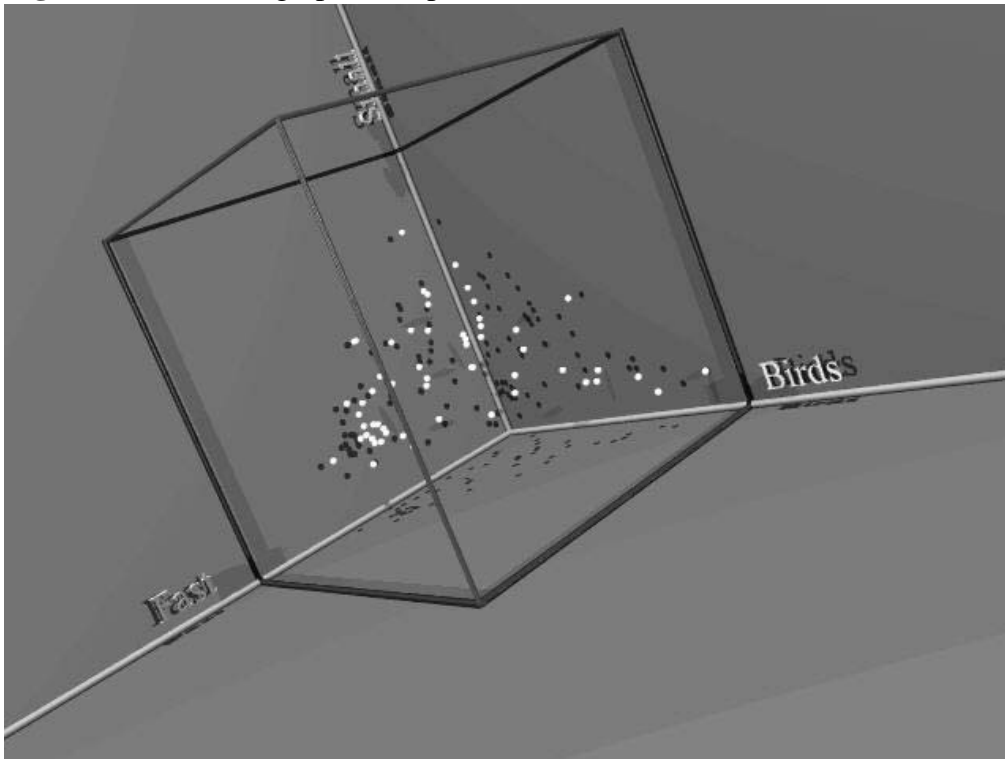
Similarly, question nine was plotted for a comparison against question seven. Figure 7 displays the data points closer to each of the dimensions' labelled vertex.

Figure 7 Question 9 graphical representation of data in 3D.
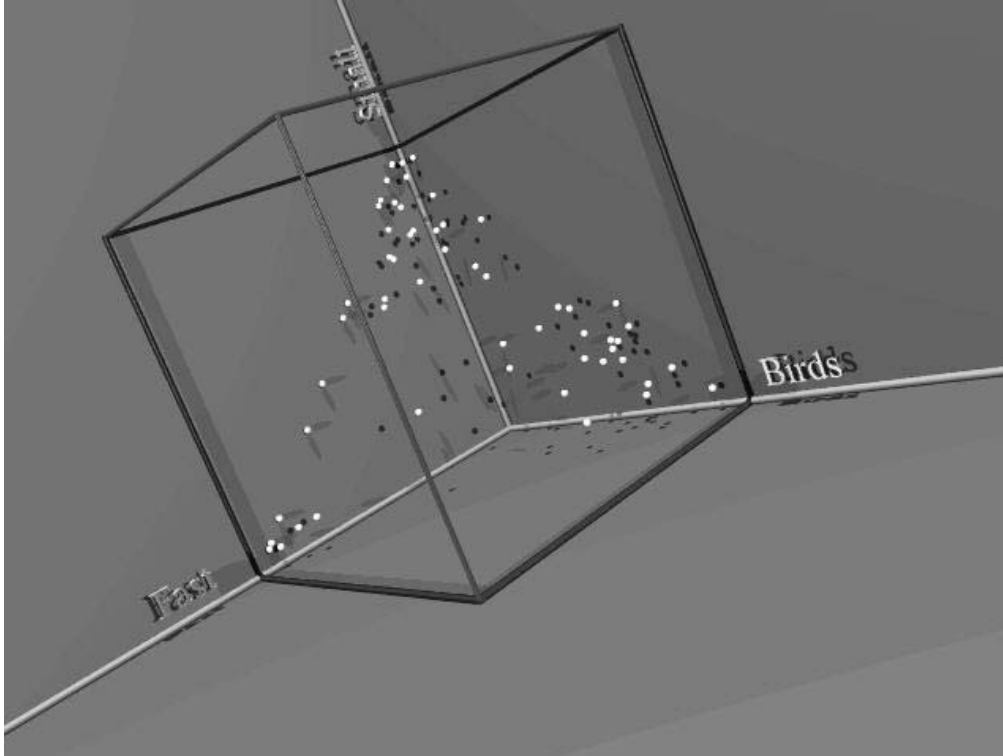
Comparing the last two figures, one can immediately see a difference between exemplar and label matching. The clustering of points is central for the exemplar matching. This is different from the label matching, as clustering seems to be pulled away from the centre and distributed outwardly to the vertexes.

Question eight and 10, although different categories, allows us the ability to validate the possibility of a difference in how items are categorized by exemplar matching, or label matching. The following, Figure 8, is a graphical representation of question eight within a three-dimensional framework. All of the data from question eight is plotted for a comparison with question 10. Figure 6, shown previously, and Figure 8 show a central tendency for the data.

Figure 8 Question 8 graphical representation of data in 3D.
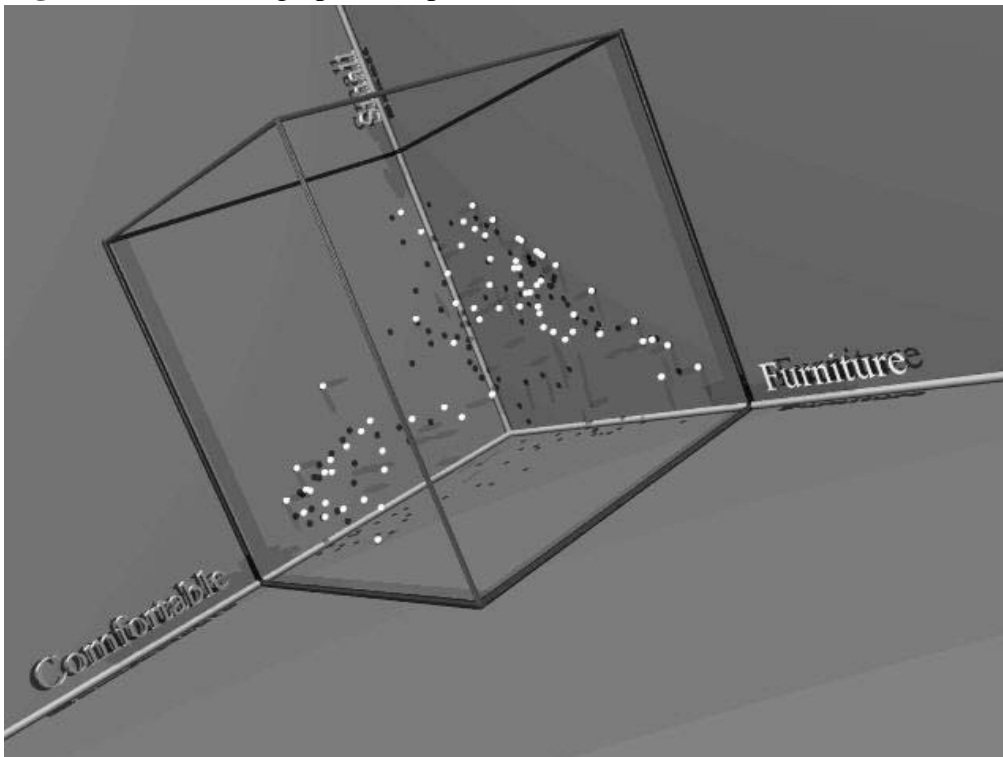
Finally, Figure 9 is a plot of the last question, which is number 10. The data aligns to the edges of the three-dimensional space, which is similar to Figure 7. This difference in distribution is the basis for using a distance measure in later analyses.

Figure 9 Question 10 graphical representation of data in 3D.
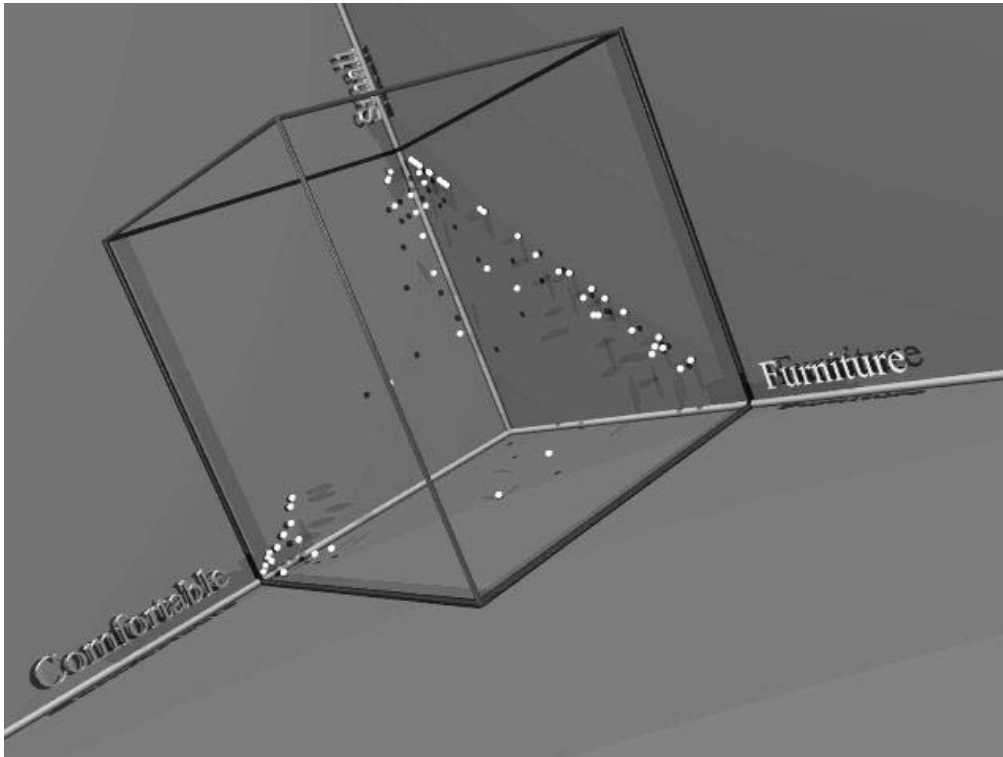
Given that we can visualize in three dimensions and comparatively see a difference in exemplar matching versus label matching, determines the analysis which follows. Statistical correlation on the ratio values themselves is a promising statistic. Alternatively, using a distance measure to capture the difference in 3D space, defined by the ratio dimensions, seems very plausible at this time.

At this point, we are going to present the three bird categories which are based on the relative ratios independent of the thirteen study groups. The following three figures show the categories for "bird," "fast," and "small" from question seven.

Figure 10 Bird   **Figure 11** Fast   **Figure 12** Small
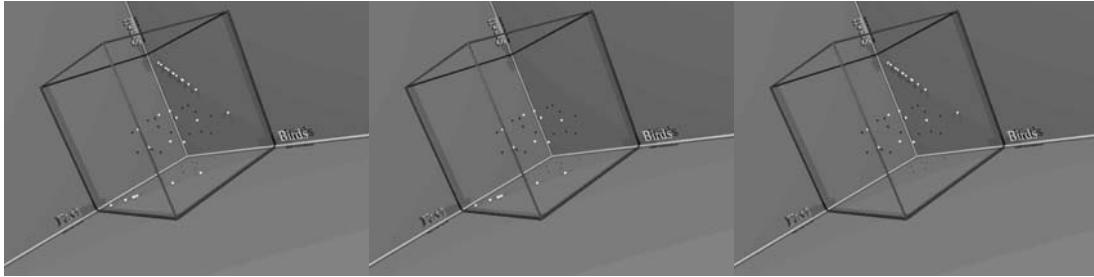
Similarly, we are going to present the three furniture categories which are based on the relative ratios independent of the thirteen study groups. The following three figures show the categories for "furniture," "comfortable," and "small" from question eight.

Figure 13 Furniture   **Figure 14** Comfortable   **Figure 15** Small
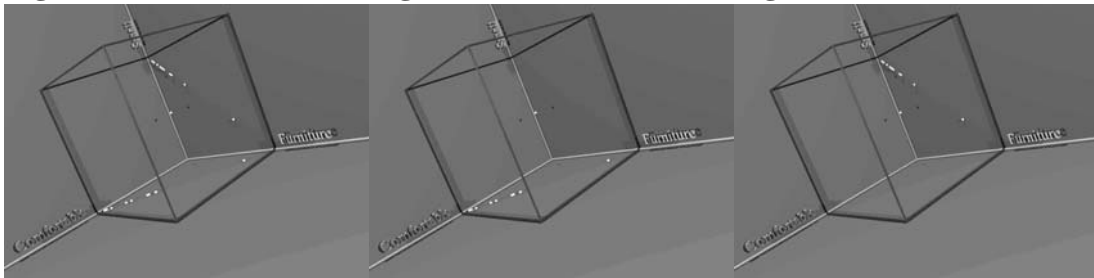
The preceding graphs do not give an indication of the frequency with which any point on the plot might have. Conclusions which may be drawn from observing Figures 10 through 15 maybe a bit misleading. To help understand how the data is distributed, plots of each of the thirteen study groups, for questions seven and eight, will be shown next.

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Visual comparisons of study groups for question seven, see Figures 16 to 28.

Figure 16 T.C 1.1	**Figure 17** T.C 1.2	**Figure 18** T.C 1.4

Figure 19 T.C 2.1	**Figure 20** T.C 2.2	**Figure 21** T.C 2.4

Figure 22 T.C 3.1	**Figure 23** T.C 3.2	**Figure 24** T.C 3.4

Figure 25 T.C 4.2	**Figure 26** T.C 4.4

Figure 27 T.C 5.2	**Figure 28** T.C 5.4

Visual comparisons of study groups for question eight, see Figures 29 to 41.

Figure 29 T.C 1.1
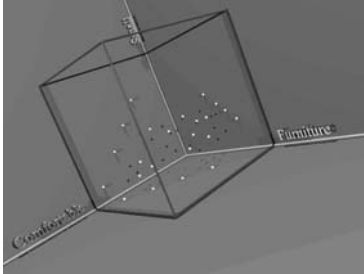
Figure 30 T.C 1.2
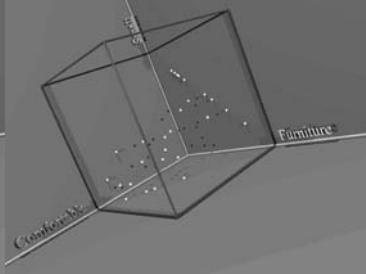
Figure 31 T.C 1.4
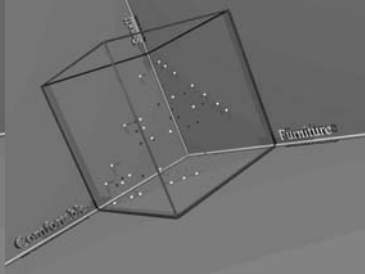
Figure 32 T.C 2.1
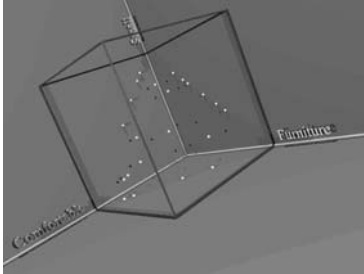
Figure 33 T.C 2.2
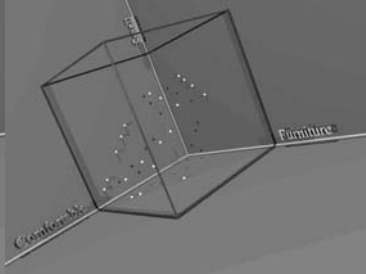
Figure 34 T.C 2.4
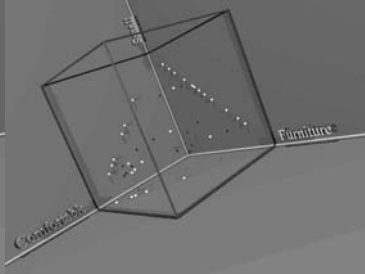
Figure 35 T.C 3.1
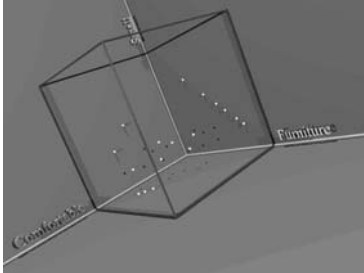
Figure 36 T.C 3.2
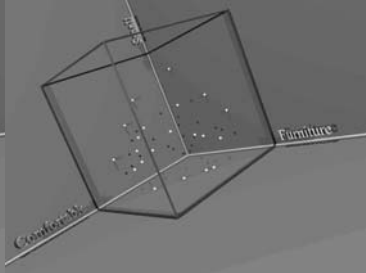
Figure 37 T.C 3.4
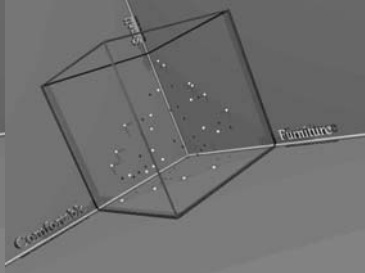
Figure 38 T.C 4.2
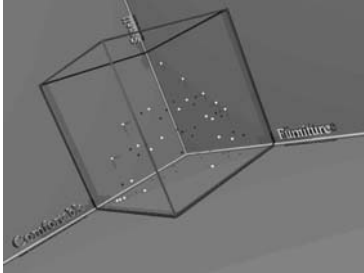
Figure 39 T.C 4.4
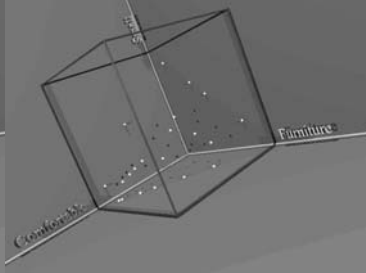
Figure 40 T.C 5.2
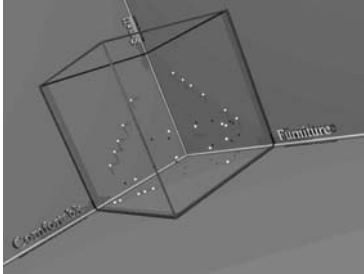
Figure 41 T.C 5.4
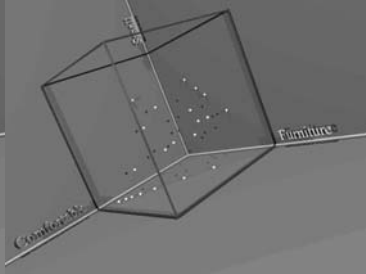
Analysis

Three statistical tests are used to test the hypotheses in this study. The first one used, is the Pearson product-moment correlation coefficient which estimates the correlation of two random variables. This statistic is a measure of the tendency of two variables to increase or decrease together. The correlation coefficient adds a sign to show the direction of the relationship. The coefficient ranges from -1 to 1. A value of 1 shows that a perfect positive linear relationship exists, with all points lying on the same line, and with Y increasing with X. A score of -1 shows that all the data points lie on a single line but that Y increases as X decreases. A value of 0 indicates a linear model is not appropriate, and there is not linear relationship.

In the second test, the sign test is used to determine that there is "no difference" between two continuous distributions X and Y. The null hypothesis H_o: $p = 0.50$, where $p = P(X > Y)$, implies that given a random pair of measurements, both are equally likely to be larger than the other.

The final statistical test used in this study is the Analysis of Variance (ANOVA). Means for each of the test conditions are compared by splitting the observed variance into different parts. Specifically, the One-way ANOVA is used to test for differences among three or more independent groups.

The following results were obtained by using SPSS. The correlation results were obtained by comparing the relative ratio for each item's dimension (i.e., Fast, Small, and Bird) within the test groups to the relative ratio for the respective label question. Chapter 3, Tables 3.19 and 3.20, give example data items with relative ratios. These values are predominately used for the following statistical analyses. Tables 4.1, 4.2, and 4.3 each deal with question seven while

reducing the number of items in each of the correlations. The first table takes all of the items'

dimensions equally. Subsequent tables reduce the dimensions to each respective list of items and

finally to a reduced list of only the top 16 (or 15 for question 8) items of each list. Similarly,

Tables 4.4, 4.5, and 4.6 represent the same conditions for question eight.

The reason for multiple correlation analyses is dependent on the following reason. Each

of the dimensions has different item lists with respect to members of the category and amount in

each category. Taking the full set of all items answered in one of the thirteen test groups biases

the results to the relative comparison groups (questions nine and 10). Participants are

redefining/replicating category labels from the original seed lists. Any correlation results are

comparing equally to each of the dimensions from the comparison ratios. It may be possible that

new prototypical members are being actively created. To correlate the results of the exemplars,

where participants were asked to match items to one, two, or four examples from each of the three

categories require adjusting analysis to only members within each dimension's list of members.

To reduce the amount of noise, steps were taken to pull only items listed from the original

lists determining the dimension. This reduced the significance levels for all conditions. The

possibility that the noise with respect to prototypical category members was taken into account

by the last of the three correlation tables. This was done by isolating the most prototypical

category members for analysis in large dimension lists to the size of the smallest dimension list.

A cut off to the number of items in the smallest list of the dimensions was used for all dimension

lists. Question seven had the Fast dimension with the smallest number of items in the original list.

There were 16 members in the original list. Table 4.3 shows correlations for each of the

dimensions restricted to the top 16, or more prototypical members. Question eight was dealt within

the same way, but reduced to 15 by its smallest list of original dimensions.

Correlation Results

A legend for identifying the T.C codes in the following tables, was given earlier in Chapter

3 as Table 3.3 and is reproduced here.

Table 3.3 Legend of thirteen T.C test groups: T - sampling technique (degree of correspondence to typicality distribution), C - prompt conditions.

Distribution/Condition	1	2	4
Random	1.1	1.2	1.4
Weighted Random	2.1	2.2	2.4
Top N	3.1	3.2	3.4
Quartile		4.2	4.4
Range		5.2	5.4

The results shown in Table 4.1 show some interesting results. There is some strong

significance, but generally the correlation is negative in sign.

Table 4.1 Question 7 Pearson Correlation.

T.C Correlations	Fast	Small	Birds
1.1 Pearson Correlation	-0.28	-0.003	-0.022
Sig. (2-tailed)	0.0724	0.9853	0.8891
N	42	42	42
1.2 Pearson Correlation	-0.05	* -0.349	0.2774
Sig. (2-tailed)	0.7367	0.0161	0.059
N	47	47	47
1.4 Pearson Correlation	-0.182	-0.205	0.116
Sig. (2-tailed)	0.2196	0.1669	0.4374
N	47	47	47
2.1 Pearson Correlation	** -0.519	** -0.365	-0.022
Sig. (2-tailed)	0.0001	0.0092	0.8804
N	50	50	50
2.2 Pearson Correlation	-0.117	-0.276	0.2798
Sig. (2-tailed)	0.4378	0.0636	0.0596
N	46	46	46
2.4 Pearson Correlation	* -0.368	** -0.394	** 0.5024
Sig. (2-tailed)	0.0101	0.0056	0.0003
N	48	48	48
3.1 Pearson Correlation	** -0.528	-0.208	* 0.32
Sig. (2-tailed)	0.0001	0.1599	0.0284
N	47	47	47
3.2 Pearson Correlation	** -0.442	-0.082	-0.075
Sig. (2-tailed)	0.0015	0.5762	0.6075
N	49	49	49
3.4 Pearson Correlation	* -0.291	* -0.357	** 0.4808
Sig. (2-tailed)	0.0497	0.0149	0.0007
N	46	46	46
4.2 Pearson Correlation	** -0.476	* -0.35	0.0987
Sig. (2-tailed)	0.0015	0.0229	0.5339
N	42	42	42
4.4 Pearson Correlation	-0.081	0.1437	0.2797
Sig. (2-tailed)	0.6009	0.3521	0.066
N	44	44	44
5.2 Pearson Correlation	-0.229	* -0.376	* 0.3919
Sig. (2-tailed)	0.1495	0.0153	0.0113
N	41	41	41
5.4 Pearson Correlation	** -0.471	* -0.381	0.1975
Sig. (2-tailed)	0.0025	0.0168	0.2281
N	39	39	39
** Correlation is significant at the 0.01 level (2-tailed).			
* Correlation is significant at the 0.05 level (2-tailed).			

The results in Table 4.2 represent each of the bird dimensions reduced to the members of each of the categories. This was done to see if reducing noise in the data from other categories would increase the correlation. Unexpectedly, this was not supported, and in fact, the significance is reduced.

Table 4.2 Question 7 Pearson Correlation Reduced

T.C	Correlations	Fast	Small	Birds
1.1	Pearson Correlation	0.0782	0.1061	-0.058
	Sig. (2-tailed)	0.7818	0.6472	0.7203
	N	15	21	40
1.2	Pearson Correlation	-0.075	-0.368	* 0.3283
	Sig. (2-tailed)	0.7916	0.0921	0.0277
	N	15	22	45
1.4	Pearson Correlation	** -0.669	0.0799	0.0916
	Sig. (2-tailed)	0.0064	0.7379	0.5497
	N	15	20	45
2.1	Pearson Correlation	* -0.543	0.205	0.0364
	Sig. (2-tailed)	0.0299	0.3602	0.8061
	N	16	22	48
2.2	Pearson Correlation	* -0.582	0.3106	0.2776
	Sig. (2-tailed)	0.023	0.1706	0.0681
	N	15	21	44
2.4	Pearson Correlation	-0.5	0.0258	** 0.5664
	Sig. (2-tailed)	0.0688	0.9115	4e-05
	N	14	21	46
3.1	Pearson Correlation	* -0.534	-0.174	* 0.3575
	Sig. (2-tailed)	0.0403	0.4494	0.0159
	N	15	21	45
3.2	Pearson Correlation	* -0.551	-0.021	-0.105
	Sig. (2-tailed)	0.041	0.9251	0.483
	N	14	22	47
3.4	Pearson Correlation	-0.161	-0.04	** 0.5119
	Sig. (2-tailed)	0.6166	0.8642	0.0004
	N	12	21	44
4.2	Pearson Correlation	* -0.602	-0.086	0.1174
	Sig. (2-tailed)	0.0228	0.7176	0.4649
	N	14	20	41
4.4	Pearson Correlation	-0.393	0.2955	0.2848
	Sig. (2-tailed)	0.2057	0.206	0.0641
	N	12	20	43
5.2	Pearson Correlation	-0.459	-0.187	** 0.4211
	Sig. (2-tailed)	0.0985	0.443	0.0076
	N	14	19	39
5.4	Pearson Correlation	-0.537	-0.288	0.2305
	Sig. (2-tailed)	0.0885	0.1932	0.1639
	N	11	22	38
** Correlation is significant at the 0.01 level (2-tailed).				
* Correlation is significant at the 0.05 level (2-tailed).				

The last set of correlations for question seven is an attempt to reduce most of the lists to the most prototypical category members. This was balanced between the smallest category list size and minimum number of items for statistically significant results.

Table 4.3 Question 7 Pearson Correlation Reduced to 16

T.C Correlations	Fast	Small	Birds
1.1 Pearson Correlation	0.0782	0.1667	0.4503
Sig. (2-tailed)	0.7818	0.5527	0.1225
N	15	15	13
1.2 Pearson Correlation	-0.075	-0.37	0.4416
Sig. (2-tailed)	0.7916	0.1589	0.114
N	15	16	14
1.4 Pearson Correlation	** -0.669	0.0753	0.4897
Sig. (2-tailed)	0.0064	0.7896	0.0894
N	15	15	13
2.1 Pearson Correlation	* -0.543	0.3573	-0.019
Sig. (2-tailed)	0.0299	0.1742	0.9432
N	16	16	16
2.2 Pearson Correlation	* -0.582	0.3245	** 0.7786
Sig. (2-tailed)	0.023	0.2201	0.0006
N	15	16	15
2.4 Pearson Correlation	-0.5	-0.141	** 0.7099
Sig. (2-tailed)	0.0688	0.6174	0.0045
N	14	15	14
3.1 Pearson Correlation	* -0.534	-0.181	** 0.7755
Sig. (2-tailed)	0.0403	0.5182	0.003
N	15	15	12
3.2 Pearson Correlation	* -0.551	0.0787	-0.268
Sig. (2-tailed)	0.041	0.7721	0.3548
N	14	16	14
3.4 Pearson Correlation	-0.161	0.002	0.5942
Sig. (2-tailed)	0.6166	0.9944	0.0539
N	12	15	11
4.2 Pearson Correlation	* -0.602	0.0344	0.4467
Sig. (2-tailed)	0.0228	0.9031	0.126
N	14	15	13
4.4 Pearson Correlation	-0.393	0.2934	0.1484
Sig. (2-tailed)	0.2057	0.2885	0.6453
N	12	15	12
5.2 Pearson Correlation	-0.459	-0.229	** 0.8711
Sig. (2-tailed)	0.0985	0.4515	0.0002
N	14	13	12
5.4 Pearson Correlation	-0.537	-0.21	* 0.5574
Sig. (2-tailed)	0.0885	0.4343	0.0478
N	11	16	13
** Correlation is significant at the 0.01 level (2-tailed).			
* Correlation is significant at the 0.05 level (2-tailed).			

In looking at the correlation of question eight, an immediate difference from question seven, is that generally the correlations are positive in sign. The category "comfortable" seems to be very salient with the participants in this study.

Table 4.4 Question 8 Pearson Correlation

T.C	Correlations	Small	Comfortable	Furniture
1.1	Pearson Correlation	-0.068	** 0.5402	0.0945
	Sig. (2-tailed)	0.6408	5e-05	0.5141
	N	50	50	50
1.2	Pearson Correlation	* 0.333	** 0.4255	0.1846
	Sig. (2-tailed)	0.0114	00.001	0.1691
	N	57	57	57
1.4	Pearson Correlation	** 0.386	** 0.8693	** 0.5638
	Sig. (2-tailed)	0.0036	8e-18	7e-06
	N	55	55	55
2.1	Pearson Correlation	** 0.3851	** 0.7302	0.1082
	Sig. (2-tailed)	0.0053	1e-09	0.4497
	N	51	51	51
2.2	Pearson Correlation	** 0.501	** 0.7439	** 0.3755
	Sig. (2-tailed)	8e-05	5e-11	0.0043
	N	56	56	56
2.4	Pearson Correlation	* 0.27	** 0.8426	** 0.355
	Sig. (2-tailed)	0.0441	4e-16	0.0073
	N	56	56	56
3.1	Pearson Correlation	** 0.3638	** 0.6002	0.1347
	Sig. (2-tailed)	0.0046	5e-07	0.3089
	N	59	59	59
3.2	Pearson Correlation	0.2467	** 0.5503	** 0.4912
	Sig. (2-tailed)	0.0722	2e-05	0.0002
	N	54	54	54
3.4	Pearson Correlation	** 0.5106	** 0.7497	** 0.4578
	Sig. (2-tailed)	0.0002	4e-10	0.0008
	N	50	50	50
4.2	Pearson Correlation	** 0.4406	** 0.7762	** 0.3652
	Sig. (2-tailed)	0.0007	2e-12	0.0057
	N	56	56	56
4.4	Pearson Correlation	0.1618	** 0.6817	** 0.4655
	Sig. (2-tailed)	0.2518	3e-08	0.0005
	N	52	52	52
5.2	Pearson Correlation	0.201	** 0.8741	** 0.4905
	Sig. (2-tailed)	0.1573	6e-17	0.0003
	N	51	51	51
5.4	Pearson Correlation	* 0.3158	** 0.8012	** 0.4729
	Sig. (2-tailed)	0.0255	3e-12	0.0005
	N	50	50	50

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The results in Table 4.5 represent each of the furniture dimensions reduced to the members of each of the categories. As in question seven, this was done to see if reducing noise in the data from other categories would increase the correlation. Unexpectedly, this was not supported, and in fact, the significance is reduced

Table 4.5 Question 8 Pearson Correlation Reduced

T.C	Correlations	Small	Comfortable	Furniture
1.1	Pearson Correlation	0.2116	0.2983	0.1228
	Sig. (2-tailed)	0.4878	0.2618	0.4329
	N	13	16	43
1.2	Pearson Correlation	0.4824	0.0203	0.1571
	Sig. (2-tailed)	0.0686	0.9405	0.2759
	N	15	16	50
1.4	Pearson Correlation	0.137	** 0.6641	** 0.5668
	Sig. (2-tailed)	0.6263	0.005	3e-05
	N	15	16	48
2.1	Pearson Correlation	0.3124	* 0.5822	0.1608
	Sig. (2-tailed)	0.257	0.018	0.2972
	N	15	16	44
2.2	Pearson Correlation	0.5021	** 0.765	* 0.3305
	Sig. (2-tailed)	0.0565	0.0002	0.0204
	N	15	18	49
2.4	Pearson Correlation	0.3914	0.4188	* 0.3027
	Sig. (2-tailed)	0.1859	0.1064	0.0345
	N	13	16	49
3.1	Pearson Correlation	* 0.5517	0.0467	0.0442
	Sig. (2-tailed)	0.0408	0.8587	0.7555
	N	14	17	52
3.2	Pearson Correlation	0.1118	0.415	** 0.4348
	Sig. (2-tailed)	0.7161	0.11	0.0023
	N	13	16	47
3.4	Pearson Correlation	0.4096	** 0.6457	** 0.4198
	Sig. (2-tailed)	0.2398	0.0093	0.0051
	N	10	15	43
4.2	Pearson Correlation	0.3688	* 0.5838	* 0.3222
	Sig. (2-tailed)	0.215	0.0139	0.024
	N	13	17	49
4.4	Pearson Correlation	0.2578	0.1658	** 0.4274
	Sig. (2-tailed)	0.472	0.5395	0.0034
	N	10	16	45
5.2	Pearson Correlation	0.4004	** 0.6994	** 0.4595
	Sig. (2-tailed)	0.1752	0.0012	0.0015
	N	13	18	45
5.4	Pearson Correlation	0.1106	* 0.6117	** 0.4483
	Sig. (2-tailed)	0.7609	0.0201	0.0023
	N	10	14	44
** Correlation is significant at the 0.01 level (2-tailed).				
* Correlation is significant at the 0.05 level (2-tailed).				

The last set of correlations is also an attempt to reduce most of the lists to the most prototypical category members. This was balanced between the smallest category list size and minimum number of items for statistically significant results. It seems that reducing the category list items also reduce the Pearson Correlations.

Table 4.6 Question 8 Pearson Correlation Reduced to 15

T.C Correlations		Small	Comfortable	Furniture
1.1	Pearson Correlation	0.2116	-0.042	0.376
	Sig. (2-tailed)	0.4878	0.8923	0.2843
	N	13	13	10
1.2	Pearson Correlation	0.4824	-0.509	-0.069
	Sig. (2-tailed)	0.0686	0.0758	0.8302
	N	15	13	12
1.4	Pearson Correlation	0.137	0.2025	0.4442
	Sig. (2-tailed)	0.6263	0.507	0.1984
	N	15	13	10
2.1	Pearson Correlation	0.3124	0.2447	0.454
	Sig. (2-tailed)	0.257	0.4205	0.1382
	N	15	13	12
2.2	Pearson Correlation	0.5021	* 0.5622	0.5512
	Sig. (2-tailed)	0.0565	0.0292	0.0632
	N	15	15	12
2.4	Pearson Correlation	0.3914	-0.308	0.1974
	Sig. (2-tailed)	0.1859	0.3054	0.5606
	N	13	13	11
3.1	Pearson Correlation	* 0.5517	-0.21	0.1919
	Sig. (2-tailed)	0.0408	0.4711	0.5501
	N	14	14	12
3.2	Pearson Correlation	0.1118	-0.299	-0.049
	Sig. (2-tailed)	0.7161	0.3218	0.9008
	N	13	13	9
3.4	Pearson Correlation	0.4096	* 0.6259	0.5818
	Sig. (2-tailed)	0.2398	0.0295	0.2258
	N	10	12	6
4.2	Pearson Correlation	0.3688	0.5131	0.5015
	Sig. (2-tailed)	0.215	0.0606	0.0808
	N	13	14	13
4.4	Pearson Correlation	0.2578	0.0443	0.6032
	Sig. (2-tailed)	0.472	0.8856	0.1134
	N	10	13	8
5.2	Pearson Correlation	0.4004	* 0.5551	* 0.6044
	Sig. (2-tailed)	0.1752	0.0317	0.0489
	N	13	15	11
5.4	Pearson Correlation	0.1106	0.5407	0.388
	Sig. (2-tailed)	0.7609	0.0695	0.3897
	N	10	12	7
** Correlation is significant at the 0.01 level (2-tailed).				
* Correlation is significant at the 0.05 level (2-tailed).				

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Summary Tables 4.7 and 4.8, for correlation results of question seven and eight are presented next. In a side by side comparison, it can be observed that the strengths of the correlations tend to fade as the number of items being correlated are reduced. Question seven does not seem to replicate or validate the results in question eight. The bird (natural kind) category is not equal to furniture (nominal kind) category. In the following two tables, "NonDup" identifies all participant answers, "Reduced" as correlations restricted to dimension list, and "Reduced16" as the correlations restricted to the top 16 prototypical members for each dimension.

Table 4.7 Summary Correlation for Question 7.

T.C	NonDup			Reduced			Reduced16		
---	Fast	Small	Birds	Fast	Small	Birds	Fast	Small	Birds
1.1	-0.28	-0.003	-0.022	0.0782	0.1061	-0.058	0.0782	0.1667	0.4503
1.2	-0.05	* -0.349	0.2774	-0.075	-0.368	* 0.3283	-0.075	-0.37	0.4416
1.4	-0.182	-0.205	0.116	** -0.669	0.0799	0.0916	** -0.669	0.0753	0.4897
2.1	** -0.519	** -0.365	-0.022	* -0.543	0.205	0.0364	* -0.543	0.3573	-0.019
2.2	-0.117	-0.276	0.2798	* -0.582	0.3106	0.2776	* -0.582	0.3245	** 0.7786
2.4	* -0.368	** -0.394	** 0.5024	-0.5	0.0258	** 0.5664	-0.5	-0.141	** 0.7099
3.1	** -0.528	-0.208	* 0.32	* -0.534	-0.174	* 0.3575	* -0.534	-0.181	** 0.7755
3.2	** -0.442	-0.082	-0.075	* -0.551	-0.021	-0.105	* -0.551	0.0787	-0.268
3.4	* -0.291	* -0.357	** 0.4808	-0.161	-0.04	** 0.5119	-0.161	0.002	0.5942
4.2	** -0.476	* -0.35	0.0987	* -0.602	-0.086	0.1174	* -0.602	0.0344	0.4467
4.4	-0.081	0.1437	0.2797	-0.393	0.2955	0.2848	-0.393	0.2934	0.1484
5.2	-0.229	* -0.376	* 0.3919	-0.459	-0.187	** 0.4211	-0.459	-0.229	** 0.8711
5.4	** -0.471	* -0.381	0.1975	-0.537	-0.288	0.2305	-0.537	-0.21	* 0.5574

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The results in Table 4.7 show two things right away. The first is that the dimensions Fast and Small are not salient with the participants in the study. There is a high amount of negative correlation with respect to these two dimensions. Secondly, reduction in dimension items to more prototypical members lightly reduces correlation results, but in a random pattern.

Table 4.8 Summary Correlation for Question 8.

T.C	NonDup			Reduced			Reduced15		
---	Small	Comfort	Furniture	Small	Comfort	Furniture	Small	Comfort	Furniture
1.1	-0.068	** 0.5402	0.0945	0.2116	0.2983	0.1228	0.2116	-0.042	0.376
1.2	* 0.333	** 0.4255	0.1846	0.4824	0.0203	0.1571	0.4824	-0.509	-0.069
1.4	** 0.386	** 0.8693	** 0.5638	0.137	** 0.6641	** 0.5668	0.137	0.2025	0.4442
2.1	** 0.3851	** 0.7302	0.1082	0.3124	* 0.5822	0.1608	0.3124	0.2447	0.454

2.2	** 0.501	** 0.7439	** 0.3755	0.5021	** 0.765	* 0.3305	0.5021	* 0.5622	0.5512
2.4	* 0.27	** 0.8426	** 0.355	0.3914	0.4188	* 0.3027	0.3914	-0.308	0.1974
3.1	** 0.3638	** 0.6002	0.1347	* 0.5517	0.0467	0.0442	* 0.5517	-0.21	0.1919
3.2	0.2467	** 0.5503	** 0.4912	0.1118	0.415	** 0.4348	0.1118	-0.299	-0.049
3.4	** 0.5106	** 0.7497	** 0.4578	0.4096	** 0.6457	** 0.4198	0.4096	* 0.6259	0.5818
4.2	** 0.4406	** 0.7762	** 0.3652	0.3688	* 0.5838	* 0.3222	0.3688	0.5131	0.5015
4.4	0.1618	** 0.6817	** 0.4655	0.2578	0.1658	** 0.4274	0.2578	0.0443	0.6032
5.2	0.201	** 0.8741	** 0.4905	0.4004	** 0.6994	** 0.4595	0.4004	* 0.5551	* 0.6044
5.4	* 0.3158	** 0.8012	** 0.4729	0.1106	* 0.6117	** 0.4483	0.1106	0.5407	0.388

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

A much more structured, and nearly predictable pattern are revealed with question eight. Table 4.8 shows three things at once. The most notable is that the dimension Comfortable is very salient with the study participants. The second is that a reduction in list items, for a dimension, results in a reduction of the strength of the correlation. The final point to make is that the pattern to the reduction indicates a pattern that seems to be much more predictable. The significance is "fading" almost mathematically based on original strength of significance.

Sign Test

To capture the results from the correlations given earlier, a sign test was performed to determine the statistical validity of our hypotheses. One of the presumptions made was that if we increase the number of prompts, there would also be an increase in the likelihood of a match for items given. To do this, aggregate values of dimensions for each test were used to generate the following tables. That is to say, the Pearson coefficient for question seven, T.C group 1.1 had the dimensions for Fast, Small, and Birds averaged together to obtain one measure for comparison. Each of the tests in "Sign1" of Table 4.9 are examining all cases where more prompts are given relative to fewer prompts of the same sampling technique.

Table 4.9 First Sign test, more prompts produces greater Pearson coefficient.

Sign1	Q7	Q7reduced	Q7reduce16	Q8	Q8reduced	Q8reduce15
1.1 - 1.2	+	-	-	+	+	-
1.2 - 1.4	-	-	-	+	+	+
2.1 - 2.2	+	+	+	+	+	+
2.2 - 2.4	-	+	-	-	-	-
3.1 - 3.2	-	-	-	+	+	-
3.2 - 3.4	+	+	+	+	+	+
4.2 - 4.4	+	+	+	-	-	-
5.2 - 5.4	-	-	-	+	-	-
Ratio	4 / 8	4 / 8	3 / 8	6 / 8	5 / 8	3 / 8
P	0.362	0.362	0.363	0.035	0.145	0.363

The tests for both of question seven and eight given above, in Table 4.9, try to determine if holding the test constant and increasing prompts lead to high aggregate Pearson coefficient (test H_2). "P" comes from the table of probabilities associated with values as small as observed values of "Z" in the binomial table. Only Q8 stands out with a probability of 0.035, which indicates the possibility that we reject the "null hypothesis," and there is a difference when we increase the number of samples.

The results in Table 4.9 try to determine if increasing number of prompts, while holding the sampling procedure the same, will effectively give more information for the participants to use in recognizing a category. The next test will try to keep the number of prompts the same, but change the sampling technique, to determine if more information can be obtained by the participants in identifying a category to match.

Table 4.10 Second Sign test, sampling procedure produces greater Pearson coefficient.

Sign2	Q7	Q7reduced	Q7reduce16	Q8	Q8reduced	Q8reduce15
3.1 - 4.2	-	-	-	+	+	+
4.2 - 4.4	+	+	+	-	-	-
4.2 - 5.2	+	+	+	-	+	+
5.2 - 5.4	-	-	-	+	-	-
3.2 - 4.4	+	+	+	+	-	+
4.4 - 5.4	-	-	-	+	+	+
Ratio	3 / 6	3 / 6	3 / 6	4 / 6	3 / 6	4 / 6
P	0.344	0.344	0.344	0.109	0.344	0.109

The tests for both of question seven and eight, in Table 4.10, try to determine if sampling

condition and prompt is the same, or more information from sampling condition leads to high

aggregate Pearson coefficient (tests $\mathbf{H_3}$ and $\mathbf{H_4}$). With an Alpha of 0.05 level of significance, we

fail to reject the "null hypothesis" for all tests in both questions. There is no difference that is

statistically significant.

ANOVA

The next four tables take question seven with the number of category list items being

reduced in subsequent tables. Similarly question eight follows with four tables. In order to run an

ANOVA on the hypotheses, the three dimensions (Bird: fast, small, birds; Furniture: small,

comfortable, furniture) need to be reduced to a single value. In this case, a difference in distance

measure was used, which is a calculated 3 Dimensional value, based on the Pythagorean theorem.

An extension of the Pythagorean theorem which was utilized is given as:

$$a^2 + b^2 + c^2 = d^2$$

$$(Fast_7 - Fast_9)^2 + (Small_7 - Small_9)^2 + (Bird_7 - Bird_9)^2 = (\Delta Distance)^2$$

$$(Small_8 - Small_{10})^2 + (Comfort_8 - Comfort_{10})^2 + (Furniture_8 - Furniture_{10})^2 = (\Delta Distance)^2$$

The values used for the dimensions, was each of the relative ratios for each item in a given

test condition. All of these values were then used to create a "distance measure" which was used

in all of the ANOVA statistical tests.

Table 4.11 Example distance calculation for question seven.

T.C	Item	$Fast_7$	$Small_7$	$Bird_7$	$Fast_9$	$Small_9$	$Bird_9$	Distance
1.1	albatross	0.5	0.5	0	0	0.4	0.6	0.7874
1.1	blackbird	0.25	0.75	0	0.4237	0.2373	0.339	0.6387
1.1	bluebird	0.1667	0.6667	0.1667	0.623	0.1475	0.2295	0.694
1.1	budgie	0	0.6667	0.3333	0.6897	0.069	0.2414	0.9172
1.1	canary	0	0	1	0.8209	0.0448	0.1343	1.1938
1.1	cardinal	0.3333	0.6667	0	0.7097	0.0968	0.1935	0.7098
1.1	chickadee	0	0.5	0.5	0.9155	0.0282	0.0563	1.1214

1.1 chicken	0.2857	0.1429	0.5714	0.1393	0.0492	0.8115	0.2963
...							
1.2 chicken	0.5	0.5	0	0.1393	0.0492	0.8115	0.9959
1.4 chicken	0.5	0.5	0	0.1393	0.0492	0.8115	0.9959
2.1 chicken	0.2222	0.2222	0.5556	0.1393	0.0492	0.8115	0.3199
2.2 chicken	0.2857	0.5714	0.1429	0.1393	0.0492	0.8115	0.8609
2.4 chicken	0	0.5	0.5	0.1393	0.0492	0.8115	0.5654
3.1 chicken	0.1667	0.1667	0.6667	0.1393	0.0492	0.8115	0.1885
3.2 chicken	0	1	0	0.1393	0.0492	0.8115	1.2578
3.4 chicken	0.3333	0	0.6667	0.1393	0.0492	0.8115	0.247
4.2 chicken	0	0.5	0.5	0.1393	0.0492	0.8115	0.5654
4.4 chicken	0	0.5	0.5	0.1393	0.0492	0.8115	0.5654
5.2 chicken	0.1667	0.1667	0.6667	0.1393	0.0492	0.8115	0.1885
5.4 chicken	0.25	0	0.75	0.1393	0.0492	0.8115	0.1358

Table 4.12 Example distance calculation for question eight.

T.C Item	$Small_8$	Comfort$_8$	Furniture$_8$	$Small_{10}$	Comfort$_{10}$	Furniture$_{10}$	Distance
1.1 armchair	0	1	0	0.0303	0.8636	0.1061	0.1754
1.1 armoire	1	0	0	0.1429	0.1429	0.7143	1.1249
1.1 beanbag chair	0.25	0.25	0.5	0.0617	0.8765	0.0617	0.7875
1.1 bedside table	0	0.3333	0.6667	0.7727	0.0227	0.2045	0.9524
1.1 bench	0.25	0	0.75	0.1266	0.0759	0.7975	0.1525
1.1 bookcase	1	0	0	0.2727	0	0.7273	1.0285
1.1 bookshelf	1	0	0	0.0556	0	0.9444	1.3356
1.1 box	0	0	1	0.6364	0	0.3636	0.9
...							
1.2 bench	0.3333	0.3333	0.3333	0.1266	0.0759	0.7975	0.5696
1.4 bench	0.2857	0.5714	0.1429	0.1266	0.0759	0.7975	0.8363
2.1 bench	0.3333	0.6667	0	0.1266	0.0759	0.7975	1.0137
2.2 bench	0	1	0	0.1266	0.0759	0.7975	1.2271
2.4 bench	0.6667	0.3333	0	0.1266	0.0759	0.7975	0.9969
3.1 bench	0	0.8333	0.1667	0.1266	0.0759	0.7975	0.9938
3.2 bench	0.1429	0.2857	0.5714	0.1266	0.0759	0.7975	0.3088
3.4 bench	0.4	0.4	0.2	0.1266	0.0759	0.7975	0.7326
4.2 bench	0.2	0.6	0.2	0.1266	0.0759	0.7975	0.7981
4.4 bench	0.3333	0.6667	0	0.1266	0.0759	0.7975	1.0137
5.2 bench	0.2	0.2	0.6	0.1266	0.0759	0.7975	0.2445
5.4 bench	0.5556	0.3333	0.1111	0.1266	0.0759	0.7975	0.8493

The following result tables of the ANOVA tests have a few things in common which needs to be mentioned at this time for clarification. Each row in the table corresponds to a separate one way ANOVA. The rows are qualified by a code for what type of test was done. The meaning of each test is given as follows:

All   - all thirteen groups are compared at the same time
T = only   - H_1 test, analysis is done on all thirteen groups, factored by T, the sampling

technique.

C = 1	- H_1 test, only groups with a prompt of one are compared.
C = 2	- H_1 test, only groups with two prompts are compared.
C only	- H_2 test, analysis is done on all thirteen groups, factored by C, the number of prompts.
T = 1	- H_3 test, only groups with the first sampling technique are compared.
T = 2	- H_3 test, only groups with the second sampling technique are compared.
T <= 3	- H_3 test, only groups the first, second, and third sampling techniques are compared.
T = 1|3	- H_3 test, only the first and third sampling techniques are compared.
T.C = 3.1|4.2	- H_4 test, only third sampling technique with one prompt compared with fourth sampling technique with two prompts.
T.C = 3.2|4.4|5.4	- H_4 test, only third sampling technique with two prompt compared with fourth sampling technique with four prompts and compared with fifth sampling technique with four prompts.

Table 4.13 Question 7 merged with 9 Hypothesis tests on Distance

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis Scheffe
All	12	575	1.2534	0.2428	1.75	Fail to reject Ho
C = 1	2	136	2.0929	0.1273	3	Fail to reject Ho
C = 2	4	220	0.8496	0.4951	2.37	Fail to reject Ho
C = 4	4	219	1.3741	0.2439	2.45	Fail to reject Ho
C only	2	585	0.9931	0.371	3	Fail to reject Ho
T <= 3	8	413	1.0356	0.4083	1.94	Fail to reject Ho
T = 1	2	133	0.7776	0.4616	3	Fail to reject Ho
T = 1 | 2	5	274	1.4901	0.1931	2.21	Fail to reject Ho
T = 1 | 3	5	272	0.5988	0.7009	2.21	Fail to reject Ho
T = 2	2	141	2.6111	0.077	3	Fail to reject Ho
T = 2 | 3	5	280	1.1314	0.3438	2.21	Fail to reject Ho
T = 3	2	139	0.2507	0.7786	3	Fail to reject Ho
T = 4	1	84	5.0988*	0.0265	3.96	Ho is rejected
T = 5	1	78	0.9438	0.3343	3.96	Fail to reject Ho
T only	4	583	0.5357	0.7095	2.37	Fail to reject Ho
T.C = 3.1 | 4.2	1	87	0.0176	0.8948	3.95	Fail to reject Ho
T.C = 3.1 | 4.2 | 4.4	2	130	2.9215	0.0574	3	Fail to reject Ho
T.C = 3.1 | 4.2 | 5.2	2	127	0.5191	0.5963	3	Fail to reject Ho
T.C = 3.1 | 5.2	1	86	0.6441	0.4244	3.96	Fail to reject Ho
T.C = 3.1 | 5.2 | 5.4	2	124	0.5223	0.5945	3.07	Fail to reject Ho
T.C = 3.2 | 4.4	1	91	4.4723*	0.0372	3.95	Ho is rejected
T.C = 3.2 | 4.4 | 5.4	2	129	3.0072	0.0529	3.06	Fail to reject Ho
T.C = 3.2 | 5.4	1	86	0.0299	0.8632	3.96	Fail to reject Ho

* The mean difference is significant at the .05 level

Table 4.14 Question 7 merged with 9 Distance Means and Standard Deviations

C	Distance		
T	1	2	4
Mean			
1	0.7152	0.8068	0.7389
2	0.8779	0.7054	0.7753
3	0.8151	0.8159	0.7669
4.		0.826	0.6535
5.		0.7466	0.8302
Std Deviation			
1	0.3613	0.3791	0.3478
2	0.3695	0.3834	0.3657
3	0.4101	0.3854	0.3508
4.		0.3566	0.3515
5.		0.3863	0.3826

Table 4.15 Question 7 ANOVA reduced to top sixteen items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis	Scheffe
All	12	318	1.2773	0.2305		Fail to reject Ho	
C = 1	2	77	3.8204*	0.0262		Ho is rejected	1.1 vs 2.1
C = 2	4	125	1.0734	0.3726		Fail to reject Ho	
C = 4	4	116	0.6708	0.6135		Fail to reject Ho	
C only	2	328	0.2303	0.7944		Fail to reject Ho	
T <= 3	8	226	1.5759	0.133		Fail to reject Ho	
T = 1	2	75	2.1159	0.1277		Fail to reject Ho	
T = 1 | 2	5	155	2.4399*	0.0368		Ho is rejected	
T = 1 | 3	5	146	1.1666	0.3285		Fail to reject Ho	
T = 2	2	80	3.3005*	0.0419		Ho is rejected	2.1 vs 2.2
T = 2 | 3	5	151	1.3537	0.245		Fail to reject Ho	
T = 3	2	71	0.3551	0.7023		Fail to reject Ho	
T = 4	1	48	1.3728	0.2471		Fail to reject Ho	
T = 5	1	44	0.9397	0.3377		Fail to reject Ho	
T only	4	326	0.5257	0.7169		Fail to reject Ho	
T.C = 3.1 | 4.2	1	49	0.0001	0.9917		Fail to reject Ho	
T.C = 3.1 | 4.2 | 4.4	2	72	0.7446	0.4786		Fail to reject Ho	
T.C = 3.1 | 4.2 | 5.2	2	71	0.242	0.7857		Fail to reject Ho	
T.C = 3.1 | 5.2	1	46	0.3365	0.5647		Fail to reject Ho	
T.C = 3.1 | 5.2 | 5.4	2	68	0.4326	0.6506		Fail to reject Ho	
T.C = 3.2 | 4.4	1	48	2.5873	0.1143		Fail to reject Ho	
T.C = 3.2 | 4.4 | 5.4	2	70	1.5022	0.2297		Fail to reject Ho	
T.C = 3.2 | 5.4	1	47	0.0061	0.938		Fail to reject Ho	

* The mean difference is significant at the .05 level

Table 4.16 Question 7 Mean and Standard Deviation for top sixteen items.

C	Distance		
T	1	2	4
Mean			
1	0.6105	0.7997	0.686
2	0.8834	0.6433	0.7535
3	0.767	0.8157	0.7215
4.		0.7658	0.6547
5.		0.6997	0.8072
Std Deviation			
1	0.3264	0.3454	0.34
2	0.3381	0.3719	0.3487
3	0.4307	0.3767	0.3614
4.		0.3424	0.3267
5.		0.3662	0.3856

Table 4.17 Question 7 ANOVA reduced to top ten items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis Scheffe
All	12	190	0.8428	0.6062		Fail to reject Ho
C = 1	2	47	1.8363	0.1707		Fail to reject Ho
C = 2	4	74	0.9418	0.4447		Fail to reject Ho
C = 4	4	69	0.4998	0.7359		Fail to reject Ho
C only	2	200	0.261	0.7706		Fail to reject Ho
T <= 3	8	136	1.0522	0.4005		Fail to reject Ho
T = 1	2	46	1.4285	0.2501		Fail to reject Ho
T = 1 | 2	5	93	0.9701	0.4403		Fail to reject Ho
T = 1 | 3	5	89	1.3078	0.2679		Fail to reject Ho
T = 2	2	47	0.7121	0.4958		Fail to reject Ho
T = 2 | 3	5	90	1.0185	0.4116		Fail to reject Ho
T = 3	2	43	1.7028	0.1942		Fail to reject Ho
T = 4	1	27	0.5088	0.4818		Fail to reject Ho
T = 5	1	27	0.3345	0.5678		Fail to reject Ho
T only	4	198	0.3321	0.8562		Fail to reject Ho
T.C = 3.1 | 4.2	1	29	0.0413	0.8405		Fail to reject Ho
T.C = 3.1 | 4.2 | 4.4	2	42	0.1676	0.8462		Fail to reject Ho
T.C = 3.1 | 4.2 | 5.2	2	42	0.0345	0.9661		Fail to reject Ho
T.C = 3.1 | 5.2	1	28	0.0019	0.9656		Fail to reject Ho
T.C = 3.1 | 5.2 | 5.4	2	42	0.1826	0.8338		Fail to reject Ho
T.C = 3.2 | 4.4	1	28	4.7932*	0.0371		Ho is rejected
T.C = 3.2 | 4.4 | 5.4	2	42	1.9764	0.1512		Fail to reject Ho
T.C = 3.2 | 5.4	1	29	0.915	0.3467		Fail to reject Ho

* The mean difference is significant at the .05 level

Table 4.18 Question 7 Mean and Standard Deviation for top ten items.

C	Distance		
T	1	2	4
Mean			
1	0.5679	0.747	0.7408
2	0.8129	0.6709	0.735
3	0.6635	0.8596	0.6222
4.		0.6916	0.6141
5.		0.6567	0.7397
Std Deviation			
1	0.3207	0.3584	0.345
2	0.3316	0.3609	0.3676
3	0.4659	0.3025	0.3555
4.		0.2744	0.3109
5.		0.3794	0.3924

Table 4.19 Question 7 ANOVA reduced to top five items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis	Scheffe
All	12	115	0.798	0.6517		Fail to reject Ho	
C = 1	2	29	1.8641	0.1731		Fail to reject Ho	
C = 2	4	45	0.5843	0.6756		Fail to reject Ho	
C = 4	4	41	0.569	0.6865		Fail to reject Ho	
C only	2	125	0.4169	0.66		Fail to reject Ho	
T <= 3	8	83	0.9573	0.475		Fail to reject Ho	
T = 1	2	28	1.3132	0.285		Fail to reject Ho	
T = 1 | 2	5	58	0.9718	0.4427		Fail to reject Ho	
T = 1 | 3	5	53	1.2259	0.31		Fail to reject Ho	
T = 2	2	30	0.3501	0.7074		Fail to reject Ho	
T = 2 | 3	5	55	0.6815	0.6393		Fail to reject Ho	
T = 3	2	25	1.3001	0.2903		Fail to reject Ho	
T = 4	1	15	1.1578	0.2989		Fail to reject Ho	
T = 5	1	17	0.1255	0.7275		Fail to reject Ho	
T only	4	123	0.5713	0.6839		Fail to reject Ho	
T.C = 3.1 | 4.2	1	17	0.1718	0.6837		Fail to reject Ho	
T.C = 3.1 | 4.2 | 4.4	2	24	0.3866	0.6835		Fail to reject Ho	
T.C = 3.1 | 4.2 | 5.2	2	25	0.0945	0.9102		Fail to reject Ho	
T.C = 3.1 | 5.2	1	17	0.0803	0.7803		Fail to reject Ho	
T.C = 3.1 | 5.2 | 5.4	2	26	0.2055	0.8156		Fail to reject Ho	
T.C = 3.2 | 4.4	1	16	3.7447	0.0709		Fail to reject Ho	
T.C = 3.2 | 4.4 | 5.4	2	25	1.849	0.1783		Fail to reject Ho	
T.C = 3.2 | 5.4	1	18	0.4875	0.494		Fail to reject Ho	

* The mean difference is significant at the .05 level

Table 4.20 Question 7 Mean and Standard Deviation for top five items.

C	Distance		
T	1	2	4
Mean			
1	0.5827	0.7679	0.8483
2	0.9044	0.7812	0.8353
3	0.7647	0.9745	0.719
4.		0.8336	0.6762
5.		0.82	0.8787
Std Deviation			
1	0.3675	0.4413	0.2992
2	0.3404	0.3556	0.3684
3	0.4598	0.2694	0.3397
4.		0.2008	0.3849
5.		0.3816	0.3404

Tables 4.13 to 4.20 show a similar effect to the Pearson coefficient results. That is, as we reduce the lists from all members, to those most likely to be prototypical members, the analysis is less able to find a difference (or a consistent difference) between distance means. Either there is no difference in the hypothesis, or the statistical variability (noise) is greater than the effects we

are trying to test.

Following are the results for question eight. It is interesting to note that in the Pearson coefficient test given earlier, question eight was different from seven in the saliency of each of the dimensions. There were negligible negative coefficients, and the strengths seem to diminish in a predictable pattern. The ANOVA results for question eight may help to interpret these findings.

Table 4.21 Question 8 merged with 10 Hypothesis tests on Distance

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis	Scheffe
All	12	684	1.5485	0.1022	1.75	Fail to reject Ho	
C = 1	2	157	0.7069	0.4947	3	Fail to reject Ho	
C = 2	4	269	0.9858	0.4157	2.37	Fail to reject Ho	
C = 4	4	258	0.435	0.7833	2.37	Fail to reject Ho	
C only	2	694	5.7644	* 0.0033	3	Ho is rejected	C1 vs C2C4
T <= 3	8	479	1.8969	0.0585	1.94	Fail to reject Ho	
T = 1	2	159	4.4649	* 0.013	3	Ho is rejected	1.1 vs 1.4
T = 1 | 2	5	319	2.5065	* 0.0303	2.21	Ho is rejected	
T = 1 | 3	5	319	2.3564	* 0.0403	2.21	Ho is rejected	
T = 2	2	160	1.2043	0.3026	3	Fail to reject Ho	
T = 2 | 3	5	320	1.1074	0.3563	2.21	Fail to reject Ho	
T = 3	2	160	1.3974	0.2502	3	Fail to reject Ho	
T = 4	1	106	0.0306	0.8614	3.94	Fail to reject Ho	
T = 5	1	99	0.2449	0.6218	3.94	Fail to reject Ho	
T only	4	692	0.9294	0.4462	2.37	Fail to reject Ho	
T.C = 3.1 | 4.2	1	113	0.8481	0.3591	3.93	Fail to reject Ho	
T.C = 3.1 | 4.2 | 4.4	2	164	0.5257	0.5921	3	Fail to reject Ho	
T.C = 3.1 | 4.2 | 5.2	2	163	1.7616	0.175	3	Fail to reject Ho	
T.C = 3.1 | 5.2	1	108	3.5539	0.0621	3.93	Fail to reject Ho	
T.C = 3.1 | 5.2 | 5.4	2	157	1.982	0.1412	3	Fail to reject Ho	
T.C = 3.2 | 4.4	1	104	0.0283	0.8667	3.94	Fail to reject Ho	
T.C = 3.2 | 4.4 | 5.4	2	153	0.3369	0.7145	3	Fail to reject Ho	
T.C = 3.2 | 5.4	1	102	0.5775	0.4491	3.94	Fail to reject Ho	

* The mean difference is significant at the .05 level

Table 4.22 Question 8 merged with 10 Distance Means and Standard Deviations

C	Distance		
T	1	2	4
Mean			
1	0.6904	0.5818	0.4407
2	0.5902	0.4654	0.4952
3	0.6026	0.5519	0.4606
4.		0.5241	0.5381
5.		0.4484	0.487
Std Deviation			
1	0.463	0.4379	0.389
2	0.4509	0.4077	0.4369
3	0.4771	0.4483	0.4002
4.		0.4351	0.3933
5.		0.3624	0.42

Table 4.23 Question 8 ANOVA reduced to top fifteen items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis	Scheffe
All	12	363	1.4846	0.1274		Fail to reject Ho	
C = 1	2	87	1.8617	0.1615		Fail to reject Ho	
C = 2	4	145	2.338	0.0581		Fail to reject Ho	
C = 4	4	131	0.3611	0.8359		Fail to reject Ho	
C only	2	373	1.5546	0.2126		Fail to reject Ho	
T <= 3	8	255	2.0001	* 0.0469		Ho is rejected	
T = 1	2	85	1.459	0.2382		Fail to reject Ho	
T = 1 | 2	5	174	1.814	0.1124		Fail to reject Ho	
T = 1 | 3	5	166	2.183	0.0584		Fail to reject Ho	
T = 2	2	89	1.4559	0.2387		Fail to reject Ho	
T = 2 | 3	5	170	2.0457	0.0747		Fail to reject Ho	
T = 3	2	81	3.5274	* 0.034		Ho is rejected	3.2 vs 3.4
T = 4	1	56	0.0864	0.7699		Fail to reject Ho	
T = 5	1	52	0.0419	0.8387		Fail to reject Ho	
T only	4	371	1.2468	0.2907		Fail to reject Ho	
T.C = 3.1 | 4.2	1	60	0.0853	0.7712		Fail to reject Ho	
T.C = 3.1 | 4.2 | 4.4	2	86	0.1707	0.8433		Fail to reject Ho	
T.C = 3.1 | 4.2 | 5.2	2	88	0.1343	0.8745		Fail to reject Ho	
T.C = 3.1 | 5.2	1	58	0.0505	0.823		Fail to reject Ho	
T.C = 3.1 | 5.2 | 5.4	2	82	0.0291	0.9714		Fail to reject Ho	
T.C = 3.2 | 4.4	1	53	1.2836	0.2623		Fail to reject Ho	
T.C = 3.2 | 4.4 | 5.4	2	77	1.4835	0.2332		Fail to reject Ho	
T.C = 3.2 | 5.4	1	51	2.7163	0.1055		Fail to reject Ho	

* The mean difference is significant at the .05 level

Table 4.24 Question 8 Mean and Standard Deviation for top Fifteen items.

C	Distance		
T	1	2	4
	Mean		
1	0.6075	0.5542	0.4315
2	0.5093	0.3575	0.4233
3	0.4174	0.5975	0.3567
4.		0.4446	0.4744
5.		0.399	0.4172
	Std Deviation		
1	0.4268	0.4146	0.3553
2	0.365	0.2723	0.4048
3	0.342	0.4237	0.2444
4.		0.3903	0.38
5.		0.288	0.3662

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Table 4.25 Question 8 ANOVA reduced to top ten items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis Scheffe
All	12	212	1.2441	0.2546		Fail to reject Ho
C = 1	2	52	0.2101	0.8112		Fail to reject Ho
C = 2	4	89	2.4039	0.0556		Fail to reject Ho
C = 4	4	71	0.2689	0.897		Fail to reject Ho
C only	2	222	1.8046	0.1669		Fail to reject Ho
T <= 3	8	151	1.0377	0.4104		Fail to reject Ho
T = 1	2	51	0.6832	0.5096		Fail to reject Ho
T = 1	2	5	105	1.2747	0.2804	Fail to reject Ho
T = 1	3	5	97	0.6835	0.637	Fail to reject Ho
T = 2	2	54	1.5015	0.2319		Fail to reject Ho
T = 2	3	5	100	1.1546	0.3369	Fail to reject Ho
T = 3	2	46	0.927	0.403		Fail to reject Ho
T = 4	1	30	0.1866	0.6689		Fail to reject Ho
T = 5	1	31	5e-05	0.9944		Fail to reject Ho
T only	4	220	2.0994	0.0819		Fail to reject Ho
T.C = 3.1	4.2	1	35	0.6974	0.4093	Fail to reject Ho
T.C = 3.1	4.2	4.4	2	48	0.3678	0.6942	Fail to reject Ho
T.C = 3.1	4.2	5.2	2	53	0.9393	0.3973	Fail to reject Ho
T.C = 3.1	5.2	1	36	1.8314	0.1844	Fail to reject Ho
T.C = 3.1	5.2	5.4	2	49	1.2675	0.2906	Fail to reject Ho
T.C = 3.2	4.4	1	29	1.1537	0.2916	Fail to reject Ho
T.C = 3.2	4.4	5.4	2	42	1.9548	0.1543	Fail to reject Ho
T.C = 3.2	5.4	1	29	3.5024	0.0714	Fail to reject Ho

* The mean difference is significant at the .05 level

Table 4.26 Question 8 Mean and Standard Deviation for top ten items.

C	Distance		
T	1	2	4
Mean			
1	0.5995	0.6402	0.4793
2	0.5715	0.3878	0.4255
3	0.5155	0.6248	0.4334
4.		0.4122	0.4663
5.		0.3586	0.3594
Std Deviation			
1	0.4588	0.4429	0.394
2	0.3447	0.3041	0.4023
3	0.3898	0.4584	0.2578
4.		0.3609	0.3382
5.		0.3217	0.2931

Table 4.27 Question 8 ANOVA reduced to top five items.

Test	Df	df	F	Sig.	F .05(D,d)	Null Hypothesis Scheffe
All	12	89	1.0767	0.3893		Fail to reject Ho
C = 1	2	23	0.1182	0.8891		Fail to reject Ho
C = 2	4	41	2.4749	0.0592		Fail to reject Ho
C = 4	4	25	0.3696	0.828		Fail to reject Ho
C only	2	99	0.9205	0.4017		Fail to reject Ho
T <= 3	8	65	0.8703	0.5461		Fail to reject Ho
T = 1	2	23	0.2606	0.7728		Fail to reject Ho
T = 1 | 2	5	47	1.0002	0.4281		Fail to reject Ho
T = 1 | 3	5	41	0.4332	0.8228		Fail to reject Ho
T = 2	2	24	1.8296	0.1822		Fail to reject Ho
T = 2 | 3	5	42	1.2306	0.3119		Fail to reject Ho
T = 3	2	18	0.7137	0.5032		Fail to reject Ho
T = 4	1	11	0.6973	0.4215		Fail to reject Ho
T = 5	1	13	0.0104	0.9203		Fail to reject Ho
T only	4	97	1.7509	0.1451		Fail to reject Ho
T.C = 3.1 | 4.2	1	15	0.0184	0.8938		Fail to reject Ho
T.C = 3.1 | 4.2 | 4.4	2	19	0.4272	0.6584		Fail to reject Ho
T.C = 3.1 | 4.2 | 5.2	2	24	1.7175	0.2009		Fail to reject Ho
T.C = 3.1 | 5.2	1	17	2.6414	0.1225		Fail to reject Ho
T.C = 3.1 | 5.2 | 5.4	2	21	1.7577	0.1969		Fail to reject Ho
T.C = 3.2 | 4.4	1	11	1.3526	0.2694		Fail to reject Ho
T.C = 3.2 | 4.4 | 5.4	2	15	1.7258	0.2116		Fail to reject Ho
T.C = 3.2 | 5.4	1	11	2.7006	0.1286		Fail to reject Ho

* The mean difference is significant at the .05 level

Table 4.28 Question 8 Mean and Standard Deviation for top five items.

C	Distance		
T	1	2	4
Mean			
1	0.5586	0.6976	0.5757
2	0.6503	0.3318	0.511
3	0.6414	0.767	0.3943
4.		0.6123	0.4283
5.		0.3164	0.2952
Std Deviation			
1	0.3833	0.4377	0.4842
2	0.3963	0.2328	0.5065
3	0.4812	0.5727	0.4175
4.		0.3907	0.3791
5.		0.3899	0.3513

Question eight is showing similar results to those for question seven. The statistical

significance (if any) tends to be reduced as the number of items for each dimensions are reduce.

That is to say, that as the more prototypical members of the lists are highlighted for selection, there

is less of a positive effect on the stated hypothesis. Again we are left to wonder if it is the noise

in the data which is actually controlling the results.

Plot of Distance Means

In trying to interpret the data, it is sometimes best to step back and look at the big picture. The next few figures graphically demonstrate the means and the standard deviations for each of the test groups used in the ANOVA results. The tables given earlier (4.14, 4.16, 4.18, and 4.20) are now plotted and present for explaining question seven. Similarly for question eight (4.22, 4.24, 4.26, and 4.28) are the plots of each of the test groups with means and standard deviations.
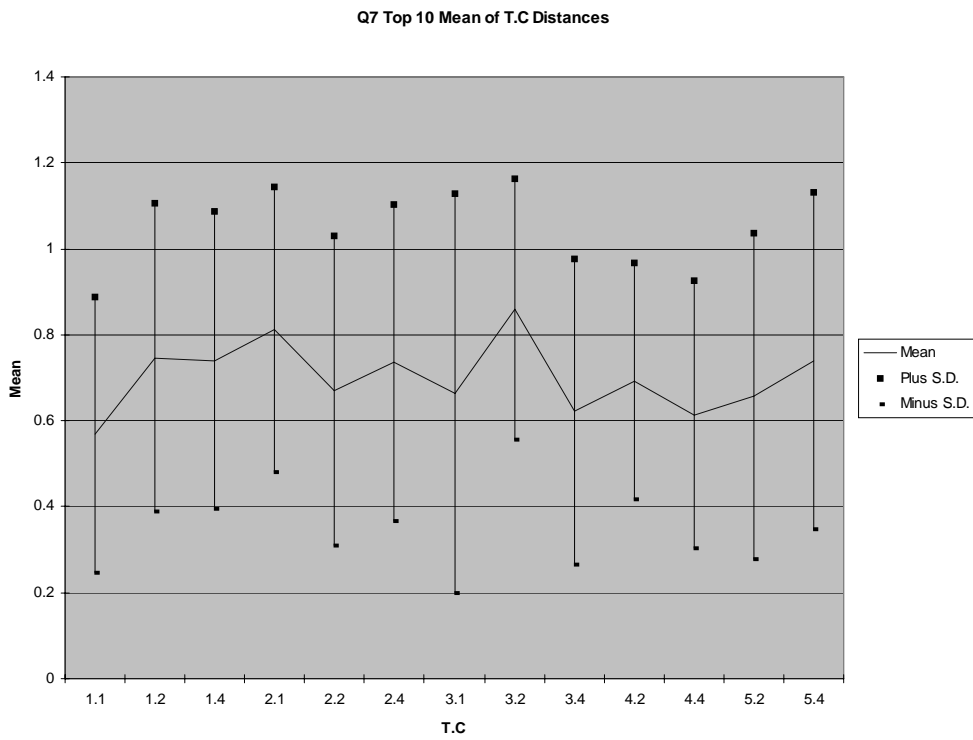
Figure 42

Mean of T.C with S.D. for Q7 Distances

Figure 43

Q7 Top 16 Mean of T.C Distances

Figure 44

Q7 Top 10 Mean of T.C Distances

Figure 45

Q7 Top 5 Mean of T.C Distances

Figure 46

Mean of T.C with S.D. for Q8 Distances

Figure 47

Q8 Top 15 Mean of T.C Distances

Figure 48

Q8 Top 10 Mean of T.C Distances

Figure 49

Q8 Top 5 Mean of T.C Distances
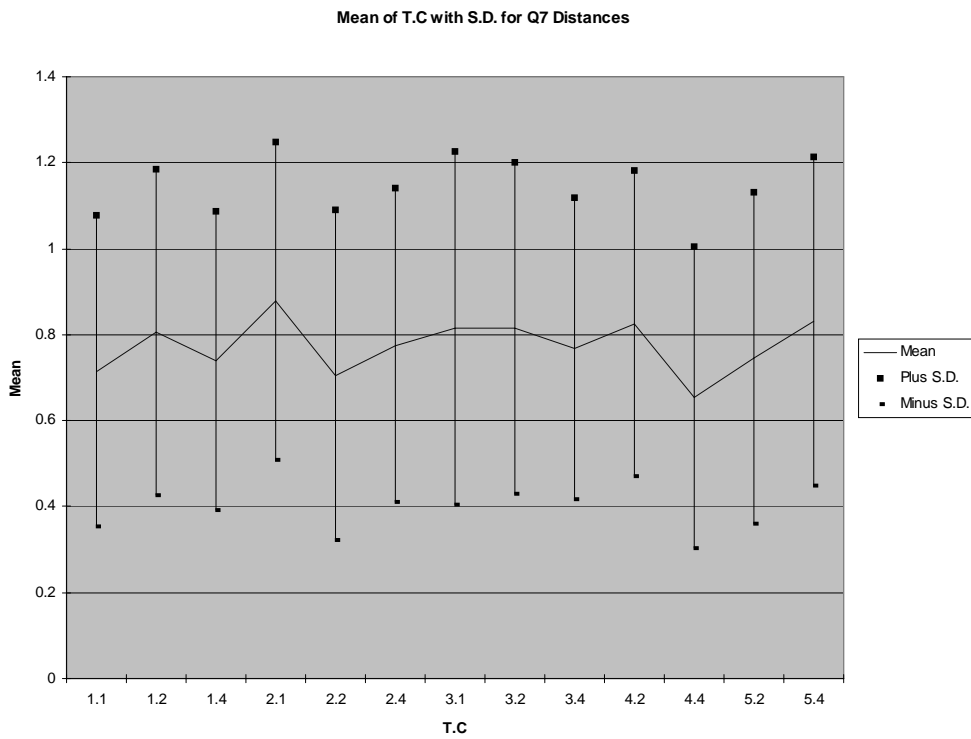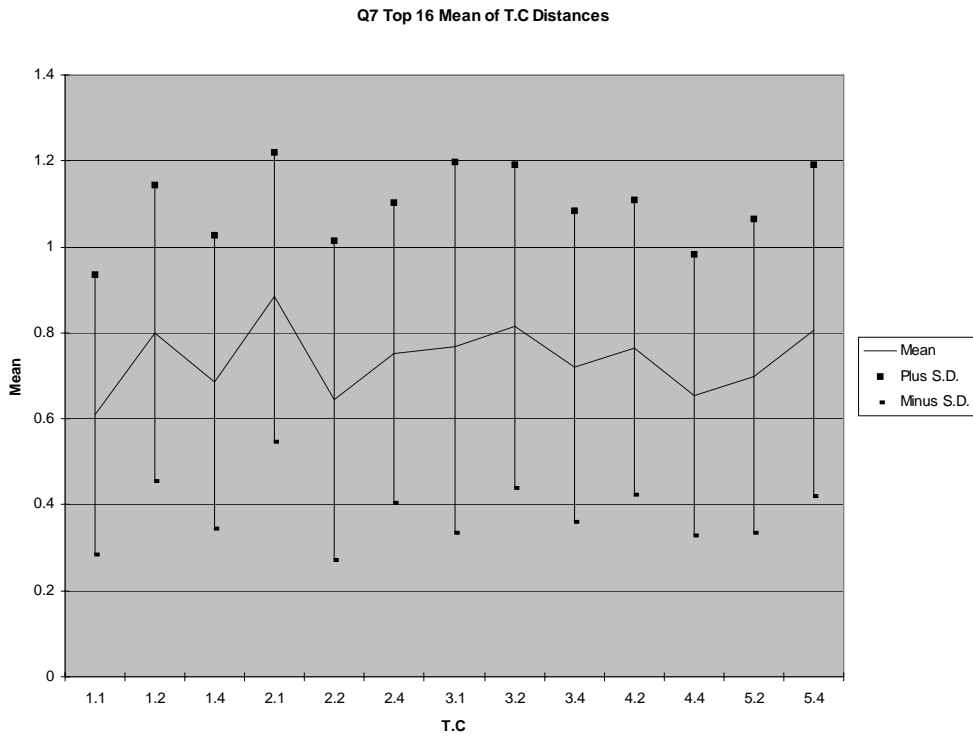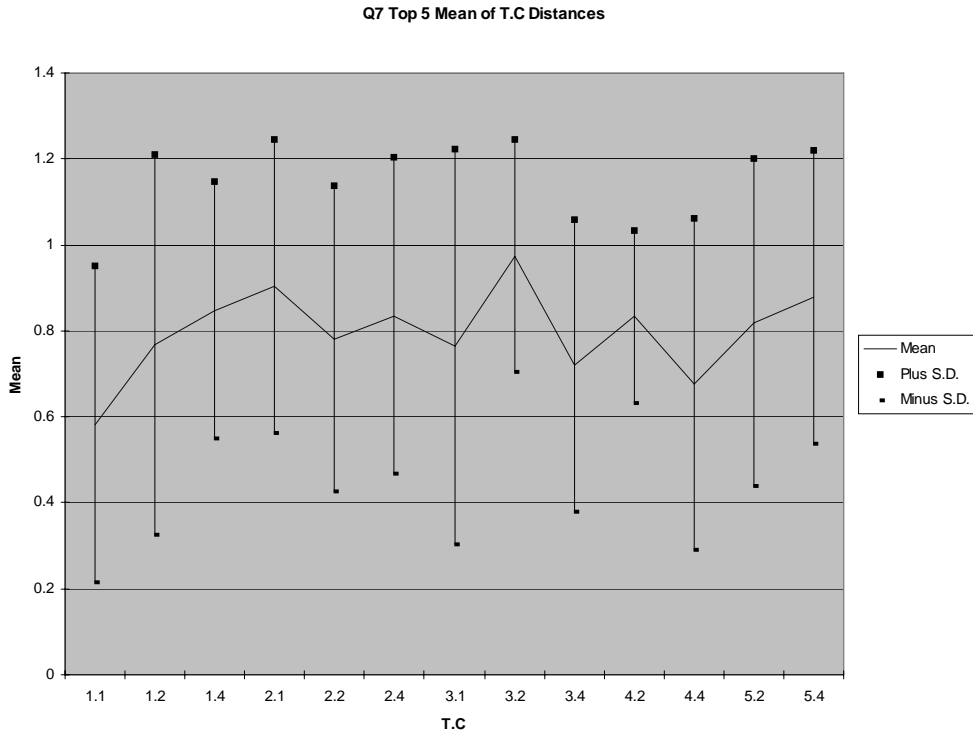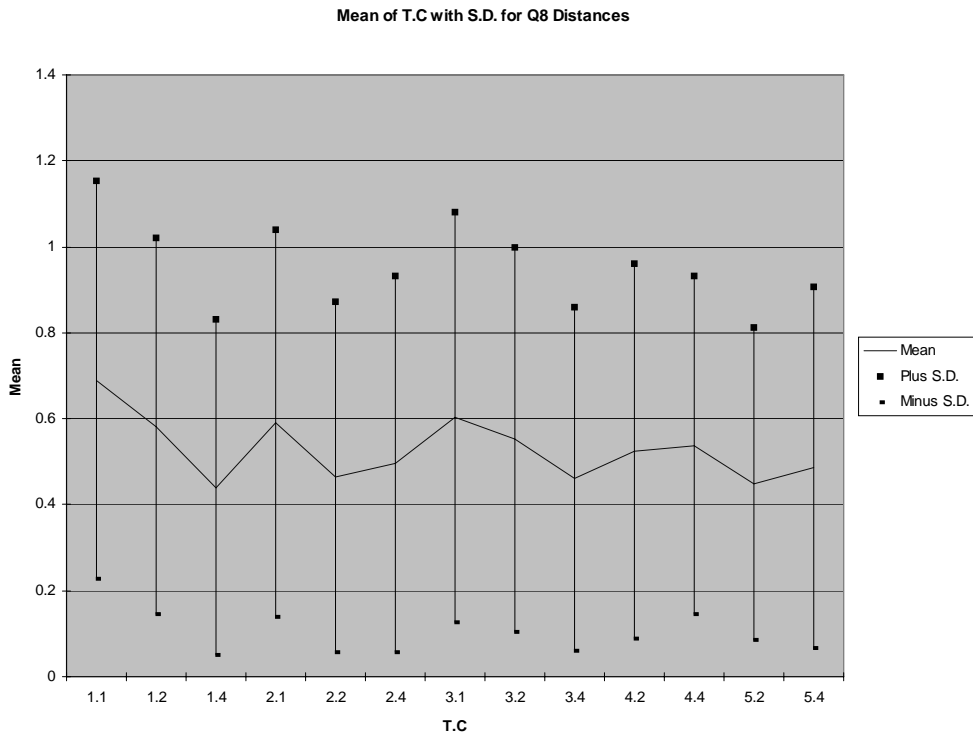
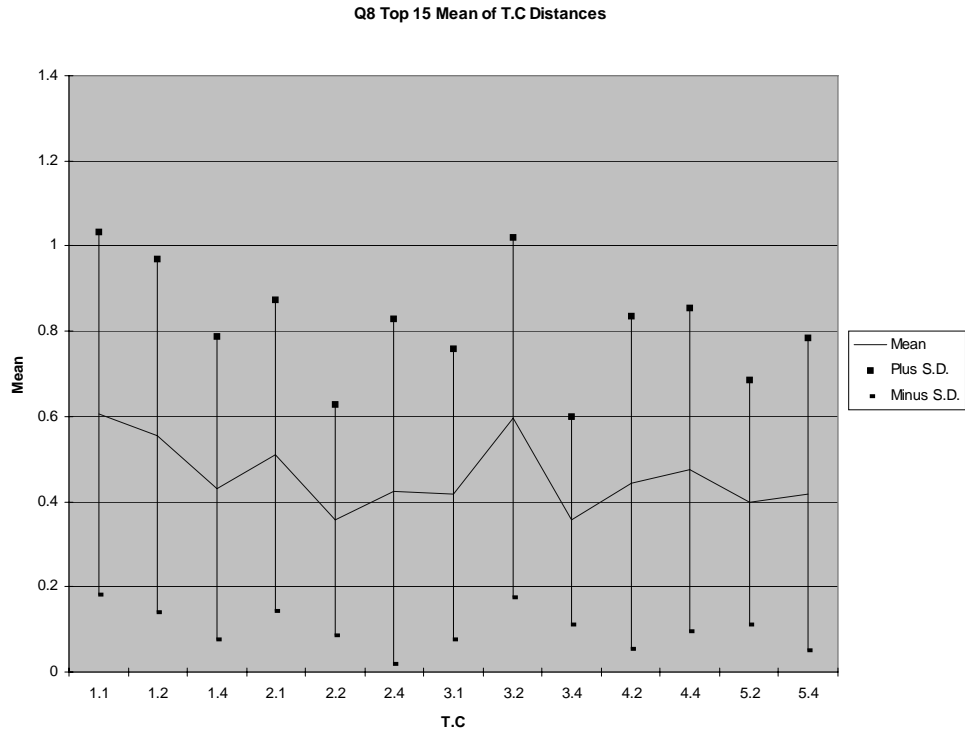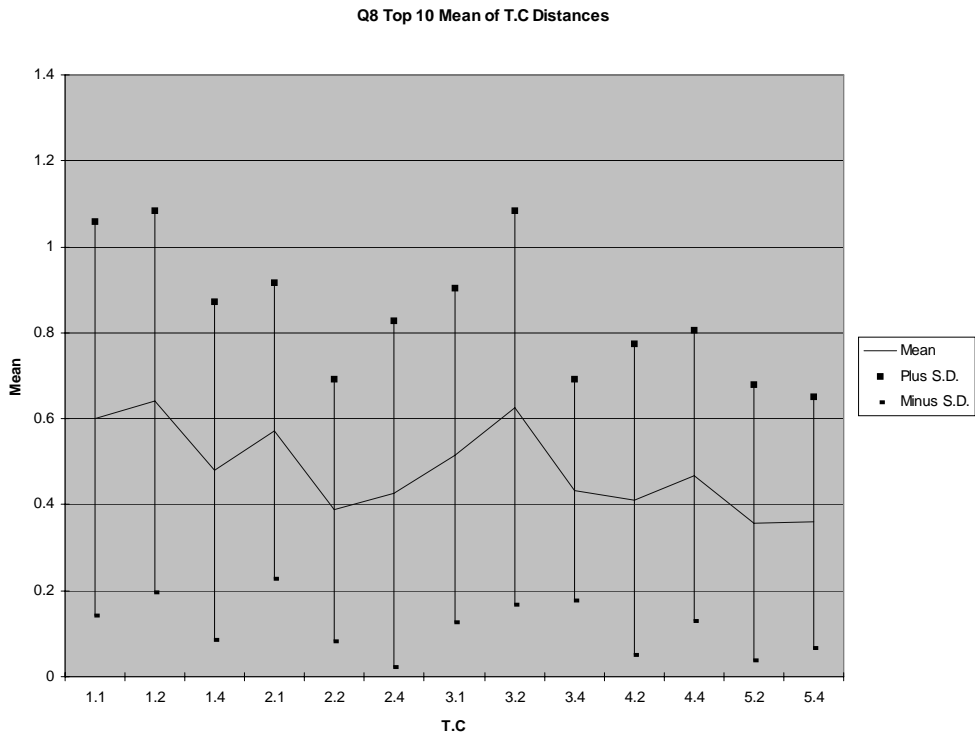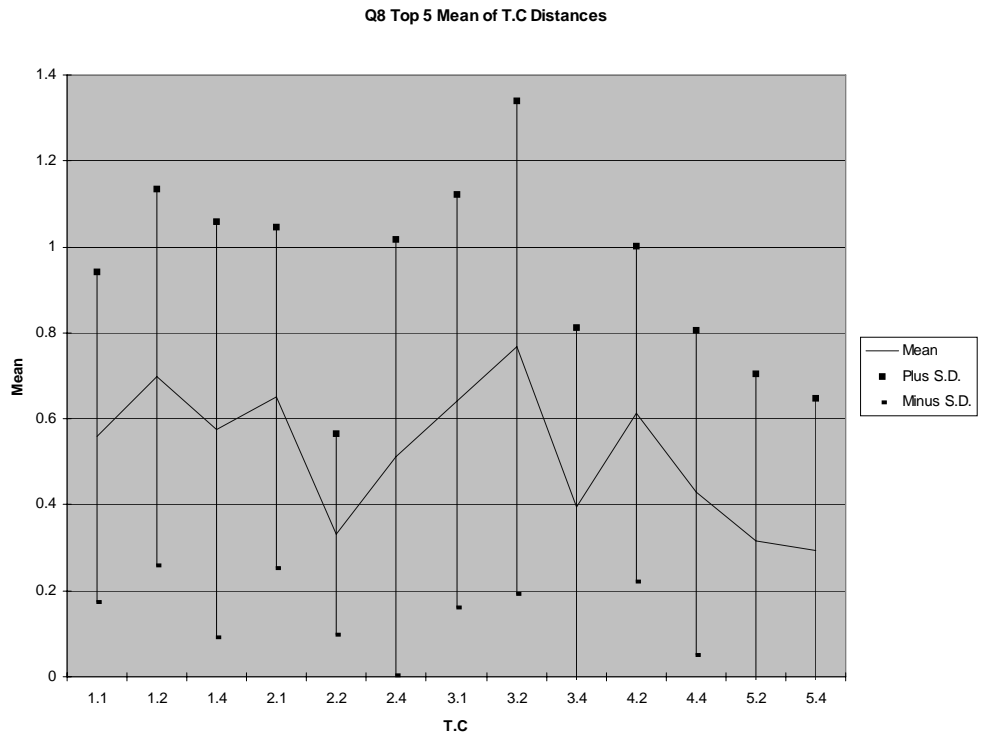## Summary of Results

The visual comparison scatter plot graphs indicate that something is going on. This may be random, but the plots tend to indicate a central dispersion when two prompts are shown to the participants.

Pearson correlations of question seven are typically negative in sign. The strength of correlation is reduced as we go from complete lists to reduced sets of most prototypical items. Reducing category list items to those most prototypical also reduces the Pearson coefficient.

Pearson correlations for question eight are completely different and do not replicate the findings from question seven. Question eight has correlation coefficients that are typically positive in sign. The category Comfortable is very salient with the participants. Reduction of category lists to most prototypical items does show the same results as question seven, the correlation

coefficients are reduced.

Overall, question seven has a random pattern with respect to strength of correlation and reducing list to most prototypical members. There did not seem to be any consistency. Question eight diminishes in an expected pattern, like water evaporating.

The sign tests for the hypothesis that an increase in prompts produced an increase in matching are not supported. Also, the same finding is for the hypothesis that sampling procedure and increasing prompts will increase matching.

ANOVA results are not strongly supporting the hypotheses of this study. Question seven and eight both show a tendency for the strength of significance to be reduced as the lists are reduced to most prototypical members. Any statistically significant tests are not validated as list sizes are reduced, those test that are flagged as significant seem random when taken into consideration with the other reduced ANOVA tests. Again, there did not seem to be any consistency.

There is evidence of a high degree of overlap among categories. The graphs shown previously indicated that something is going on. Statistically, there has not been strong significance to support our hypotheses, which is corroborated by the amount of overlap with respect to the standard deviation. The proximity of the categories to one another is interfering with selection. If the categories were place farther apart, like birds, furniture, and automobiles, instead of small, fast, and birds, we would have clearly supported the hypotheses. Classification of super-ordinates maximizes accuracy of classification. We deliberately chose a difficult test. Fine distinctions between basic level and subordinate categories by matching category members requires maximizing predictive accuracy of classification, which is information.

Prototypicality of categories, with respect to the dimensions or aspects, for a given item comes

with information. That information is the saliency of the category. We did not control for this, nor

did we measure the saliency.

CHAPTER 5

General Discussion

It can be observed that the correlations for each of the dimensions are the strongest when all category items are included for analysis. This indicates that in most cases, whatever variables affect one of these dependent variables, will affect all of them.

The Furniture category does not seem to display the problems which the Bird category is indicating. Furniture is much more salient than the Bird category. This may be indicative of the "Natural" versus "Nominal" kind categories. The relationships pertaining to the Bird category are typically negative. This has been unexpected, and addresses the control of the experiment.

Participants are not discriminating the samples or prompts which were given. The variation is about the same, with a fair bit of overlap, for each of the categories tested. The relationship between concepts and what we were asking is not the same. Each item has a prototypical set of features which has not been addressed in this study.

IMPLICATIONS AND CONCLUSIONS

Implications, Limitations, and Future Research

This study examined factors that affect the matching of category items through the underlying factors of degree of correspondence to typicality distribution and conditions. The findings do not support the hypotheses presented earlier in the study. The results indicate that something else is influencing the study. The overall pattern did not change or lead to significant findings.

In reviewing the literature, it is common to find a graded structure in going from a category to an item. In this thesis we were looking at going from an item up to a category. That is to say,

given an item, what category is the item a part of? Does the fact of prototypicality in the category have an effect on determining, or putting together (rebuilding) the category?

One way of looking at this would be the amount of information given about the category. Thus, in our tests within this study, we tried to give more information by increasing the number of prompts. The literature review also showed how Rosch had identified the distribution and typicality of items within categories. This thesis tried to show that the more prototypical items convey more information about the category. As Rosch had used distorted shapes to display the same influences in natural categories as colour categories, so we too, tried to use distorted sampling techniques. Rosch found that central members of focal colours or form categories were easier to learn than non central members, or unnaturally structured sets.

This study is indicating that the categories used have dimensions which are much more the same, or similar, than they are different. If the items could not be differentiated on the dimensions we were testing, it would explain the reason why we found few significant differences between different sampling procedures. Classification at the general (superordinate) level maximizes accuracy of classification. With any item, the participants are picking up the most prototypical thing, that it is a bird, or that it is furniture. Everyone has in their head, prototypical features about a thing, thus the general category is bird or furniture.

Similar to most studies, this research has limitations. One limitation in this study may stem from the participants' perception. Human perception is not without faults. Sometimes perceptual distortions can occur. Some common types of distortion: stereotyping, the halo effect, projection, and the self-fulfilling prophecy. These are short cuts to processing information. People do not collect enough information to describe things accurately. This would have an effect on the results

of the experiment. Not only would the category samples shape the outcome, but also how it is presented can have ramifications for the results.

"The media is the message" was a phrase first used by Marshall McLuhan in his 1964 book Understanding Media: the Extensions of Man. The available media shape human activity, more so than what media is about. Communication from differing languages, and even through information technology, may not ". . . be considered exact translation equals, even though the referential range of two words would appear to coincide," (Taylor, 1995).

Another limitation, dealing with external validity, is the fact that the survey was conducted within one organization. However, the study dealt with two different sets of participants and similar demographics were found; thus, there is some evidence that the conclusions may be generalized. A further limitation is that the study only used participants taking the MSci 311 course offered at the University of Waterloo which may affect the generalizations to other undergraduate students.

Earlier we had mentioned the informativeness and distinctiveness play a part in differentiation. Items in subordinate categories are slightly more informative and thus more specific, which ultimately makes them less distinctive. Only when the more informative subordinate information is relevant will people use this information for categorization, otherwise similar items are included in the same concept. As an example, many of us driving in the country will find cows in the fields. We may say it is a brown cow, or black and white cow, but a farmer may say the cow is a Holstein or Jersey milking breed. The extra information which the farmer has, may help him in determining if the neighbour has the right equipment which can help in his production of beef cattle.
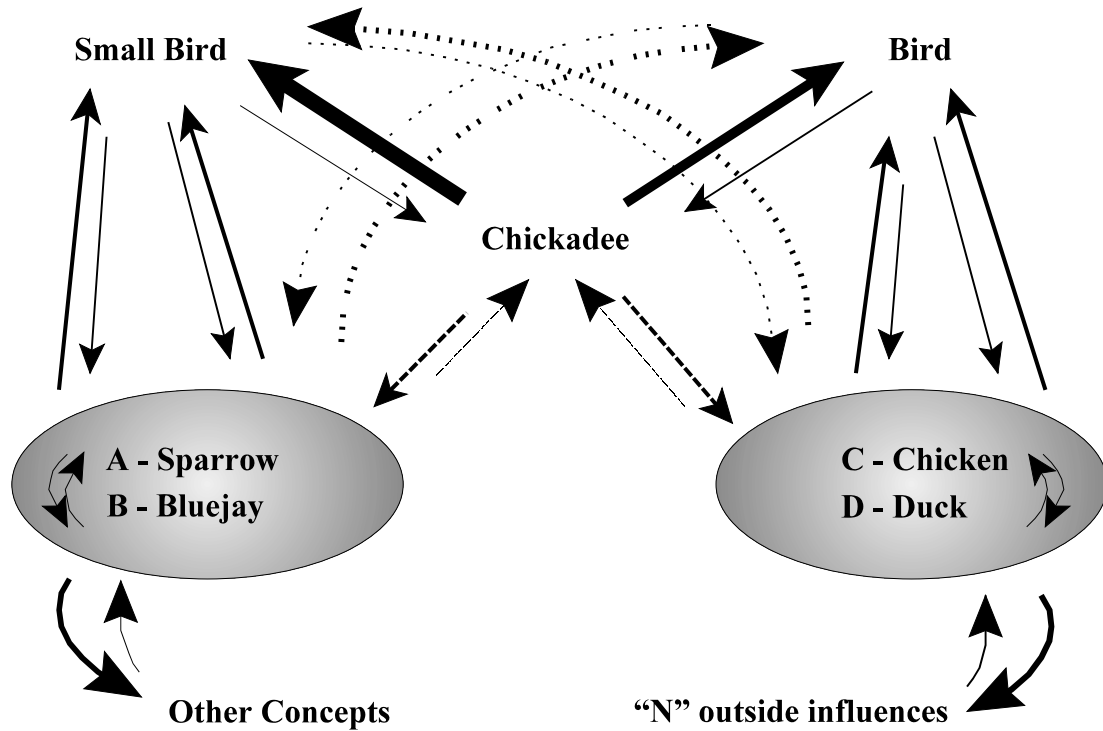
Thus, the relative saliency of a category depends on what the person knows about it. The

furniture category tended to have positive correlation coefficients. The bird category was not nearly as salient with the participants. In this study we had not controlled for participants' background knowledge in the bird and furniture domain. This could be considered for future studies, by varying the features of items themselves.

Items are connected to a category, and the item has a probability that it is in a category. Rosch had shown this probability of an item, given a category. This thesis tried to extend the graded category structure to the probability of the category to an item. With only prompt conditions and probability distributions of items, we did not find anything conclusive in this study. Future work may find that a function of knowledge or context is important in identifying information.

Another way to look at this study is what is the influences that a user has for putting something in a category. When dealing with category labels, users will tend to put probabilities to the labels for each item. If instead of category labels we use samples of a category, or exemplars, the user is only picking up the similarity of the item to those exemplars presented. This can lead to an asymmetry in pull. The label "Small Bird" really pulls chickadee, but not the other way around, i.e., chickadee really pulls the label "Small Bird." What forces are pulling chickadees to the exemplars? Realistic substitutability of labels to exemplars is not so equal on influences of user choice. Future research may find that category labels has less misinterpretation than exemplars on the original classifications of things.

Figure 50 Influences of user choice.

Small Bird

Bird

Chickadee

A - Sparrow
B - Bluejay

C - Chicken
D - Duck

Other Concepts

"N" outside influences

Conclusions

The four hypotheses in the model developed in this research were not supported by the findings. The results indicate that the two independent variables (degree of correspondence to typicality distribution and sampling condition) do not influence the dependent variable (matching). The similarity between categories in this study is much stronger than the differences.

The results are nonetheless important and can be used to build a better model. Most research in this area has focused on the category views and supporting research. Meanwhile, little research has been conducted on investigating the saliency of a category or attribute that can vary by context or knowledge. This study is a contribution because of the lack of research in this area. Not only is this research valuable because it investigates gradient prototypicality further, but because it also

reveals some of the many areas for future research.

The prototypical items were the first and most frequently produced items when subjects are asked to list the members of a category. Prototypes are members of a category that most reflect the redundancy structure of a category. To use an analogy from physics, light reflected through a prism will be split into the various wavelengths of light that make it up. In a sense, we have been trying in this study to reconstitute the original light, or category, by using selected category members.

This may not be what we are really after. To see something as a category from the prototypical members, may not be about just combining them together. To see clearly, one must bring an object, and it's light, into focus. Instead of a prism, the material is shaped into a lense for enhanced vision. The context of the material has changed. Using context to shape prototypical items may bring into focus the ability of prototypical members to reproduce a category.

The way we communicate with words and our choice of prototypical category members to represent our thoughts, only touches the surface. The information which may be embedded within items is an untapped resource with respect to the transfer of information.

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Table 1. Reproduction of Furniture Goodness of Example ratings (Taylor, 1995).

Table 3.1 pg 44 Rosch's Goodness of Example ratings for 60 category members			Table 3.2 pg 57 German reproduction of ratings for 55 category members		
Member	Rank	Specific score	Member	Rank	Specific score
chair	1.5	1.04	bed	1.5	1.00
sofa	1.5	1.04	table	1.5	1.00
couch	3.5	1.1	sofa	3.0	1.13
table	3.5	1.1	cupboard	5.0	1.20
easy chair	5	1.33	desk	5.0	1.20
dresser	6.5	1.37	closet	5.0	1.20
rocking chair	6.5	1.37	chair	5.0	1.20
coffee table	8	1.38	love seat	8.0	1.40
rocker	9	1.42	chest of drawers	9.0	1.43
love seat	10	1.44	bookcase	10.0	1.47
chest of drawers	11	1.48	night table	11.0	1.53
desk	12	1.54	coffee table	12.5	1.67
bed	13	1.58	couch	12.5	1.67
bureau	14	1.59	china closet	14.0	1.70
davenport	15.5	1.61	cabinet	16.0	1.73
end table	15.5	1.61	divan	16.0	1.73
divan	17	1.7	bureau	16.0	1.73
night table	18	1.83	buffet	18.0	1.80
chest	19	1.98	davenport	19.0	1.93
cedar chest	20	2.11	shelf	20.5	2.00
vanity	21	2.13	rocking chair	20.5	2.00
bookcase	22	2.15	bench	22.0	2.10
lounge	23	2.17	lounge	23.0	2.27
chaise longue	24	2.26	stool	23.0	2.27
ottoman	25	2.43	vanity	23.0	2.27
footstool	26	2.45	ottoman	26.0	2.43
cabinet	27	2.49	end table	27.0	2.80
china closet	28	2.59	magazine rack	28.0	3.40
bench	29	2.77	bar	29.0	3.70
buffet	30	2.89	counter	30.0	3.73
lamp	31	2.94	mirror	31.0	4.20
stool	32	3.13	drawers	32.0	4.38
hassock	33	3.43	dresser	33.0	4.47
drawers	34	3.63	lamp	34.0	4.79
piano	35	3.64	piano	35.0	5.07
cushion	36	3.7	clock	36.0	5.20
magazine rack	37	4.14	stove	37.0	5.33
hi-fi	38	4.25	wastebasket	38.0	5.42

cupboard	39	4.27	refrigerator	39.0	5.73
stereo	40	4.32	rug	40.0	5.80
mirror	41	4.39	picture	41.0	5.93
television	42	4.41	hassock	42.5	6.00
bar	43	4.46	drapes	42.5	6.00
shelf	44	4.52	TV	45.0	6.07
rug	45	5	rocker	45.0	6.07
pillow	46	5.03	footstool	45.0	6.07
wastebasket	47	5.34	hi-fi	47.0	6.33
radio	48	5.37	vase	48.0	6.40
sewing machine	49	5.39	radio	49.5	6.47
stove	50	5.4	sewing machine	49.5	6.47
counter	51	5.44	fan	51.0	6.54
clock	52	5.48	stereo	52.0	6.64
drapes	53	5.67	pillow	54.0	6.80
refigerator	54	5.7	telephone	54.0	6.80
picture	55	5.75	ashtray	54.0	6.80
closet	56	5.95			
vase	57	6.23			
ashtray	58	6.35			
fan	59	6.49			
telephone	60	6.68			

Table 2. Reproduction of Example of Taxonomies Used in Basic Object Research.

Superordinate	Basic Level	Subordinate
Furniture	Chair	Kitchen chair
		Living-room chair
	Table	Kitchen table
		Dining-room table
	Lamp	Floor lamp
		Desk Lamp
Tree	Oak	White oak
		Red oak
	Maple	Silver maple
		Sugar maple
	Birch	River birch
		White birch

Table 3. Undergraduate Student Registration Head Counts by Faculty/Group (Institutional Analysis & Planning, 2006).

Head Count		AHS	ARTS	ENG	ENV S	ID S	MATH	SCI	SE	FACULTY
Male										
Jan-05	**Full Time**	90	431	560	105		630	267	76	2159
	Part Time		127	1	11		42	28		209
	Attendance	90	558	561	116		672	295	76	2368
Female										
Jan-05	**Full Time**	196	925	217	127		256	335	13	2069
	Part Time	2	305	2	16	2	12	44		383
	Attendance	198	1230	219	143	2	268	379	13	2452
Total										
Jan-05	**Full Time**	286	1356	777	232		886	602	89	4228
	Part Time	2	432	3	27	2	54	72		592
	Attendance	288	1788	780	259	2	940	674	89	4820
Male										
Sep-05	**Full Time**	134	437	313	130		564	358	73	2009
	Part Time		119	3	9		34	23		188
	Attendance	134	556	316	139	0	598	381	73	2197
Female										
Sep-05	**Full Time**	241	927	118	157	2	253	504	13	2215
	Part Time	2	294		16		10	36		358
	Attendance	243	1221	118	173	2	263	540	13	2573
Total										
Sep-05	**Full Time**	375	1364	431	287	2	817	862	86	4224
	Part Time	2	413	3	25		44	59		546
	Attendance	377	1777	434	312	2	861	921	86	4770

Table 4. Fall 2004 study with differing types of categories and subordinate categories

Group	Task	Category	Recode Task
1	1	Furniture	1
1	2	Bird	2
1	3	Small Bird	3
1	4	Fast Furniture	4
2	1	Furniture	1
2	2	Bird	2
2	3	Small Furniture	**5**
2	4	Comfortable Bird	**6**
3	1	Furniture	1
3	2	Bird	2
3	3	Difficult Bird	**7**
3	4	Comfortable Furniture	**8**
4	1	Furniture	1
4	2	Bird	2
4	3	Difficult Furniture	**9**
4	4	Fast Bird	**10**
5	1	Furniture	1
5	2	Bird	2
5	3	Furniture Bird	**11**
5	4	Bird Furniture	**12**

Table 5. Sample answers of students from the Fall 2004 survey.

Group	User	Task	Line	Item	Comment
1	1	1	1	Chair	Furniture is the things we use in buildings to make life neater, easier, and more comfortable
1	1	1	2	Desk	
1	1	1	3	Table	
1	1	1	4	counter	
1	1	1	5	couch	
1	1	1	6	bed	
1	1	1	7	nightstand	
1	1	1	8	dresser drawers	
1	1	2	1	Blue Jay	anything with wings and feathers that nests and lay eggs
1	1	2	2	robin	
1	1	2	3	cardinal	
1	1	2	4	duck	
1	1	2	5	swan	
1	1	2	6	dove	
1	1	2	7	goose	
1	1	2	8	ostridge	
1	1	2	9	pelican	
1	1	2	10	chicken	
1	1	2	11	turkey	
1	1	3	1	dove	any bird that has a wing span of less than a foot
1	1	3	2	blue jay	
1	1	3	3	cardinal	
1	1	3	4	pigeon	
1	1	3	5	chicken	
1	1	3	6	duck	
1	1	4	1	tv table	any portable furniture that can be used quickly, broken down and stored easy
1	1	4	2	lawn chair	

Sample SPSS 14.0 for Windows recode script for the Fall 2004 survey data.

```
RECODE DATA ("bed (mattress)"="bed") INTO Data.
RECODE DATA ("bed cover"="cover") INTO Data.
RECODE DATA ("bed frame"="bed") INTO Data.
RECODE DATA ("bed head"="bed") INTO Data.
RECODE DATA ("bed lamp"="lamp") INTO Data.
RECODE DATA ("bed matress"="mattress") INTO Data.
RECODE DATA ("bed post"="bed") INTO Data.
RECODE DATA ("bed sheets"="bed sheet") INTO Data.
RECODE DATA ("bed side table"="bedside table") INTO Data.
RECODE DATA ("bed spread"="bed cover") INTO Data.
RECODE DATA ("bed table"="bedside table") INTO Data.
RECODE DATA ("Bed"="bed") INTO Data.
RECODE DATA ("bedframe"="bed") INTO Data.
RECODE DATA ("BedFrame"="bed") INTO Data.
RECODE DATA ("bedroombureau/vanity"="vanity") INTO Data.
RECODE DATA ("beds"="bed") INTO Data.
RECODE DATA ("Beds"="bed") INTO Data.
RECODE DATA ("blue jay"="bluejay") INTO Data.
RECODE DATA ("blue Jay"="bluejay") INTO Data.
RECODE DATA ("Blue Jay"="bluejay") INTO Data.
RECODE DATA ("Blue Jays"="bluejay") INTO Data.
RECODE DATA ("blue jays"="bluejay") INTO Data.
RECODE DATA ("Blue Parrot"="parrot") INTO Data.
RECODE DATA ("bluebirds"="bluebird") INTO Data.
RECODE DATA ("Bluejay"="bluejay") INTO Data.
RECODE DATA ("BlueJay"="bluejay") INTO Data.
RECODE DATA ("blue-jay"="bluejay") INTO Data.
RECODE DATA ("bluejays"="bluejay") INTO Data.
RECODE DATA ("Cardinal"="cardinal") INTO Data.
RECODE DATA ("cardinals"="cardinal") INTO Data.
RECODE DATA ("Cardinals"="cardinal") INTO Data.
RECODE DATA ("cardnial"="cardinal") INTO Data.
RECODE DATA ("chair (the type at the living room table)"="chair") INTO Data.
RECODE DATA ("chair with wheels"="chair") INTO Data.
RECODE DATA ("Chair"="chair") INTO Data.
RECODE DATA ("chairs for dinning table"="chair") INTO Data.
RECODE DATA ("chairs"="chair") INTO Data.
RECODE DATA ("Chairs"="chair") INTO Data.
RECODE DATA ("chichkens"="chicken") INTO Data.
RECODE DATA ("Chicken"="chicken") INTO Data.
```

RECODE DATA ("chickens"="chicken") INTO Data.
RECODE DATA ("Couch"="couch") INTO Data.
RECODE DATA ("couch(can b. usd. as bed"="couch") INTO Data.
RECODE DATA ("couch/sofa"="couch") INTO Data.
RECODE DATA ("couches"="couch") INTO Data.
RECODE DATA ("Couches"="couch") INTO Data.
RECODE DATA ("counter top"="counter") INTO Data.
RECODE DATA ("counter tops"="counter") INTO Data.
RECODE DATA ("Counter"="counter") INTO Data.
RECODE DATA ("counters (kitchen)"="counter") INTO Data.
RECODE DATA ("counters"="counter") INTO Data.
RECODE DATA ("countertop"="counter") INTO Data.
RECODE DATA ("countertops"="counter") INTO Data.
RECODE DATA ("country"="counter") INTO Data.
RECODE DATA ("desk (office)"="desk") INTO Data.
RECODE DATA ("desk (working desk)"="desk") INTO Data.
RECODE DATA ("desk chair"="chair") INTO Data.
RECODE DATA ("Desk Chair"="chair") INTO Data.
RECODE DATA ("desk clock"="clock") INTO Data.
RECODE DATA ("desk lamp"="lamp") INTO Data.
RECODE DATA ("desk light"="lamp") INTO Data.
RECODE DATA ("Desk"="desk") INTO Data.
RECODE DATA ("Dove"="dove") INTO Data.
RECODE DATA ("doves"="dove") INTO Data.
RECODE DATA ("dresser - chest of drawers"="dresser") INTO Data.
RECODE DATA ("dresser / chest of drawers"="dresser") INTO Data.
RECODE DATA ("dresser drawer"="dresser") INTO Data.
RECODE DATA ("dresser drawers"="dresser") INTO Data.
RECODE DATA ("Dresser"="dresser") INTO Data.
RECODE DATA ("dressing table"="dresser") INTO Data.
RECODE DATA ("dressingtable"="dresser") INTO Data.
RECODE DATA ("dressor"="dresser") INTO Data.
RECODE DATA ("Duck"="duck") INTO Data.
RECODE DATA ("ducks"="duck") INTO Data.
RECODE DATA ("Goose"="goose") INTO Data.
RECODE DATA ("lawn chair"="lawn-chair") INTO Data.
RECODE DATA ("lawn chairs"="lawn-chair") INTO Data.
RECODE DATA ("night - table"="night-table") INTO Data.
RECODE DATA ("night light lartern"="night light") INTO Data.
RECODE DATA ("night stand"="night-table") INTO Data.
RECODE DATA ("night stands"="night-table") INTO Data.
RECODE DATA ("night table"="night-table") INTO Data.
RECODE DATA ("Night Table"="night-table") INTO Data.
RECODE DATA ("nightengale"="nightingale") INTO Data.

RECODE DATA ("nightside table"="night-table") INTO Data.
RECODE DATA ("nightstand"="night-table") INTO Data.
RECODE DATA ("Nightstand"="night-table") INTO Data.
RECODE DATA ("NightStand"="night-table") INTO Data.
RECODE DATA ("night-stand"="night-table") INTO Data.
RECODE DATA ("nighttable"="night-table") INTO Data.
RECODE DATA ("osterich"="ostrich") INTO Data.
RECODE DATA ("Osterich"="ostrich") INTO Data.
RECODE DATA ("ostrich - not sure"="ostrich") INTO Data.
RECODE DATA ("Ostrich"="ostrich") INTO Data.
RECODE DATA ("ostriche"="ostrich") INTO Data.
RECODE DATA ("ostriches"="ostrich") INTO Data.
RECODE DATA ("ostrichric"="ostrich") INTO Data.
RECODE DATA ("ostrick"="ostrich") INTO Data.
RECODE DATA ("ostridge"="ostrich") INTO Data.
RECODE DATA ("Ostridge"="ostrich") INTO Data.
RECODE DATA ("ostrige"="ostrich") INTO Data.
RECODE DATA ("ostritch"="ostrich") INTO Data.
RECODE DATA ("pelcan"="pelican") INTO Data.
RECODE DATA ("Pelican"="pelican") INTO Data.
RECODE DATA ("pelicans"="pelican") INTO Data.
RECODE DATA ("Pelicans"="pelican") INTO Data.
RECODE DATA ("pelicun"="pelican") INTO Data.
RECODE DATA ("peligan"="pelican") INTO Data.
RECODE DATA ("pellican"="pelican") INTO Data.
RECODE DATA ("Pidgeon"="pigeon") INTO Data.
RECODE DATA ("pidgeon"="pigeon") INTO Data.
RECODE DATA ("pidgin"="pigeon") INTO Data.
RECODE DATA ("robbin"="robin") INTO Data.
RECODE DATA ("Robbin"="robin") INTO Data.
RECODE DATA ("robin red breast"="robin") INTO Data.
RECODE DATA ("Robin"="robin") INTO Data.
RECODE DATA ("robins"="robin") INTO Data.
RECODE DATA ("Robins"="robin") INTO Data.
RECODE DATA ("robyn"="robin") INTO Data.
RECODE DATA ("Swan"="swan") INTO Data.
RECODE DATA ("swans"="swan") INTO Data.
RECODE DATA ("table (dining)"="dining-room table") INTO Data.
RECODE DATA ("table (dinner)"="dining-room table") INTO Data.
RECODE DATA ("table center piece"="decoration") INTO Data.
RECODE DATA ("table lamp"="lamp") INTO Data.
RECODE DATA ("table lamps"="lamp") INTO Data.
RECODE DATA ("table lanp"="lamp") INTO Data.
RECODE DATA ("table light"="light") INTO Data.

RECODE DATA ("table tennis table"="ping-pong table") INTO Data.
RECODE DATA ("Table"="table") INTO Data.
RECODE DATA ("tablelight"="light") INTO Data.
RECODE DATA ("tables (dining etc)"="table") INTO Data.
RECODE DATA ("Tables"="table") INTO Data.
RECODE DATA ("tables"="table") INTO Data.
RECODE DATA ("Turkey"="turkey") INTO Data.
RECODE DATA ("turkeys"="turkey") INTO Data.
RECODE DATA ("Turkeys"="turkey") INTO Data.
RECODE DATA ("TV bench"="tv-stand") INTO Data.
RECODE DATA ("TV cabinet / stand"="tv-stand") INTO Data.
RECODE DATA ("tv chest"="tv-stand") INTO Data.
RECODE DATA ("TV holder"="tv-stand") INTO Data.
RECODE DATA ("tv rack"="tv-stand") INTO Data.
RECODE DATA ("tv set"="television") INTO Data.
RECODE DATA ("TV set"="television") INTO Data.
RECODE DATA ("tv shelf"="tv-stand") INTO Data.
RECODE DATA ("TV shelf"="tv-stand") INTO Data.
RECODE DATA ("tv shelves"="tv-stand") INTO Data.
RECODE DATA ("tv stand"="tv-stand") INTO Data.
RECODE DATA ("TV stand"="tv-stand") INTO Data.
RECODE DATA ("TV Stand"="tv-stand") INTO Data.
RECODE DATA ("TV stand/cabinet"="tv-stand") INTO Data.
RECODE DATA ("tv table"="tv-stand") INTO Data.
RECODE DATA ("tv tray"="tv dinner tray") INTO Data.
RECODE DATA ("tv unit"="television") INTO Data.
RECODE DATA ("tv"="television") INTO Data.
RECODE DATA ("Tv"="television") INTO Data.
RECODE DATA ("TV"="television") INTO Data.
RECODE DATA ("tvstand"="tv-stand") INTO Data.
RECODE DATA ("TVstand"="tv-stand") INTO Data.
RECODE DATA ("tvtray"="tv-stand") INTO Data.

APPENDIX B: SAMPLE PARTICIPANT FILE

test1;1;1;5;4;5;2;4;test1@mail.uwaterloo.ca
test2;1;2;5;4;5;4;4;test2@mail.uwaterloo.ca
test3;1;4;5;2;5;2;1;test3@mail.uwaterloo.ca
test4;2;1;4;4;4;4;3;test4@mail.uwaterloo.ca
test5;2;2;4;2;4;2;4;test5@mail.uwaterloo.ca
test6;2;4;3;4;3;4;2;test6@mail.uwaterloo.ca
test7;3;1;3;2;3;2;1;test7@mail.uwaterloo.ca
test8;3;2;3;1;3;1;3;test8@mail.uwaterloo.ca
test9;3;4;2;4;2;4;3;test9@mail.uwaterloo.ca
testa;4;2;2;1;1;4;4;testa@mail.uwaterloo.ca
testb;4;4;1;4;1;2;3;testb@mail.uwaterloo.ca
testc;5;2;1;4;1;4;1;testc@mail.uwaterloo.ca
testd;5;4;1;2;1;2;4;testd@mail.uwaterloo.ca

MSci 311 Final Exam Bonus Activity

You are being invited to participate in an Exam Bonus Activity. If you choose to participate in this voluntary activity, you will receive **3 bonus marks added to your final exam grade**. If you agree to participate we ask that you complete a web-based survey that will take about 30 minutes.

The survey has multiple pages divided into 4 sections, with a total of 14 pages. This is not a test, and there are no correct answers. We are really interested in your initial reactions. Please finish each page and you will be asked to submit, moving you to the next page or section. Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously. In order to receive the bonus marks we will be looking at your response to determine if you have complied.

In the first task, you are presented with one or more examples, and your task will be to identify as many (up to nine) similar items.

In the second task, you are presented with three groups, each with one or more examples, and your task will be to identify nine similar items as belonging to one of the groups.

In the third task, you are presented with three labelled groups, and your task will be to identify nine similar items as belonging to one of the groups.

The final task is to give examples of items based on a given concept.

Informed Consent Form

I state that I wish to participate in a program of research being conducted by Dr. R. Duimering and S. Sempson for Thesis research, Winter 2005, Department of Management Sciences, Faculty of Engineering, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1.

This survey meets with ethical guidelines and complies with the University of Waterloo's standards for ethical research. There are no known risks to participating in this research.

Participation in this survey is voluntary and completely anonymous. All information will be kept confidential and on a secure server. Your student identification number will be used to ensure multiple surveys are not submitted by one student. Your student identification number is not linked to your submission and therefore anonymity is maintained. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time. Your participation or non-participation will have no impact on your relationship with the University of Waterloo.

This research is being conducted under the supervision of Dr. R. Duimering. Questions or

comments may be directed to the Department of Management Sciences at 888-4567, ext. 2831 or e-mail rduimering@uwaterloo.ca or 888-4567, ext. 6183 or e-mail sempson@uwaterloo.ca .

This survey will be available for your input on Wednesday, April 13th, 2005 for one week (until April 23th, 2005).

If you have any problems logging in, contact via e-mail sempson@uwaterloo.ca .

Please login now to the Student Survey .

MSci 311 Fall 2005 Experimental Activity

Section 2: 1 of 2

You are presented here with three groups, each with one or more examples, and your task will be to identify nine similar items as belonging to one of the groups.

Group 1	Group 2	Group 3
eagle	hummingbird	seagull
falcon	oriole	penguin
road-runner	sparrow	swan
swallow	parrot	crow

Each of the 9 items listed below are members of one of the three labeled groups. For each item please select the group in which the item belongs.

Item	1	2	3
ostrich	○	○	○
pigeon	○	○	○
kingfisher	○	○	○
lovebird	○	○	○
canary	○	○	○
robin	○	○	○
stork	○	○	○
chicken	○	○	○
goose	○	○	○

Submit Clear

Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.

MSci 311 Fall 2005 Experimental Activity

Section 2: 2 of 2

You are presented here with three groups, each with one or more examples, and your task will be to identify nine similar items as belonging to one of the groups.

Group 1	Group 2	Group 3
lamp	leather couch	bookshelf
chair	loveseat	end table
tv-stand	vibrating-chair	sofa
vase	cushioned chair	night-table

Each of the 9 items listed below are members of one of the three labeled groups. For each item please select the group in which the item belongs.

Item	1	2	3
desk	○	○	○
side-table	○	○	○
bedside table	○	○	○
couch	○	○	○
armchair	○	○	○
futon	○	○	○
lazyboy-chair	○	○	○
dresser	○	○	○
pillow	○	○	○

Submit Clear

Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.

Section 3: 1 of 2

You are presented here with three labeled groups, and your task will be to identify nine similar items as belonging to one of the groups.

1. Small Birds	2. Fast Birds	3. Birds

Each of the 9 items listed below are members of one of the three labeled groups. For each item please select the group in which the item belongs.

Item	1	2	3
crow	○	○	○
owl	○	○	○
swallow	○	○	○
parrot	○	○	○
bluebird	○	○	○
canary	○	○	○
cormorant	○	○	○
vulture	○	○	○
sparrow	○	○	○

Submit   Clear

Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.

MSci 311 Fall 2005 Experimental Activity

Section 3: 2 of 2

You are presented here with three labeled groups, and your task will be to identify nine similar items as belonging to one of the groups.

1. Small Furniture	2. Comfortable Furniture	3. Furniture

Each of the 9 items listed below are members of one of the three labeled groups. For each item please select the group in which the item belongs.

Item	1	2	3
end table	○	○	○
stool	○	○	○
coffee table	○	○	○
beanbag chair	○	○	○
table	○	○	○
recliner	○	○	○
wardrobe	○	○	○
couch	○	○	○
desk	○	○	○

Submit   Clear

Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.

APPENDIX E: SURVEY SCRIPT FOR RUNNING THE WEB FORM

```perl
#!/xhbin/perl5
require "/software/www_server/servers/cgi-lib.pl";

&ReadParse(*input);
use IO::File;

sub trim {
   my @out = @_;
   for (@out) {
      s/^\s+//; # remove space at beginning
      s/\s+$//; # remove space at end
      s/^\r+//; # remove Carriage Return at beginning
      s/\r+$//; # remove Carriage Return at end
      s/^\n+//; # remove NewLine at beginning
      s/\n+$//; # remove NewLine Return at end
      s/\r+/ /; # remove Carriage Return anywhere in line
      s/\n+/ /; # remove NewLine Return anywhere in line
      s/\s+/ /; # change multiple blanks with just one
   }
   return wantarray ? @out : $out[0];
}

sub error_no_descr {

   print ("<p>Userid: <b>", $your_user, "</b> you did not enter a description!  Please, press the back button and try again...</p>");
   print "\n";
   print "</body></html>";
}

sub error_no_data {

   print ("<p>Userid: <b>", $your_user, "</b> you did not enter anything!  Please, press the back button and try again...</p>");
   print "\n";
   print "</body></html>";
}

sub error_missing_data {

   print ("<p>Userid: <b>", $your_user, "</b> you missed some data entry!  Please, press the back button and try again...</p>");
   print "\n";
   print "</body></html>";
}

sub error_matching_data {

   print ("<p>Userid: <b>", $your_user, "</b> some of your items match the examples!  Please, press the back button and try again...</p>");
   print "\n";
   print "</body></html>";
}

sub have_got_you_already {

   start_of_output_head();
   print '<p>Your information has already been received by the Faculty of Engineering at the University of Waterloo.</p>';
   print "\n";
   print "</body></html>";
}

sub have_not_got_you {

   start_of_output_head();
   print "<p>Userid: <b>", $your_user, "</b> you are not on my list of students who are eligible to take this Bonus Activity!</p>";
   print "\n";
   print "</body></html>";
}

sub final_page_thankyou {

   $test_if_did = find_data();
   if ($test_if_did eq "False") {
      collect_the_data();
      mail_out_info($pick_userid);
      print ("<p>Userid: <b>", $your_user, "</b> your information has been received. Thank you for your participation in the MSci 311 Final Exam Bonus Activity.</p>");
   } else {
      print '<p>Your information has already been received by the Faculty of Engineering at the University of Waterloo.</p>';
   }
   print "\n";
   print "</body></html>";
}

sub collect_the_data {

   $value14 = commify_series(@page_fourteen);
```

```perl
  @questions = ("$value1", "$prompt1", "$descr1", "$value2", "$prompt2", "$descr2", "$value3", "$prompt3", "$descr3", "$value4", "$prompt4", "$descr4", "$value5", "$prompt5", "$descr5",
"$value6", "$prompt6", "$descr6", "$prompt7g1", "$prompt7g2", "$prompt7g3", "$prompt7p1", "$prompt7p2", "$prompt7p3", "$q7_0", "$q7_1", "$q7_2", "$q7_3", "$q7_4", "$q7_5", "$q7_6",
"$q7_7", "$q7_8", "$prompt8g1", "$prompt8g2", "$prompt8g3", "$prompt8p1", "$prompt8p2", "$prompt8p3", "$q8_0", "$q8_1", "$q8_2", "$q8_3", "$q8_4", "$q8_5", "$q8_6", "$q8_7", "$q8_8",
"$prompt9p1", "$prompt9p2", "$prompt9p3", "$q9_0", "$q9_1", "$q9_2", "$q9_3", "$q9_4", "$q9_5", "$q9_6", "$q9_7", "$q9_8", "$prompt10p1", "$prompt10p2", "$prompt10p3", "$q10_0",
"$q10_1", "$q10_2", "$q10_3", "$q10_4", "$q10_5", "$q10_6", "$q10_7", "$q10_8", "$value11", "$descr11", "$value12", "$descr12", "$value13", "$descr13", "$value14", "$descr14" );
  $questRef = \@questions;
  open(POLL_INFO, ">> $poll_info")  or die "can't open $poll_info: $!";
  flock (POLL_INFO, 2);
  select(POLL_INFO);
  print ($your_user, ";");
  for ($i=0; $i <= $#$questRef; $i++) {
    print "$questions[$i]";
    if ($i != $#$questRef) {
      print ";";
    } else {
      print "\n";
    }
  }
  flock (POLL_INFO, 8);
  close(POLL_INFO) or die "can't close $poll_info: $!";
  select (STDOUT);
}


sub find_data {

  open(POLL_READ, "< $poll_info")  or die "can't open $poll_info: $!";
  flock (POLL_READ, 1);
  @data_lines = <POLL_READ>;
  flock (POLL_READ, 8);
  close(POLL_READ);
  $data_find = "False";
  foreach $data_line(@data_lines) {
    @data_item = split(/\;/, $data_line);
    if (uc($data_item[0]) eq uc($your_user)) {
      $data_find = "True";
    }
  }
  return($data_find);
}


sub find_user {

  open(LIST_READ, "< $poll_list")  or die "can't open $poll_list: $!";
  flock (LIST_READ, 1);
  @list_lines = <LIST_READ>;
  flock (LIST_READ, 8);
  close(LIST_READ);
  $list_find = "False";
  foreach $list_line(@list_lines) {
    @list_item = split(/\;/, $list_line);
    if (uc($list_item[0]) eq uc($your_user)) {
      $list_find = "True";
      $pick_type = $list_item[1];
      $pick_nums = $list_item[2];
      $pick_userid = $list_item[3];
    }
  }
  return($list_find);
}


sub fix_rand {

  if ($pick_nums == 1) {
    @loop_array = (0, 0, 0);
  } else {
    if ($pick_nums == 2) {
      @loop_array = (1, 1, 1);
    } else {
      if ($pick_nums == 4) {
        @loop_array = (3, 3, 3);
      }
    }
  }
}


sub start_of_output_head {

# Print a title and initial heading
  print "Content-type: text/html\n\n";
  print "<HEAD>","\n";
  print '<meta http-equiv="Content-type" content="text/html; charset=iso-8859-1">',"\n";
  print "\n";
#  print '<META HTTP-EQUIV="Cache-Control" CONTENT="no-cache">';
#  print "\n";
#  print '<META HTTP-EQUIV="Pragma" CONTENT="no-cache">';
#  print "\n";
#  print '<META HTTP-EQUIV="Expires" CONTENT="-1">';
```

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```perl
#   print "\n";
  print "<TITLE>MSci 311 Final Exam Bonus Activity</title></head>","\n";
  print "\n";
  print "<BODY>";
  print "<H2>MSci 311 Final Exam Bonus Activity</h2>","\n";
}

sub get_page_number {

  $pages = 0;
  if ($page_type eq "page13") {
    $pages = 14;
  } else {
    if ($page_type eq "page12") {
      $pages = 13;
    } else {
      if ($page_type eq "page11") {
        $pages = 12;
      } else {
        if ($page_type eq "page10") {
          $pages = 11;
        } else {
          if ($page_type eq "page9") {
            $pages = 10;
          } else {
            if ($page_type eq "page8") {
              $pages = 9;
            } else {
              if ($page_type eq "page7") {
                $pages = 8;
              } else {
                if ($page_type eq "page6") {
                  $pages = 7;
                } else {
                  if ($page_type eq "page5") {
                    $pages = 6;
                  } else {
                    if ($page_type eq "page4") {
                      $pages = 5;
                    } else {
                      if ($page_type eq "page3") {
                        $pages = 4;
                      } else {
                        if ($page_type eq "page2") {
                          $pages = 3;
                        } else {
                          if ($page_type eq "page1") {
                            $pages = 2;
                          } else {
                            $pages = 1;
                          }
                        }
                      }
                    }
                  }
                }
              }
            }
          }
        }
      }
    }
  }
  return($pages);
}

sub start_of_output {

  if ($page_number_print <= 6) {
    print ("<p><b>Section 1: ", $page_number_print, " of 6</b></p>");
    print "\n";
    print "You are presented here with one or more examples, and your task will be to identify as many (up to nine) similar items.";
  } else {
    if ($page_number_print == 7) {
      $new_page_number_print = 1;
      print ("<p><b>Section 2: ", $new_page_number_print, " of 2</b></p>");
      print "\n";
      print "You are presented here with three groups, each with one or more examples, and your task will be to identify nine similar items as belonging to one of the groups.";
    } else {
      if ($page_number_print == 8) {
        $new_page_number_print = 2;
        print ("<p><b>Section 2: ", $new_page_number_print, " of 2</b></p>");
        print "\n";
        print "You are presented here with three groups, each with one or more examples, and your task will be to identify nine similar items as belonging to one of the groups.";
      } else {
        if ($page_number_print == 9) {
          $new_page_number_print = 1;
```

```perl
            print ("<p><b>Section 3: ", $new_page_number_print, " of 2</b></p>");
            print "\n";
            print "You are presented here with three labeled groups, and your task will be to identify nine similar items as belonging to one of the groups.";
          } else {
            if ($page_number_print == 10) {
              $new_page_number_print = 2;
              print ("<p><b>Section 3: ", $new_page_number_print, " of 2</b></p>");
              print "\n";
              print "You are presented here with three labeled groups, and your task will be to identify nine similar items as belonging to one of the groups.";
            } else {
              if ($page_number_print == 11) {
                $new_page_number_print = 1;
              } else {
                if ($page_number_print == 12) {
                  $new_page_number_print = 2;
                } else {
                  if ($page_number_print == 13) {
                    $new_page_number_print = 3;
                  } else {
                    if ($page_number_print == 14) {
                      $new_page_number_print = 4;
                    }
                  }
                }
              }
              print ("<p><b>Section 4: ", $new_page_number_print, " of 4</b></p>");
              print "\n";
              print "You are presented here with a type of concept, and your task will be to identify as many (up to nine) items.";
            }
          }
        }
      }
    }
  }
  print "\n";
  print "<hr>";
  print ('<FORM METHOD=POST ACTION="http://www.science.uwaterloo.ca/~sempson/thesis/research/research.pl">');
  print "\n";
}

sub commify_series {

  my $sepchar = grep(/,/ => @_) ? ";" : ",";
  (@_ == 0) ? ''                          :
  (@_ == 1) ? $_[0]                       :
  (@_ == 2) ? join("$sepchar", @_)        :
         join("$sepchar", @_[0 .. ($#_-1)], "$_[-1]");
}

sub print_user_lines {

  for ($i=1; $i <= $number_of_list_items; $i++) {
    print ('<b>', $i, '</b>. <INPUT NAME="', $which_pg_value, '" MAXLENGTH=25 SIZE=25 VALUE=""><br>');
    print ("\n");
  }
}

sub print_user_lines2 {

  @array_all_3 = @p1_array;
  push(@array_all_3, @p2_array);
  push(@array_all_3, @p3_array);
  print ("<table border=1 cellspacing=2 cellpadding=0>");
  print ("\n");
  print ('<tr><td bgcolor="#f9e000"><b>Item</b></td><td bgcolor="#f9e000"><b>1</b></td><td bgcolor="#f9e000"><b>2</b></td><td bgcolor="#f9e000"><b>3</b></td></tr>');
  print ("\n");
  $end_value = $number_of_list_items - 1;
  for ($i=0; $i <= $end_value; $i++) {
    print ('<tr><td><b>', $array_all_3[$i], '</b></td><td><INPUT NAME="q', $page_number_print, '_', $i, '" TYPE="radio" VALUE="1"></td><td><INPUT NAME="q', $page_number_print,
'_', $i, '" TYPE="radio" VALUE="2"></td><td><INPUT NAME="q', $page_number_print, '_', $i, '" TYPE="radio" VALUE="3"></td></tr>');
    print ("\n");
  }
  print ("</table>");
  print ("\n");
}

sub print_vpd_1 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE1" VALUE="', $value1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT1" VALUE="', $prompt1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR1" VALUE="', $descr1, '">');
  print "\n";
}

sub print_vpd_2 {
```

```perl
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE2" VALUE="', $value2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT2" VALUE="', $prompt2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR2" VALUE="', $descr2, '">');
  print "\n";
}

sub print_vpd_3 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE3" VALUE="', $value3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT3" VALUE="', $prompt3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR3" VALUE="', $descr3, '">');
  print "\n";
}

sub print_vpd_4 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE4" VALUE="', $value4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT4" VALUE="', $prompt4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR4" VALUE="', $descr4, '">');
  print "\n";
}

sub print_vpd_5 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE5" VALUE="', $value5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT5" VALUE="', $prompt5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR5" VALUE="', $descr5, '">');
  print "\n";
}

sub print_vpd_6 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE6" VALUE="', $value6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT6" VALUE="', $prompt6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR6" VALUE="', $descr6, '">');
  print "\n";
}

sub print_pq_7 {

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G1" VALUE="', $prompt7g1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G2" VALUE="', $prompt7g2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G3" VALUE="', $prompt7g3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P1" VALUE="', $prompt7p1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P2" VALUE="', $prompt7p2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P3" VALUE="', $prompt7p3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_0" VALUE="', $q7_0, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_1" VALUE="', $q7_1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_2" VALUE="', $q7_2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_3" VALUE="', $q7_3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_4" VALUE="', $q7_4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_5" VALUE="', $q7_5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_6" VALUE="', $q7_6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_7" VALUE="', $q7_7, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q7_8" VALUE="', $q7_8, '">');
  print "\n";
}

sub print_pq_8 {

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G1" VALUE="', $prompt8g1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G2" VALUE="', $prompt8g2, '">');
```

```perl
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G3" VALUE="', $prompt8g3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P1" VALUE="', $prompt8p1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P2" VALUE="', $prompt8p2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P3" VALUE="', $prompt8p3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_0" VALUE="', $q8_0, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_1" VALUE="', $q8_1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_2" VALUE="', $q8_2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_3" VALUE="', $q8_3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_4" VALUE="', $q8_4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_5" VALUE="', $q8_5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_6" VALUE="', $q8_6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_7" VALUE="', $q8_7, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q8_8" VALUE="', $q8_8, '">');
  print "\n";
}

sub print_pq_9 {

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P1" VALUE="', $prompt9p1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P2" VALUE="', $prompt9p2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P3" VALUE="', $prompt9p3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_0" VALUE="', $q9_0, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_1" VALUE="', $q9_1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_2" VALUE="', $q9_2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_3" VALUE="', $q9_3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_4" VALUE="', $q9_4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_5" VALUE="', $q9_5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_6" VALUE="', $q9_6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_7" VALUE="', $q9_7, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q9_8" VALUE="', $q9_8, '">');
  print "\n";
}

sub print_pq_10 {

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P1" VALUE="', $prompt10p1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P2" VALUE="', $prompt10p2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P3" VALUE="', $prompt10p3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_0" VALUE="', $q10_0, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_1" VALUE="', $q10_1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_2" VALUE="', $q10_2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_3" VALUE="', $q10_3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_4" VALUE="', $q10_4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_5" VALUE="', $q10_5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_6" VALUE="', $q10_6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_7" VALUE="', $q10_7, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="q10_8" VALUE="', $q10_8, '">');
  print "\n";
}

sub print_vpd_11 {
```

```perl
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE11" VALUE="', $value11, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR11" VALUE="', $descr11, '">');
  print "\n";
}

sub print_vpd_12 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE12" VALUE="', $value12, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR12" VALUE="', $descr12, '">');
  print "\n";
}

sub print_vpd_13 {

  print ('<INPUT TYPE="HIDDEN" NAME="VALUE13" VALUE="', $value13, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR13" VALUE="', $descr13, '">');
  print "\n";
}

sub print_hidden_page2 {

  $which_pg_value = "VALUE3";
  $descr_pg_value = "DESCR3";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page3">');
  print "\n";
  print_vpd_1();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE2" VALUE="' . commify_series(@page_two) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT2" VALUE="' . commify_series(@prompt_2) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR2" VALUE="', $descr2, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT3" VALUE="' . commify_series(@answer_array) . '">');
}

sub print_hidden_page3 {

  $which_pg_value = "VALUE4";
  $descr_pg_value = "DESCR4";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page4">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE3" VALUE="' . commify_series(@page_three) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT3" VALUE="' . commify_series(@prompt_3) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR3" VALUE="', $descr3, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT4" VALUE="' . commify_series(@answer_array) . '">');
}

sub print_hidden_page4 {

  $which_pg_value = "VALUE5";
  $descr_pg_value = "DESCR5";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page5">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE4" VALUE="' . commify_series(@page_four) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT4" VALUE="' . commify_series(@prompt_4) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR4" VALUE="', $descr4, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT5" VALUE="' . commify_series(@answer_array) . '">');
}

sub print_hidden_page5 {

  $which_pg_value = "VALUE6";
  $descr_pg_value = "DESCR6";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page6">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE5" VALUE="' . commify_series(@page_five) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT5" VALUE="' . commify_series(@prompt_5) . '">');
  print "\n";
```

```perl
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR5" VALUE="', $descr5, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT6" VALUE="' . commify_series(@answer_array) . '">');
}

sub print_hidden_page6 {

  $which_pg_value = "VALUE7";
  $descr_pg_value = "DESCR7";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page7">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE6" VALUE="' . commify_series(@page_six) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT6" VALUE="' . commify_series(@prompt_6) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR6" VALUE="', $descr6, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G1" VALUE="' . commify_series(@g1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G2" VALUE="' . commify_series(@g2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7G3" VALUE="' . commify_series(@g3_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P1" VALUE="' . commify_series(@p1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P2" VALUE="' . commify_series(@p2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT7P3" VALUE="' . commify_series(@p3_array) . '">');
  print "\n";
}

sub print_hidden_page7 {

  $which_pg_value = "VALUE8";
  $descr_pg_value = "DESCR8";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page8">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G1" VALUE="' . commify_series(@g1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G2" VALUE="' . commify_series(@g2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8G3" VALUE="' . commify_series(@g3_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P1" VALUE="' . commify_series(@p1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P2" VALUE="' . commify_series(@p2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT8P3" VALUE="' . commify_series(@p3_array) . '">');
  print "\n";
}

sub print_hidden_page8 {

  $which_pg_value = "VALUE9";
  $descr_pg_value = "DESCR9";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page9">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P1" VALUE="' . commify_series(@p1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P2" VALUE="' . commify_series(@p2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT9P3" VALUE="' . commify_series(@p3_array) . '">');
  print "\n";
}
```

```perl
sub print_hidden_page9 {

  $which_pg_value = "VALUE10";
  $descr_pg_value = "DESCR10";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page10">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();
  print_pq_9();

  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P1" VALUE="' . commify_series(@p1_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P2" VALUE="' . commify_series(@p2_array) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT10P3" VALUE="' . commify_series(@p3_array) . '">');
  print "\n";
}

sub print_hidden_page10 {

  $which_pg_value = "VALUE11";
  $descr_pg_value = "DESCR11";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page11">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();
  print_pq_9();
  print_pq_10();
}

sub print_hidden_page11 {

  $which_pg_value = "VALUE12";
  $descr_pg_value = "DESCR12";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page12">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();
  print_pq_9();
  print_pq_10();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE11" VALUE="' . commify_series(@page_eleven) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR11" VALUE="', $descr11, '">');
  print "\n";
}

sub print_hidden_page12 {

  $which_pg_value = "VALUE13";
  $descr_pg_value = "DESCR13";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page13">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();
  print_pq_9();
  print_pq_10();
  print_vpd_11();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE12" VALUE="' . commify_series(@page_twelve) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR12" VALUE="', $descr12, '">');
  print "\n";
}
```

```perl
sub print_hidden_page13 {

  $which_pg_value = "VALUE14";
  $descr_pg_value = "DESCR14";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page14">');
  print "\n";
  print_vpd_1();
  print_vpd_2();
  print_vpd_3();
  print_vpd_4();
  print_vpd_5();
  print_vpd_6();
  print_pq_7();
  print_pq_8();
  print_pq_9();
  print_pq_10();
  print_vpd_11();
  print_vpd_12();
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE13" VALUE="' . commify_series(@page_thirteen) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR13" VALUE="', $descr13, '">');
  print "\n";
}

sub print_hidden_page1 {

  $which_pg_value = "VALUE2";
  $descr_pg_value = "DESCR2";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page2">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="VALUE1" VALUE="' . commify_series(@page_one) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT1" VALUE="' . commify_series(@prompt_1) . '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="DESCR1" VALUE="', $descr1, '">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT2" VALUE="' . commify_series(@answer_array) . '">');
}

sub print_hidden_page0 {

  $which_pg_value = "VALUE1";
  $descr_pg_value = "DESCR1";
  print ('<INPUT TYPE="HIDDEN" NAME="PAGE_TYPE" VALUE="page1">');
  print "\n";
  print ('<INPUT TYPE="HIDDEN" NAME="PROMPT1" VALUE="' . commify_series(@answer_array) . '">');
}

sub end_of_output3 {

  $which_pg_value = "";
  $descr_pg_value = "";
  print "\n";
  print ("<p>Please give as many examples of the following concept as you can think of. Write these examples in the order that you think of them.</p>");
  print "\n";
  if ($page_type eq "page10") {
    $concept = "Furniture";
    print "<p><b>", $concept, "</b></p>";
    print "\n";
    print_hidden_page10();
  } else {
    if ($page_type eq "page11") {
      $concept = "Difficult";
      print "<p><b>", $concept, "</b></p>";
      print "\n";
      print_hidden_page11();
    } else {
      if ($page_type eq "page12") {
        $concept = "Fast";
        print "<p><b>", $concept, "</b></p>";
        print "\n";
        print_hidden_page12();
      } else {
        if ($page_type eq "page13") {
          $concept = "Small";
          print "<p><b>", $concept, "</b></p>";
          print "\n";
          print_hidden_page13();
        }
      }
    }
  }
}

sub end_of_output2 {

  $which_pg_value = "";
```

```perl
    $descr_pg_value = "";
    print "<td>    </td><td>";
    print "\n";
    print ("<p>Please select a similar group to each item based on the given <b>example(s)</b>.</p>");
    print "\n";
    if ($page_type eq "page9") {
      print_hidden_page9();
    } else {
      if ($page_type eq "page8") {
        print_hidden_page8();
      } else {
        if ($page_type eq "page7") {
          print_hidden_page7();
        } else {
          if ($page_type eq "page6") {
            print_hidden_page6();
          }
        }
      }
    }
    if (($page_number_print == 7) || ($page_number_print == 8) || ($page_number_print == 9) || ($page_number_print == 10)) {
      print_7_to_8_page();
    }
}

sub end_of_output {

    $which_pg_value = "";
    $descr_pg_value = "";
    print '</td><td>    </td><td>';
    print "\n";
    print ("<p>Please enter as many similar item(s) that you can think of (up to 9), based on the given <b>example(s)</b>.</p>");
    print "\n";
    if ($page_type eq "page5") {
      print_hidden_page5();
    } else {
      if ($page_type eq "page4") {
        print_hidden_page4();
      } else {
        if ($page_type eq "page3") {
          print_hidden_page3();
        } else {
          if ($page_type eq "page2") {
            print_hidden_page2();
          } else {
            if ($page_type eq "page1") {
              print_hidden_page1();
            } else {
              print_hidden_page0();
            }
          }
        }
      }
    }
    if ($page_number_print <= 6) {
      print_1_to_6_page();
    }
}

sub house_on_fire {

    print_user_lines();
    print "<hr>";
    print "\n";
    print "<p>Please define / explain / describe what <b>", $concept, "</b> means in your own words.</p>";
    print "\n";
    print ('<INPUT NAME="', $descr_pg_value, '" MAXLENGTH=100 SIZE=100 VALUE=""><br>');
    print "\n";
    print "<hr>";
    print "\n";
    print ('<input name="submit" type="submit" value="Submit">  <input name="Reset" type="Reset" value="Clear">');
    print "\n";
    print "<p>Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.</p>";
    print "\n";
    print "</body></html>","\n";
}

sub print_1_to_6_page {

    print "\n";
    print_user_lines();
    print "</tr></table>";
    print "<hr>";
    print ("<p>In a few words, how would you describe your <b>item(s)</b> and the given <b>example(s)</b>.</p>");
    print "\n";
    print ('<INPUT NAME="', $descr_pg_value, '" MAXLENGTH=50 SIZE=50 VALUE=""><br>');
    print "\n";
```

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```perl
    print "<hr>";
    print "\n";
    print ('<input name="submit" type="submit" value="Submit">  <input name="Reset" type="Reset" value="Clear">');
    print "\n";
    print "<p>Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.</p>";
    print "\n";
    print "</body></html>","\n";
}

sub print_7_to_8_page {
    print "\n";
    print_user_lines2();
    print "</td></tr></table>";
    print "<hr>";
    print "\n";
    print ('<input name="submit" type="submit" value="Submit">  <input name="Reset" type="Reset" value="Clear">');
    print "\n";
    print "<p>Please, fully complete each task and move forward. Do not go back after completing to change any of your answers. We want you to take this task seriously.</p>";
    print "\n";
    print "</body></html>","\n";
}

sub print_array_out {

    $answer_Ref = \@answer_array;
    print '<table border="0" cellspacing="1" cellpadding="5">';
    print "\n";
    print '<tr valign="top"><td>';
    print "\n";
    print '<table border="1" cellspacing="1" bordercolor="#000000" cellpadding="5">';
    print "\n";
    print '<td bgcolor="#f9e000"><font size="2"><B>Example(s)</b></td>';
    print "\n";
    for ($kloop=0; $kloop <= $#$answer_Ref; $kloop++) {
        print '</tr><tr>';
        print '<td ALIGN="left"><font size="2">', $answer_array[$kloop], '</td>';
        print "\n";
    }
    print "</tr></table>";
    print "<BR><BR>";

}

sub print_multi_group_only {

    if ($page_number_print == 9) {
        @group_type = ("Small Birds", "Fast Birds", "Birds");
    } else {
        @group_type = ("Small Furniture", "Comfortable Furniture", "Furniture");
    }
    $group_type_Ref = \@group_type;
    for ($lloop=0; $lloop <= $#$group_type_Ref; $lloop++) {
        print ("<td>");
        print ("\n");
        print '<table border="1" cellspacing="1" bordercolor="#000000" cellpadding="5">';
        print "\n";
        $group_num_label = $lloop + 1;
        print '<tr><td bgcolor="#f9e000"><font size="2"><B>', $group_num_label, '. ', $group_type[$lloop], '</b></td>';
        print "\n";
        print "</tr></table>";
        print ("</td>");
        print ("\n");
    }
}

sub print_multi_array_out {

    my($table_label) = @_;
    $answer_Ref = \@answer_array;
    print '<table border="1" cellspacing="1" bordercolor="#000000" cellpadding="5">';
    print "\n";
    print '<tr><td bgcolor="#f9e000"><font size="2"><B>Group ', $table_label, '</b></td>';
    print "\n";
    for ($kloop=0; $kloop <= $#$answer_Ref; $kloop++) {
        print '</tr><tr>';
        print '<td ALIGN="left"><font size="2">', $answer_array[$kloop], '</td>';
        print "\n";
    }
    print "</tr></table>";
}

sub random_one {

    $rand_element = int(rand(@item_array));
    my (@new_array, @rand_add);
    $send_back_value = $item_array[$rand_element];
    @new_array = ("");
```

```perl
    @rand_add = ("");
    for ($iloop=0; $iloop <= $#$array_Ref; $iloop++) {
      if (($iloop == 0) && ($rand_element != 0)) {
        $new_array[0] = $item_array[$iloop];
      } else {
        if (($iloop == 1) && ($rand_element == 0)) {
          $new_array[0] = $item_array[$iloop];
        } else {
          if ($iloop != $rand_element) {
            $rand_add[0] = $item_array[$iloop];
            push(@new_array, @rand_add);
          }
        }
      }
    }
    @item_array = @new_array;
    return($send_back_value);
}

sub common_list_item {

  my ($array_test1, $array_test2) = @_;
  for ($i=0; $i < @$array_test1; $i++) {
    for ($j=0; $j < @$array_test2; $j++) {
      if ($array_test1->[$i] eq $array_test2->[$j]) {
        $Match_item = "True";
      }
    }
  }

}

sub get_and_print_example {

# @item_array = ("one", "two", "three", "four", "five", "six", "seven", "eight", "nine", "ten");
  @item_array = ("bed", "table", "sofa", "cupboard", "desk", "closet", "chair", "love seat", "chest of drawers", "bookcase", "night table", "coffee table", "couch", "china closet", "cabinet", "divan", "bureau", "buffet", "davenport", "shelf", "rocking chair", "bench", "lounge", "stool", "vanity", "ottoman", "end table", "magazine rack", "bar", "counter", "mirror", "drawers", "dresser", "lamp", "piano", "clock", "stove", "wastebasket", "refrigerator", "rug", "picture", "hassock", "drapes", "TV", "rocker", "footstool", "hi-fi", "vase", "radio", "sewing machine", "fan", "stereo", "pillow", "telephone", "ashtray");

  @array_furn = ("chair", "bed", "table", "desk", "sofa", "couch", "dresser", "lamp", "coffee table", "stool", "armoire", "cabinet", "dining-room table", "night-table", "tv-stand", "bookshelf", "drawers", "shelf", "closet", "loveseat", "television", "cupboard", "rug", "armchair", "light", "ottoman", "futon", "mirror", "rocking chair", "shoe-rack", "wardrobe", "bench", "bookcase", "counter", "end table", "fridge", "coat-hanger/rack", "lazyboy-chair", "bedside table", "blackboard/whiteboard", "chest", "mattress", "oven", "side-table", "stereo", "blinds", "chest of drawers", "china-cabinet", "credenza", "entertainment set", "pillow", "podium", "projector", "beanbag chair", "box", "buffet-table", "computer", "curtains", "dvd player", "footrest", "footstool", "guitar stand", "hammock", "hutch", "pictures", "recliner", "wall-unit", "washing-machine");
  @array_birds = ("bluejay", "eagle", "chicken", "duck", "robin", "seagull", "pigeon", "hawk", "ostrich", "sparrow", "crow", "goose", "penguin", "parrot", "cardinal", "turkey", "owl", "hummingbird", "swan", "dove", "pelican", "vulture", "woodpecker", "flamingo", "chickadee", "falcon", "peacock", "budgie", "oriole", "canary", "emu", "finch", "canada goose", "condor", "hen", "lovebird", "rooster", "albatross", "blackbird", "bluebird", "heron", "loon", "mockingbird", "parakeet", "raven", "swallow", "cockatoo", "kingfisher", "stork", "cormorant", "dodo", "kiwi", "macau", "peregrine-falcon", "red bird", "swift");
  @array_small_furn = ("lamp", "chair", "stool", "coffee table", "night-table", "bedside table", "bench", "desk", "end table", "footstool", "lamp-stand", "ottoman", "side-table", "tv-stand", "vase");
  @array_comf_furn = ("bed", "sofa", "couch", "lazyboy-chair", "chair", "armchair", "cushion", "futon", "leather couch", "recliner", "beanbag chair", "loveseat", "pillow", "vibrating-chair", "water-bed", "cushioned chair", "rocking chair", "table");
  @array_fast_birds = ("eagle", "falcon", "hawk", "hummingbird", "crow", "ostrich", "sparrow", "parrot", "pigeon", "robin", "seagull");
  @array_small_birds = ("bluejay", "hummingbird", "sparrow", "pigeon", "cardinal", "dove", "penguin", "robin", "crow", "blackbird", "bluebird", "canary", "chickadee", "chicken", "lovebird", "oriole", "budgie", "duck", "finch", "parrot", "quail", "seagull");

  @top1_birds = ("chicken");
  @top2_birds = ("chicken", "duck");
  @top4_birds = ("chicken", "duck", "robin", "seagull");
  @top1_small_birds = ("bluejay");
  @top2_small_birds = ("bluejay", "hummingbird");
  @top4_small_birds = ("bluejay", "hummingbird", "sparrow", "pigeon");
  @top1_fast_birds = ("eagle");
  @top2_fast_birds = ("eagle", "falcon");
  @top4_fast_birds = ("eagle", "falcon", "hawk", "crow");
  @r2_small_birds = ("bluejay", "finch");
  @r4_small_birds = ("bluejay", "hummingbird", "budgie", "finch");
  @r2_fast_birds = ("eagle", "seagull");
  @r4_fast_birds = ("eagle", "falcon", "robin", "seagull");
  @r2_birds = ("chicken", "swift");
  @r4_birds = ("chicken", "duck", "macau", "swift");
  @q2_birds = ("chicken", "goose");
  @q4_birds = ("chicken", "robin", "goose", "swan");
  @q2_small_birds = ("bluejay", "penguin");
  @q4_small_birds = ("bluejay", "sparrow", "penguin", "chickadee");
  @q2_fast_birds = ("eagle", "hawk");
  @q4_fast_birds = ("eagle", "falcon", "hawk", "crow");

  @top1_furn = ("table");
  @top2_furn = ("table", "desk");
  @top4_furn = ("table", "desk", "couch", "dresser");
  @top1_comf_furn = ("bed");
  @top2_comf_furn = ("bed", "sofa");
  @top4_comf_furn = ("bed", "sofa", "couch", "lazyboy-chair");
  @top1_small_furn = ("lamp");
  @top2_small_furn = ("lamp", "chair");
  @top4_small_furn = ("lamp", "chair", "stool", "coffee table");
```

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```perl
@r2_small_furn = ("lamp", "vase");
@r4_small_furn = ("lamp", "chair", "tv-stand", "vase");
@r2_comf_furn = ("bed", "rocking chair");
@r4_comf_furn = ("bed", "sofa", "cushion", "rocking chair");
@r2_furn = ("table", "wall-unit");
@r4_furn = ("table", "desk", "recliner", "wall-unit");
@q2_furn = ("table", "dresser");
@q4_furn = ("table", "couch", "dresser", "shelf");
@q2_small_furn = ("lamp", "stool");
@q4_small_furn = ("lamp", "chair", "stool", "desk");
@q2_comf_furn = ("bed", "lazyboy-chair");
@q4_comf_furn = ("bed", "sofa", "lazyboy-chair", "leather couch");

if ($page_type eq "") {
   @item_array = @array_furn;
} else {
  if ($page_type eq "page1") {
     @item_array = @array_birds;
   } else {
     if ($page_type eq "page2") {
        @item_array = @array_small_furn;
     } else {
       if ($page_type eq "page3") {
          @item_array = @array_small_birds;
       } else {
         if ($page_type eq "page4") {
            @item_array = @array_comf_furn;
         } else {
           if ($page_type eq "page5") {
              @item_array = @array_fast_birds;
           } else {
             if (($page_type eq "page6") || ($page_type eq "page8")) {
                @item_array1 = @array_fast_birds;
                @item_array2 = @array_small_birds;
                @item_array3 = @array_birds;
             } else {
               if (($page_type eq "page7") || ($page_type eq "page9")) {
                  @item_array1 = @array_small_furn;
                  @item_array2 = @array_comf_furn;
                  @item_array3 = @array_furn;
               }
             }
           }
         }
       }
     }
   }
}

@loop_array = (0, 1, 3);
fix_rand();

$rand_loop = int(rand(@loop_array));
if ($page_number_print <= 6 ) {
   $array_Ref = \@item_array;
   pick_from_arrays();
#    random_item_from_array();
   print_array_out();
} else {
  if (($page_number_print == 7 ) || ($page_number_print == 8 )) {
     print '<table border="0" cellspacing="1" cellpadding="5">';
     print "\n";
     print '<tr valign="top">';
     print "\n";
     for ($cloop=1; $cloop <= 3; $cloop++) {
        @answer_array = ("");
        @return_array = ("");
        if ($cloop == 1) {
           @item_array = @item_array1;
        } else {
          if ($cloop == 2) {
             @item_array = @item_array2;
          } else {
            if ($cloop == 3) {
               @item_array = @item_array3;
            }
          }
        }
        $array_Ref = \@item_array;
        pick_from_arrays2();
#          random_item_from_array();
        if ($cloop == 1) {
           @g1_array = @answer_array;
           remove_duplicates($cloop);
        } else {
          if ($cloop == 2) {
             @g2_array = @answer_array;
```

```perl
          remove_duplicates($cloop);
        } else {
          if ($cloop == 3) {
            @g3_array = @answer_array;
            remove_duplicates($cloop);
          }
        }
      }
    }
    print ("<td>");
    print ("\n");
    print_multi_array_out($cloop);
    print ("</td>");
    print ("\n");
  }
} else {
  if (($page_number_print == 9 ) || ($page_number_print == 10 )) {
    print '<table border="0" cellspacing="1" cellpadding="5">';
    print "\n";
    print '<tr valign="top">';
    print "\n";
    print_multi_group_only();
  }
}
}
  get_3_of_each();
 }
}

sub get_3_of_each {

  @loop_array = (2, 2, 2);
  $rand_loop = int(rand(@loop_array));
  for ($eloop=1; $eloop <= 3; $eloop++) {
    @answer_array = ("");
    @return_array = ("");
    if ($eloop == 1) {
      @item_array = @item_array1;
    } else {
      if ($eloop == 2) {
        @item_array = @item_array2;
      } else {
        if ($eloop == 3) {
          @item_array = @item_array3;
        }
      }
    }
    $array_Ref = \@item_array;
    random_item_from_array();
    if ($eloop == 1) {
      @p1_array = @answer_array;
      remove_duplicates2($eloop);
    } else {
      if ($eloop == 2) {
        @p2_array = @answer_array;
        remove_duplicates2($eloop);
      } else {
        if ($eloop == 3) {
          @p3_array = @answer_array;
          remove_duplicates2($eloop);
        }
      }
    }
  }
}

sub remove_duplicates2 {

  my($which_remove) = @_;
  if ($which_remove == 1) {
    @start_array = @p1_array;
    @finish_array = @item_array1;
    removing_now();
    @item_array1 = @finish_array;
    @start_array = @p1_array;
    @finish_array = @item_array2;
    removing_now();
    @item_array2 = @finish_array;
    @start_array = @p1_array;
    @finish_array = @item_array3;
    removing_now();
    @item_array3 = @finish_array;
  }
  if ($which_remove == 2) {
    @start_array = @p2_array;
    @finish_array = @item_array2;
    removing_now();
    @item_array2 = @finish_array;
    @start_array = @p2_array;
```

```perl
        @finish_array = @item_array3;
        removing_now();
        @item_array3 = @finish_array;
    }
    if ($which_remove == 3) {
        @start_array = @p3_array;
        @finish_array = @item_array3;
        removing_now();
        @item_array3 = @finish_array;
    }
}

sub remove_duplicates {

    my($which_remove) = @_;
    if ($which_remove == 1) {
        @start_array = @g1_array;
        @finish_array = @item_array1;
        removing_now();
        @item_array1 = @finish_array;
        @start_array = @g1_array;
        @finish_array = @item_array2;
        removing_now();
        @item_array2 = @finish_array;
        @start_array = @g1_array;
        @finish_array = @item_array3;
        removing_now();
        @item_array3 = @finish_array;
    }
    if ($which_remove == 2) {
        @start_array = @g2_array;
        @finish_array = @item_array2;
        removing_now();
        @item_array2 = @finish_array;
        @start_array = @g2_array;
        @finish_array = @item_array1;
        removing_now();
        @item_array1 = @finish_array;
        @start_array = @g2_array;
        @finish_array = @item_array3;
        removing_now();
        @item_array3 = @finish_array;
    }
    if ($which_remove == 3) {
        @start_array = @g3_array;
        @finish_array = @item_array3;
        removing_now();
        @item_array3 = @finish_array;
        @start_array = @g3_array;
        @finish_array = @item_array1;
        removing_now();
        @item_array1 = @finish_array;
        @start_array = @g3_array;
        @finish_array = @item_array2;
        removing_now();
        @item_array2 = @finish_array;
    }
}

sub removing_now {

    $start_array_Ref = \@start_array;
    $finish_array_Ref = \@finish_array;
    @array_values_remove = "";
    for ($grp1=0; $grp1 <= $#$start_array_Ref; $grp1++) {
        $pull_out = "False";
        $pull_out_number = 0;
        for ($grp2=0; $grp2 <= $#$finish_array_Ref; $grp2++) {
            if ($start_array[$grp1] eq $finish_array[$grp2]) {
                $pull_out = "True";
                $pull_out_number = $grp2;
            }
        }
        if ($pull_out eq "True") {
            if ($array_values_remove[0] eq "") {
                $array_values_remove[0] = $pull_out_number;
            } else {
                $dups_add[0] = $pull_out_number;
                push(@array_values_remove, @dups_add);
            }
        }
    }
    $dup_loop_Ref = \@array_values_remove;
    @array_values_removed = "";
    for ($grp2=0; $grp2 <= $#$finish_array_Ref; $grp2++) {
        $pull_out = "False";
        for ($d_loop=0; $d_loop <= $#$dup_loop_Ref; $d_loop++) {
```

```perl
      if ($grp2 == $array_values_remove[$d_loop]) {
        $pull_out = "True";
      }
    }
    if ($pull_out ne "True") {
      if ($array_values_removed[0] eq "") {
        $array_values_removed[0] = $finish_array[$grp2];
      } else {
        $dups_add[0] = $finish_array[$grp2];
        push(@array_values_removed, @dups_add);
      }
    }
  }
  }
  @finish_array = @array_values_removed;
}

sub random_item_from_array {

  for ($jloop=0; $jloop <= $loop_array[$rand_loop]; $jloop++) {
    $return_array[0] = random_one();
    if ($jloop == 0) {
      $answer_array[$jloop] = $return_array[$jloop];
    } else {
      push(@answer_array, @return_array);
    }
  }
}

sub pick_from_arrays2 {

  if ($pick_type == 1) {
    random_item_from_array();
  } else {
    if ($page_number_print == 7) {
      pick_from_birds();
    } else {
      if ($page_number_print == 8) {
        pick_from_furniture();
      }
    }
  }
}

sub pick_from_birds {

  if ($pick_type == 3) {
    if ($pick_nums == 1) {
      if ($cloop == 1) {
        @answer_array = @top1_fast_birds;
      } else {
        if ($cloop == 2) {
          @answer_array = @top1_small_birds;
        } else {
          if ($cloop == 3) {
            @answer_array = @top1_birds;
          }
        }
      }
    } else {
      if ($pick_nums == 2) {
        if ($cloop == 1) {
          @answer_array = @top2_fast_birds;
        } else {
          if ($cloop == 2) {
            @answer_array = @top2_small_birds;
          } else {
            if ($cloop == 3) {
              @answer_array = @top2_birds;
            }
          }
        }
      } else {
        if ($pick_nums == 4) {
          if ($cloop == 1) {
            @answer_array = @top4_fast_birds;
          } else {
            if ($cloop == 2) {
              @answer_array = @top4_small_birds;
            } else {
              if ($cloop == 3) {
                @answer_array = @top4_birds;
              }
            }
          }
        }
      }
    }
```

```
  } else {
    if ($pick_type == 4) {
      if ($pick_nums == 1) {
        if ($cloop == 1) {
          @answer_array = @q1_fast_birds;
        } else {
          if ($cloop == 2) {
            @answer_array = @q1_small_birds;
          } else {
            if ($cloop == 3) {
              @answer_array = @q1_birds;
            }
          }
        }
      } else {
        if ($pick_nums == 2) {
          if ($cloop == 1) {
            @answer_array = @q2_fast_birds;
          } else {
            if ($cloop == 2) {
              @answer_array = @q2_small_birds;
            } else {
              if ($cloop == 3) {
                @answer_array = @q2_birds;
              }
            }
          }
        } else {
          if ($pick_nums == 4) {
            if ($cloop == 1) {
              @answer_array = @q4_fast_birds;
            } else {
              if ($cloop == 2) {
                @answer_array = @q4_small_birds;
              } else {
                if ($cloop == 3) {
                  @answer_array = @q4_birds;
                }
              }
            }
          }
        }
      }
    } else {
      if ($pick_type == 5) {
        if ($pick_nums == 1) {
          if ($cloop == 1) {
            @answer_array = @r1_fast_birds;
          } else {
            if ($cloop == 2) {
              @answer_array = @r1_small_birds;
            } else {
              if ($cloop == 3) {
                @answer_array = @r1_birds;
              }
            }
          }
        } else {
          if ($pick_nums == 2) {
            if ($cloop == 1) {
              @answer_array = @r2_fast_birds;
            } else {
              if ($cloop == 2) {
                @answer_array = @r2_small_birds;
              } else {
                if ($cloop == 3) {
                  @answer_array = @r2_birds;
                }
              }
            }
          } else {
            if ($pick_nums == 4) {
              if ($cloop == 1) {
                @answer_array = @r4_fast_birds;
              } else {
                if ($cloop == 2) {
                  @answer_array = @r4_small_birds;
                } else {
                  if ($cloop == 3) {
                    @answer_array = @r4_birds;
                  }
                }
              }
            }
          }
        }
      }
    }
```

```perl
      }
    }
  }

sub pick_from_furniture {

  if ($pick_type == 3) {
    if ($pick_nums == 1) {
      if ($cloop == 1) {
        @answer_array = @top1_small_furn;
      } else {
        if ($cloop == 2) {
          @answer_array = @top1_comf_furn;
        } else {
          if ($cloop == 3) {
            @answer_array = @top1_furn;
          }
        }
      }
    } else {
      if ($pick_nums == 2) {
        if ($cloop == 1) {
          @answer_array = @top2_small_furn;
        } else {
          if ($cloop == 2) {
            @answer_array = @top2_comf_furn;
          } else {
            if ($cloop == 3) {
              @answer_array = @top2_furn;
            }
          }
        }
      } else {
        if ($pick_nums == 4) {
          if ($cloop == 1) {
            @answer_array = @top4_small_furn;
          } else {
            if ($cloop == 2) {
              @answer_array = @top4_comf_furn;
            } else {
              if ($cloop == 3) {
                @answer_array = @top4_furn;
              }
            }
          }
        }
      }
    }
  } else {
    if ($pick_type == 4) {
      if ($pick_nums == 1) {
        if ($cloop == 1) {
          @answer_array = @q1_small_furn;
        } else {
          if ($cloop == 2) {
            @answer_array = @q1_comf_furn;
          } else {
            if ($cloop == 3) {
              @answer_array = @q1_furn;
            }
          }
        }
      } else {
        if ($pick_nums == 2) {
          if ($cloop == 1) {
            @answer_array = @q2_small_furn;
          } else {
            if ($cloop == 2) {
              @answer_array = @q2_comf_furn;
            } else {
              if ($cloop == 3) {
                @answer_array = @q2_furn;
              }
            }
          }
        } else {
          if ($pick_nums == 4) {
            if ($cloop == 1) {
              @answer_array = @q4_small_furn;
            } else {
              if ($cloop == 2) {
                @answer_array = @q4_comf_furn;
              } else {
                if ($cloop == 3) {
                  @answer_array = @q4_furn;
                }
              }
```

```perl
            }
          }
        }
      }
    } else {
      if ($pick_type == 5) {
        if ($pick_nums == 1) {
          if ($cloop == 1) {
            @answer_array = @r1_small_furn;
          } else {
            if ($cloop == 2) {
              @answer_array = @r1_comf_furn;
            } else {
              if ($cloop == 3) {
                @answer_array = @r1_furn;
              }
            }
          }
        } else {
          if ($pick_nums == 2) {
            if ($cloop == 1) {
              @answer_array = @r2_small_furn;
            } else {
              if ($cloop == 2) {
                @answer_array = @r2_comf_furn;
              } else {
                if ($cloop == 3) {
                  @answer_array = @r2_furn;
                }
              }
            }
          } else {
            if ($pick_nums == 4) {
              if ($cloop == 1) {
                @answer_array = @r4_small_furn;
              } else {
                if ($cloop == 2) {
                  @answer_array = @r4_comf_furn;
                } else {
                  if ($cloop == 3) {
                    @answer_array = @r4_furn;
                  }
                }
              }
            }
          }
        }
      }
    }
  }
}

sub pick_from_arrays {

  if ($pick_type == 1) {
    random_item_from_array();
  } else {
    if ($pick_type == 3) {
      if ($pick_nums == 1) {
        if ($page_type eq "") {
          @answer_array = @top1_furn;
        } else {
          if ($page_type eq "page1") {
            @answer_array = @top1_birds;
          } else {
            if ($page_type eq "page2") {
              @answer_array = @top1_small_furn;
            } else {
              if ($page_type eq "page3") {
                @answer_array = @top1_small_birds;
              } else {
                if ($page_type eq "page4") {
                  @answer_array = @top1_comf_furn;
                } else {
                  if ($page_type eq "page5") {
                    @answer_array = @top1_fast_birds;
                  }
                }
              }
            }
          }
        }
      } else {
        if ($pick_nums == 2) {
          if ($page_type eq "") {
            @answer_array = @top2_furn;
          } else {
```

```perl
      if ($page_type eq "page1") {
        @answer_array = @top2_birds;
      } else {
        if ($page_type eq "page2") {
          @answer_array = @top2_small_furn;
        } else {
          if ($page_type eq "page3") {
            @answer_array = @top2_small_birds;
          } else {
            if ($page_type eq "page4") {
              @answer_array = @top2_comf_furn;
            } else {
              if ($page_type eq "page5") {
                @answer_array = @top2_fast_birds;
              }
            }
          }
        }
      }
    } else {
      if ($pick_nums == 4) {
        if ($page_type eq "") {
          @answer_array = @top4_furn;
        } else {
          if ($page_type eq "page1") {
            @answer_array = @top4_birds;
          } else {
            if ($page_type eq "page2") {
              @answer_array = @top4_small_furn;
            } else {
              if ($page_type eq "page3") {
                @answer_array = @top4_small_birds;
              } else {
                if ($page_type eq "page4") {
                  @answer_array = @top4_comf_furn;
                } else {
                  if ($page_type eq "page5") {
                    @answer_array = @top4_fast_birds;
                  }
                }
              }
            }
          }
        }
      }
    }
  }
} else {
  if ($pick_type == 4) {
    if ($pick_nums == 2) {
      if ($page_type eq "") {
        @answer_array = @q2_furn;
      } else {
        if ($page_type eq "page1") {
          @answer_array = @q2_birds;
        } else {
          if ($page_type eq "page2") {
            @answer_array = @q2_small_furn;
          } else {
            if ($page_type eq "page3") {
              @answer_array = @q2_small_birds;
            } else {
              if ($page_type eq "page4") {
                @answer_array = @q2_comf_furn;
              } else {
                if ($page_type eq "page5") {
                  @answer_array = @q2_fast_birds;
                }
              }
            }
          }
        }
      }
    } else {
      if ($pick_nums == 4) {
        if ($page_type eq "") {
          @answer_array = @q4_furn;
        } else {
          if ($page_type eq "page1") {
            @answer_array = @q4_birds;
          } else {
            if ($page_type eq "page2") {
              @answer_array = @q4_small_furn;
            } else {
              if ($page_type eq "page3") {
                @answer_array = @q4_small_birds;
```

```perl
            } else {
              if ($page_type eq "page4") {
                @answer_array = @q4_comf_furn;
              } else {
                if ($page_type eq "page5") {
                  @answer_array = @q4_fast_birds;
                }
              }
            }
          }
        }
      }
    }
  } else {
    if ($pick_type == 5) {
      if ($pick_nums == 2) {
        if ($page_type eq "") {
          @answer_array = @r2_furn;
        } else {
          if ($page_type eq "page1") {
            @answer_array = @r2_birds;
          } else {
            if ($page_type eq "page2") {
              @answer_array = @r2_small_furn;
            } else {
              if ($page_type eq "page3") {
                @answer_array = @r2_small_birds;
              } else {
                if ($page_type eq "page4") {
                  @answer_array = @r2_comf_furn;
                } else {
                  if ($page_type eq "page5") {
                    @answer_array = @r2_fast_birds;
                  }
                }
              }
            }
          }
        }
      } else {
        if ($pick_nums == 4) {
          if ($page_type eq "") {
            @answer_array = @r4_furn;
          } else {
            if ($page_type eq "page1") {
              @answer_array = @r4_birds;
            } else {
              if ($page_type eq "page2") {
                @answer_array = @r4_small_furn;
              } else {
                if ($page_type eq "page3") {
                  @answer_array = @r4_small_birds;
                } else {
                  if ($page_type eq "page4") {
                    @answer_array = @r4_comf_furn;
                  } else {
                    if ($page_type eq "page5") {
                      @answer_array = @r4_fast_birds;
                    }
                  }
                }
              }
            }
          }
        }
      }
    }
  }
}

sub clean_up_the_input {

# Cleanup line breaks in data coming in...
  my ($cleanup_me) = @_;
  chomp($cleanup_me);
  $cr_junk = chr(10);              # Remove DOS Newline feed
  $cleanup_me =~ s/$cr_junk/ /g;
  $cr_junk = chr(13);              # Remove DOS Carrige Return ^M
  $cleanup_me =~ s/$cr_junk/ /g;
  $cleanup_me = trim($cleanup_me);
  return($cleanup_me);
}

sub get_all_page_values {
```

```perl
    $cr_junk = chr(0);
    @clean_me = split(/$cr_junk/, $in_coming);
    $clean_meRef = \@clean_me;
    @array_want = ("");
    @return_array = ("");
    $set_one = "False";
    for ($j=0; $j <= $#$clean_meRef; $j++) {
      $clean_me[$j] = clean_up_the_input($clean_me[$j]);
      if ($clean_me[$j] ne "") {
        if ($set_one eq "False") {
          $array_want[0] = $clean_me[$j];
          $set_one = "True";
        } else {
          $return_array[0] = $clean_me[$j];
          push(@array_want, @return_array);
        }
      }
    }
  return @array_want;
}

sub call_me_to_test2 {

  start_of_output_head();
  if (($q7_0 eq "") && ($q7_1 eq "") && ($q7_2 eq "") && ($q7_3 eq "") && ($q7_4 eq "") && ($q7_5 eq "") && ($q7_6 eq "") && ($q7_7 eq "") && ($q7_8 eq "")) {
    error_no_data();
  } else {
    if (($q7_0 eq "") || ($q7_1 eq "") || ($q7_2 eq "") || ($q7_3 eq "") || ($q7_4 eq "") || ($q7_5 eq "") || ($q7_6 eq "") || ($q7_7 eq "") || ($q7_8 eq "")) {
      error_missing_data();
    } else {
      if ($page_number_print == 8) {
        switch_condition_nums();
        start_of_output();
        @g1_array = ("");
        @g2_array = ("");
        @g3_array = ("");
        @p1_array = ("");
        @p2_array = ("");
        @p3_array = ("");
        get_and_print_example();
        end_of_output2();
      }
    }
  }
}

sub call_me_to_test3 {

  start_of_output_head();
  if ($page_number_print == 9) {
    if (($q8_0 eq "") && ($q8_1 eq "") && ($q8_2 eq "") && ($q8_3 eq "") && ($q8_4 eq "") && ($q8_5 eq "") && ($q8_6 eq "") && ($q8_7 eq "") && ($q8_8 eq "")) {
      error_no_data();
    } else {
      if (($q8_0 eq "") || ($q8_1 eq "") || ($q8_2 eq "") || ($q8_3 eq "") || ($q8_4 eq "") || ($q8_5 eq "") || ($q8_6 eq "") || ($q8_7 eq "") || ($q8_8 eq "")) {
        error_missing_data();
      } else {
        start_of_output();
        @p1_array = ("");
        @p2_array = ("");
        @p3_array = ("");
        get_and_print_example();
        end_of_output2();
      }
    }
  } else {
    if ($page_number_print == 10) {
      if (($q9_0 eq "") && ($q9_1 eq "") && ($q9_2 eq "") && ($q9_3 eq "") && ($q9_4 eq "") && ($q9_5 eq "") && ($q9_6 eq "") && ($q9_7 eq "") && ($q9_8 eq "")) {
        error_no_data();
      } else {
        if (($q9_0 eq "") || ($q9_1 eq "") || ($q9_2 eq "") || ($q9_3 eq "") || ($q9_4 eq "") || ($q9_5 eq "") || ($q9_6 eq "") || ($q9_7 eq "") || ($q9_8 eq "")) {
          error_missing_data();
        } else {
          start_of_output();
          @p1_array = ("");
          @p2_array = ("");
          @p3_array = ("");
          get_and_print_example();
          end_of_output2();
        }
      }
    } else {
      if ($page_number_print == 11) {
        if (($q10_0 eq "") && ($q10_1 eq "") && ($q10_2 eq "") && ($q10_3 eq "") && ($q10_4 eq "") && ($q10_5 eq "") && ($q10_6 eq "") && ($q10_7 eq "") && ($q10_8 eq "")) {
          error_no_data();
        } else {
          if (($q10_0 eq "") || ($q10_1 eq "") || ($q10_2 eq "") || ($q10_3 eq "") || ($q10_4 eq "") || ($q10_5 eq "") || ($q10_6 eq "") || ($q10_7 eq "") || ($q10_8 eq "")) {
            error_missing_data();
```

```perl
          } else {
            start_of_output();
            @p1_array = ("");
            @p2_array = ("");
            @p3_array = ("");
            $concept = "";
            end_of_output3();
            house_on_fire();
          }
        }
      }
    }
  }
}

sub call_me_to_test4 {

  ($description, $size, $page_test) = @_;
  start_of_output_head();
  if (($size == 1) && ($page_test eq "")) {
    error_no_data();
  } else {
    if ($description eq "") {
      error_no_descr();
    } else {
      final_page_thankyou();
    }
  }
}

sub call_me_to_test5 {

  ($description, $size, $page_test) = @_;
  start_of_output_head();
  if (($size == 1) && ($page_test eq "")) {
    error_no_data();
  } else {
    if ($description eq "") {
      error_no_descr();
    } else {
      start_of_output();
      end_of_output3();
      house_on_fire();
    }
  }
}

sub call_me_to_test {

  ($description, $size, $page_test) = @_;
  start_of_output_head();
  if (($size == 1) && ($page_test eq "")) {
    error_no_data();
  } else {
    if ($description eq "") {
      error_no_descr();
    } else {
      if ($Match_item eq "True") {
        error_matching_data();
      } else {
        if ($page_number_print <= 6) {
          start_of_output();
          get_and_print_example();
          end_of_output();
        } else {
          if ($page_number_print == 7) {
            switch_condition_nums();
            start_of_output();
            @g1_array = ("");
            @g2_array = ("");
            @g3_array = ("");
            @p1_array = ("");
            @p2_array = ("");
            @p3_array = ("");
            get_and_print_example();
            end_of_output2();
          }
        }
      }
    }
  }
}

sub switch_condition_nums {

  if ($pick_nums == 1) {
    $pick_nums = 2;
```

```perl
  } else {
    if ($pick_nums == 2) {
        $pick_nums = 4;
    } else {
      if ($pick_nums == 4) {
          $pick_nums = 1;
      }
    }
  }
  if ($pick_type == 1) {
    $pick_type = 3;
  } else {
    if ($pick_type == 3) {
        $pick_type = 4;
    } else {
      if ($pick_type == 4) {
          $pick_type = 5;
      } else {
        if ($pick_type == 5) {
            $pick_type = 1;
        }
      }
    }
  }
}

sub page_1_routine {

  $in_coming = "$input{VALUE1}";
  @page_one = get_all_page_values();
  $prompt1 = "$input{PROMPT1}";
  $descr1 = "$input{DESCR1}";
  @prompt_1 = split(/,/, $prompt1);
  $Match_item = "False";
  common_list_item(\@prompt_1, \@page_one);
  $array_size = scalar(@page_one);
  call_me_to_test($descr1, $array_size, $page_one[0]);
}

sub page_2_routine {

  $in_coming = "$input{VALUE2}";
  @page_two = get_all_page_values();
  $value1 = "$input{VALUE1}";
  $prompt1 = "$input{PROMPT1}";
  $prompt2 = "$input{PROMPT2}";
  $descr1 = "$input{DESCR1}";
  $descr2 = "$input{DESCR2}";
  @prompt_2 = split(/,/, $prompt2);
  $Match_item = "False";
  common_list_item(\@prompt_2, \@page_two);
  $array_size = scalar(@page_two);
  call_me_to_test($descr2, $array_size, $page_two[0]);
}

sub page_3_routine {

  $in_coming = "$input{VALUE3}";
  @page_three = get_all_page_values();
  $value1 = "$input{VALUE1}";
  $value2 = "$input{VALUE2}";
  $prompt1 = "$input{PROMPT1}";
  $prompt2 = "$input{PROMPT2}";
  $prompt3 = "$input{PROMPT3}";
  $descr1 = "$input{DESCR1}";
  $descr2 = "$input{DESCR2}";
  $descr3 = "$input{DESCR3}";
  @prompt_3 = split(/,/, $prompt3);
  $Match_item = "False";
  common_list_item(\@prompt_3, \@page_three);
  $array_size = scalar(@page_three);
  call_me_to_test($descr3, $array_size, $page_three[0]);
}

sub page_4_routine {

  $in_coming = "$input{VALUE4}";
  @page_four = get_all_page_values();
  $value1 = "$input{VALUE1}";
  $value2 = "$input{VALUE2}";
  $value3 = "$input{VALUE3}";
  $prompt1 = "$input{PROMPT1}";
  $prompt2 = "$input{PROMPT2}";
  $prompt3 = "$input{PROMPT3}";
  $prompt4 = "$input{PROMPT4}";
  $descr1 = "$input{DESCR1}";
  $descr2 = "$input{DESCR2}";
```

```perl
      $descr3 = "$input{DESCR3}";
      $descr4 = "$input{DESCR4}";
      @prompt_4 = split(/,/, $prompt4);
      $Match_item = "False";
      common_list_item(\@prompt_4, \@page_four);
      $array_size = scalar(@page_four);
      call_me_to_test($descr4, $array_size, $page_four[0]);
}

sub page_5_routine {

      $in_coming = "$input{VALUE5}";
      @page_five = get_all_page_values();
      $value1 = "$input{VALUE1}";
      $value2 = "$input{VALUE2}";
      $value3 = "$input{VALUE3}";
      $value4 = "$input{VALUE4}";
      $prompt1 = "$input{PROMPT1}";
      $prompt2 = "$input{PROMPT2}";
      $prompt3 = "$input{PROMPT3}";
      $prompt4 = "$input{PROMPT4}";
      $prompt5 = "$input{PROMPT5}";
      $descr1 = "$input{DESCR1}";
      $descr2 = "$input{DESCR2}";
      $descr3 = "$input{DESCR3}";
      $descr4 = "$input{DESCR4}";
      $descr5 = "$input{DESCR5}";
      @prompt_5 = split(/,/, $prompt5);
      $Match_item = "False";
      common_list_item(\@prompt_5, \@page_five);
      $array_size = scalar(@page_five);
      call_me_to_test($descr5, $array_size, $page_five[0]);
}

sub page_6_routine {

      $in_coming = "$input{VALUE6}";
      @page_six = get_all_page_values();
      $value1 = "$input{VALUE1}";
      $value2 = "$input{VALUE2}";
      $value3 = "$input{VALUE3}";
      $value4 = "$input{VALUE4}";
      $value5 = "$input{VALUE5}";
      $prompt1 = "$input{PROMPT1}";
      $prompt2 = "$input{PROMPT2}";
      $prompt3 = "$input{PROMPT3}";
      $prompt4 = "$input{PROMPT4}";
      $prompt5 = "$input{PROMPT5}";
      $prompt6 = "$input{PROMPT6}";
      $descr1 = "$input{DESCR1}";
      $descr2 = "$input{DESCR2}";
      $descr3 = "$input{DESCR3}";
      $descr4 = "$input{DESCR4}";
      $descr5 = "$input{DESCR5}";
      $descr6 = "$input{DESCR6}";
      @prompt_6 = split(/,/, $prompt6);
      $Match_item = "False";
      common_list_item(\@prompt_6, \@page_six);
      $array_size = scalar(@page_six);
      call_me_to_test($descr6, $array_size, $page_six[0]);
}

sub page_7_routine {

      $value1 = "$input{VALUE1}";
      $value2 = "$input{VALUE2}";
      $value3 = "$input{VALUE3}";
      $value4 = "$input{VALUE4}";
      $value5 = "$input{VALUE5}";
      $value6 = "$input{VALUE6}";
      $prompt1 = "$input{PROMPT1}";
      $prompt2 = "$input{PROMPT2}";
      $prompt3 = "$input{PROMPT3}";
      $prompt4 = "$input{PROMPT4}";
      $prompt5 = "$input{PROMPT5}";
      $prompt6 = "$input{PROMPT6}";
      $descr1 = "$input{DESCR1}";
      $descr2 = "$input{DESCR2}";
      $descr3 = "$input{DESCR3}";
      $descr4 = "$input{DESCR4}";
      $descr5 = "$input{DESCR5}";
      $descr6 = "$input{DESCR6}";
      $prompt7g1 = "$input{PROMPT7G1}";
      $prompt7g2 = "$input{PROMPT7G2}";
      $prompt7g3 = "$input{PROMPT7G3}";
      $prompt7p1 = "$input{PROMPT7P1}";
      $prompt7p2 = "$input{PROMPT7P2}";
```

```perl
    $prompt7p3 = "$input{PROMPT7P3}";
    $q7_0 = "$input{q7_0}";
    $q7_1 = "$input{q7_1}";
    $q7_2 = "$input{q7_2}";
    $q7_3 = "$input{q7_3}";
    $q7_4 = "$input{q7_4}";
    $q7_5 = "$input{q7_5}";
    $q7_6 = "$input{q7_6}";
    $q7_7 = "$input{q7_7}";
    $q7_8 = "$input{q7_8}";
    call_me_to_test2();
}

sub page_8_routine {

    $value1 = "$input{VALUE1}";
    $value2 = "$input{VALUE2}";
    $value3 = "$input{VALUE3}";
    $value4 = "$input{VALUE4}";
    $value5 = "$input{VALUE5}";
    $value6 = "$input{VALUE6}";
    $prompt1 = "$input{PROMPT1}";
    $prompt2 = "$input{PROMPT2}";
    $prompt3 = "$input{PROMPT3}";
    $prompt4 = "$input{PROMPT4}";
    $prompt5 = "$input{PROMPT5}";
    $prompt6 = "$input{PROMPT6}";
    $descr1 = "$input{DESCR1}";
    $descr2 = "$input{DESCR2}";
    $descr3 = "$input{DESCR3}";
    $descr4 = "$input{DESCR4}";
    $descr5 = "$input{DESCR5}";
    $descr6 = "$input{DESCR6}";
    $prompt7g1 = "$input{PROMPT7G1}";
    $prompt7g2 = "$input{PROMPT7G2}";
    $prompt7g3 = "$input{PROMPT7G3}";
    $prompt7p1 = "$input{PROMPT7P1}";
    $prompt7p2 = "$input{PROMPT7P2}";
    $prompt7p3 = "$input{PROMPT7P3}";
    $q7_0 = "$input{q7_0}";
    $q7_1 = "$input{q7_1}";
    $q7_2 = "$input{q7_2}";
    $q7_3 = "$input{q7_3}";
    $q7_4 = "$input{q7_4}";
    $q7_5 = "$input{q7_5}";
    $q7_6 = "$input{q7_6}";
    $q7_7 = "$input{q7_7}";
    $q7_8 = "$input{q7_8}";
    $prompt8g1 = "$input{PROMPT8G1}";
    $prompt8g2 = "$input{PROMPT8G2}";
    $prompt8g3 = "$input{PROMPT8G3}";
    $prompt8p1 = "$input{PROMPT8P1}";
    $prompt8p2 = "$input{PROMPT8P2}";
    $prompt8p3 = "$input{PROMPT8P3}";
    $q8_0 = "$input{q8_0}";
    $q8_1 = "$input{q8_1}";
    $q8_2 = "$input{q8_2}";
    $q8_3 = "$input{q8_3}";
    $q8_4 = "$input{q8_4}";
    $q8_5 = "$input{q8_5}";
    $q8_6 = "$input{q8_6}";
    $q8_7 = "$input{q8_7}";
    $q8_8 = "$input{q8_8}";
    call_me_to_test3();
}

sub page_9_routine {

    $value1 = "$input{VALUE1}";
    $value2 = "$input{VALUE2}";
    $value3 = "$input{VALUE3}";
    $value4 = "$input{VALUE4}";
    $value5 = "$input{VALUE5}";
    $value6 = "$input{VALUE6}";
    $prompt1 = "$input{PROMPT1}";
    $prompt2 = "$input{PROMPT2}";
    $prompt3 = "$input{PROMPT3}";
    $prompt4 = "$input{PROMPT4}";
    $prompt5 = "$input{PROMPT5}";
    $prompt6 = "$input{PROMPT6}";
    $descr1 = "$input{DESCR1}";
    $descr2 = "$input{DESCR2}";
    $descr3 = "$input{DESCR3}";
    $descr4 = "$input{DESCR4}";
    $descr5 = "$input{DESCR5}";
    $descr6 = "$input{DESCR6}";
    $prompt7g1 = "$input{PROMPT7G1}";
```

```perl
        $prompt7g2 = "$input{PROMPT7G2}";
        $prompt7g3 = "$input{PROMPT7G3}";
        $prompt7p1 = "$input{PROMPT7P1}";
        $prompt7p2 = "$input{PROMPT7P2}";
        $prompt7p3 = "$input{PROMPT7P3}";
        $q7_0 = "$input{q7_0}";
        $q7_1 = "$input{q7_1}";
        $q7_2 = "$input{q7_2}";
        $q7_3 = "$input{q7_3}";
        $q7_4 = "$input{q7_4}";
        $q7_5 = "$input{q7_5}";
        $q7_6 = "$input{q7_6}";
        $q7_7 = "$input{q7_7}";
        $q7_8 = "$input{q7_8}";
        $prompt8g1 = "$input{PROMPT8G1}";
        $prompt8g2 = "$input{PROMPT8G2}";
        $prompt8g3 = "$input{PROMPT8G3}";
        $prompt8p1 = "$input{PROMPT8P1}";
        $prompt8p2 = "$input{PROMPT8P2}";
        $prompt8p3 = "$input{PROMPT8P3}";
        $q8_0 = "$input{q8_0}";
        $q8_1 = "$input{q8_1}";
        $q8_2 = "$input{q8_2}";
        $q8_3 = "$input{q8_3}";
        $q8_4 = "$input{q8_4}";
        $q8_5 = "$input{q8_5}";
        $q8_6 = "$input{q8_6}";
        $q8_7 = "$input{q8_7}";
        $q8_8 = "$input{q8_8}";
        $prompt9p1 = "$input{PROMPT9P1}";
        $prompt9p2 = "$input{PROMPT9P2}";
        $prompt9p3 = "$input{PROMPT9P3}";
        $q9_0 = "$input{q9_0}";
        $q9_1 = "$input{q9_1}";
        $q9_2 = "$input{q9_2}";
        $q9_3 = "$input{q9_3}";
        $q9_4 = "$input{q9_4}";
        $q9_5 = "$input{q9_5}";
        $q9_6 = "$input{q9_6}";
        $q9_7 = "$input{q9_7}";
        $q9_8 = "$input{q9_8}";
        call_me_to_test3();
}

sub page_10_routine {

        $value1 = "$input{VALUE1}";
        $value2 = "$input{VALUE2}";
        $value3 = "$input{VALUE3}";
        $value4 = "$input{VALUE4}";
        $value5 = "$input{VALUE5}";
        $value6 = "$input{VALUE6}";
        $prompt1 = "$input{PROMPT1}";
        $prompt2 = "$input{PROMPT2}";
        $prompt3 = "$input{PROMPT3}";
        $prompt4 = "$input{PROMPT4}";
        $prompt5 = "$input{PROMPT5}";
        $prompt6 = "$input{PROMPT6}";
        $descr1 = "$input{DESCR1}";
        $descr2 = "$input{DESCR2}";
        $descr3 = "$input{DESCR3}";
        $descr4 = "$input{DESCR4}";
        $descr5 = "$input{DESCR5}";
        $descr6 = "$input{DESCR6}";
        $prompt7g1 = "$input{PROMPT7G1}";
        $prompt7g2 = "$input{PROMPT7G2}";
        $prompt7g3 = "$input{PROMPT7G3}";
        $prompt7p1 = "$input{PROMPT7P1}";
        $prompt7p2 = "$input{PROMPT7P2}";
        $prompt7p3 = "$input{PROMPT7P3}";
        $q7_0 = "$input{q7_0}";
        $q7_1 = "$input{q7_1}";
        $q7_2 = "$input{q7_2}";
        $q7_3 = "$input{q7_3}";
        $q7_4 = "$input{q7_4}";
        $q7_5 = "$input{q7_5}";
        $q7_6 = "$input{q7_6}";
        $q7_7 = "$input{q7_7}";
        $q7_8 = "$input{q7_8}";
        $prompt8g1 = "$input{PROMPT8G1}";
        $prompt8g2 = "$input{PROMPT8G2}";
        $prompt8g3 = "$input{PROMPT8G3}";
        $prompt8p1 = "$input{PROMPT8P1}";
        $prompt8p2 = "$input{PROMPT8P2}";
        $prompt8p3 = "$input{PROMPT8P3}";
        $q8_0 = "$input{q8_0}";
        $q8_1 = "$input{q8_1}";
```

```perl
    $q8_2 = "$input{q8_2}";
    $q8_3 = "$input{q8_3}";
    $q8_4 = "$input{q8_4}";
    $q8_5 = "$input{q8_5}";
    $q8_6 = "$input{q8_6}";
    $q8_7 = "$input{q8_7}";
    $q8_8 = "$input{q8_8}";
    $prompt9p1 = "$input{PROMPT9P1}";
    $prompt9p2 = "$input{PROMPT9P2}";
    $prompt9p3 = "$input{PROMPT9P3}";
    $q9_0 = "$input{q9_0}";
    $q9_1 = "$input{q9_1}";
    $q9_2 = "$input{q9_2}";
    $q9_3 = "$input{q9_3}";
    $q9_4 = "$input{q9_4}";
    $q9_5 = "$input{q9_5}";
    $q9_6 = "$input{q9_6}";
    $q9_7 = "$input{q9_7}";
    $q9_8 = "$input{q9_8}";
    $prompt10p1 = "$input{PROMPT10P1}";
    $prompt10p2 = "$input{PROMPT10P2}";
    $prompt10p3 = "$input{PROMPT10P3}";
    $q10_0 = "$input{q10_0}";
    $q10_1 = "$input{q10_1}";
    $q10_2 = "$input{q10_2}";
    $q10_3 = "$input{q10_3}";
    $q10_4 = "$input{q10_4}";
    $q10_5 = "$input{q10_5}";
    $q10_6 = "$input{q10_6}";
    $q10_7 = "$input{q10_7}";
    $q10_8 = "$input{q10_8}";
    call_me_to_test3();
}

sub page_11_routine {

    $value1 = "$input{VALUE1}";
    $value2 = "$input{VALUE2}";
    $value3 = "$input{VALUE3}";
    $value4 = "$input{VALUE4}";
    $value5 = "$input{VALUE5}";
    $value6 = "$input{VALUE6}";
    $prompt1 = "$input{PROMPT1}";
    $prompt2 = "$input{PROMPT2}";
    $prompt3 = "$input{PROMPT3}";
    $prompt4 = "$input{PROMPT4}";
    $prompt5 = "$input{PROMPT5}";
    $prompt6 = "$input{PROMPT6}";
    $descr1 = "$input{DESCR1}";
    $descr2 = "$input{DESCR2}";
    $descr3 = "$input{DESCR3}";
    $descr4 = "$input{DESCR4}";
    $descr5 = "$input{DESCR5}";
    $descr6 = "$input{DESCR6}";
    $descr11 = "$input{DESCR11}";
    $prompt7g1 = "$input{PROMPT7G1}";
    $prompt7g2 = "$input{PROMPT7G2}";
    $prompt7g3 = "$input{PROMPT7G3}";
    $prompt7p1 = "$input{PROMPT7P1}";
    $prompt7p2 = "$input{PROMPT7P2}";
    $prompt7p3 = "$input{PROMPT7P3}";
    $q7_0 = "$input{q7_0}";
    $q7_1 = "$input{q7_1}";
    $q7_2 = "$input{q7_2}";
    $q7_3 = "$input{q7_3}";
    $q7_4 = "$input{q7_4}";
    $q7_5 = "$input{q7_5}";
    $q7_6 = "$input{q7_6}";
    $q7_7 = "$input{q7_7}";
    $q7_8 = "$input{q7_8}";
    $prompt8g1 = "$input{PROMPT8G1}";
    $prompt8g2 = "$input{PROMPT8G2}";
    $prompt8g3 = "$input{PROMPT8G3}";
    $prompt8p1 = "$input{PROMPT8P1}";
    $prompt8p2 = "$input{PROMPT8P2}";
    $prompt8p3 = "$input{PROMPT8P3}";
    $q8_0 = "$input{q8_0}";
    $q8_1 = "$input{q8_1}";
    $q8_2 = "$input{q8_2}";
    $q8_3 = "$input{q8_3}";
    $q8_4 = "$input{q8_4}";
    $q8_5 = "$input{q8_5}";
    $q8_6 = "$input{q8_6}";
    $q8_7 = "$input{q8_7}";
    $q8_8 = "$input{q8_8}";
    $prompt9p1 = "$input{PROMPT9P1}";
    $prompt9p2 = "$input{PROMPT9P2}";
```

```perl
    $prompt9p3 = "$input{PROMPT9P3}";
    $q9_0 = "$input{q9_0}";
    $q9_1 = "$input{q9_1}";
    $q9_2 = "$input{q9_2}";
    $q9_3 = "$input{q9_3}";
    $q9_4 = "$input{q9_4}";
    $q9_5 = "$input{q9_5}";
    $q9_6 = "$input{q9_6}";
    $q9_7 = "$input{q9_7}";
    $q9_8 = "$input{q9_8}";
    $prompt10p1 = "$input{PROMPT10P1}";
    $prompt10p2 = "$input{PROMPT10P2}";
    $prompt10p3 = "$input{PROMPT10P3}";
    $q10_0 = "$input{q10_0}";
    $q10_1 = "$input{q10_1}";
    $q10_2 = "$input{q10_2}";
    $q10_3 = "$input{q10_3}";
    $q10_4 = "$input{q10_4}";
    $q10_5 = "$input{q10_5}";
    $q10_6 = "$input{q10_6}";
    $q10_7 = "$input{q10_7}";
    $q10_8 = "$input{q10_8}";
    $in_coming = "$input{VALUE11}";
    @page_eleven = get_all_page_values();
    $array_size = scalar(@page_eleven);
    call_me_to_test5($descr11, $array_size, $page_eleven[0]);
}

sub page_12_routine {

    $value1 = "$input{VALUE1}";
    $value2 = "$input{VALUE2}";
    $value3 = "$input{VALUE3}";
    $value4 = "$input{VALUE4}";
    $value5 = "$input{VALUE5}";
    $value6 = "$input{VALUE6}";
    $value11 = "$input{VALUE11}";
    $prompt1 = "$input{PROMPT1}";
    $prompt2 = "$input{PROMPT2}";
    $prompt3 = "$input{PROMPT3}";
    $prompt4 = "$input{PROMPT4}";
    $prompt5 = "$input{PROMPT5}";
    $prompt6 = "$input{PROMPT6}";
    $descr1 = "$input{DESCR1}";
    $descr2 = "$input{DESCR2}";
    $descr3 = "$input{DESCR3}";
    $descr4 = "$input{DESCR4}";
    $descr5 = "$input{DESCR5}";
    $descr6 = "$input{DESCR6}";
    $descr11 = "$input{DESCR11}";
    $descr12 = "$input{DESCR12}";
    $prompt7g1 = "$input{PROMPT7G1}";
    $prompt7g2 = "$input{PROMPT7G2}";
    $prompt7g3 = "$input{PROMPT7G3}";
    $prompt7p1 = "$input{PROMPT7P1}";
    $prompt7p2 = "$input{PROMPT7P2}";
    $prompt7p3 = "$input{PROMPT7P3}";
    $q7_0 = "$input{q7_0}";
    $q7_1 = "$input{q7_1}";
    $q7_2 = "$input{q7_2}";
    $q7_3 = "$input{q7_3}";
    $q7_4 = "$input{q7_4}";
    $q7_5 = "$input{q7_5}";
    $q7_6 = "$input{q7_6}";
    $q7_7 = "$input{q7_7}";
    $q7_8 = "$input{q7_8}";
    $prompt8g1 = "$input{PROMPT8G1}";
    $prompt8g2 = "$input{PROMPT8G2}";
    $prompt8g3 = "$input{PROMPT8G3}";
    $prompt8p1 = "$input{PROMPT8P1}";
    $prompt8p2 = "$input{PROMPT8P2}";
    $prompt8p3 = "$input{PROMPT8P3}";
    $q8_0 = "$input{q8_0}";
    $q8_1 = "$input{q8_1}";
    $q8_2 = "$input{q8_2}";
    $q8_3 = "$input{q8_3}";
    $q8_4 = "$input{q8_4}";
    $q8_5 = "$input{q8_5}";
    $q8_6 = "$input{q8_6}";
    $q8_7 = "$input{q8_7}";
    $q8_8 = "$input{q8_8}";
    $prompt9p1 = "$input{PROMPT9P1}";
    $prompt9p2 = "$input{PROMPT9P2}";
    $prompt9p3 = "$input{PROMPT9P3}";
    $q9_0 = "$input{q9_0}";
    $q9_1 = "$input{q9_1}";
    $q9_2 = "$input{q9_2}";
```

```perl
        $q9_3 = "$input{q9_3}";
        $q9_4 = "$input{q9_4}";
        $q9_5 = "$input{q9_5}";
        $q9_6 = "$input{q9_6}";
        $q9_7 = "$input{q9_7}";
        $q9_8 = "$input{q9_8}";
        $prompt10p1 = "$input{PROMPT10P1}";
        $prompt10p2 = "$input{PROMPT10P2}";
        $prompt10p3 = "$input{PROMPT10P3}";
        $q10_0 = "$input{q10_0}";
        $q10_1 = "$input{q10_1}";
        $q10_2 = "$input{q10_2}";
        $q10_3 = "$input{q10_3}";
        $q10_4 = "$input{q10_4}";
        $q10_5 = "$input{q10_5}";
        $q10_6 = "$input{q10_6}";
        $q10_7 = "$input{q10_7}";
        $q10_8 = "$input{q10_8}";
        $in_coming = "$input{VALUE12}";
        @page_twelve = get_all_page_values();
        $array_size = scalar(@page_twelve);
        call_me_to_test5($descr12, $array_size, $page_twelve[0]);
}

sub page_13_routine {

        $value1 = "$input{VALUE1}";
        $value2 = "$input{VALUE2}";
        $value3 = "$input{VALUE3}";
        $value4 = "$input{VALUE4}";
        $value5 = "$input{VALUE5}";
        $value6 = "$input{VALUE6}";
        $value11 = "$input{VALUE11}";
        $value12 = "$input{VALUE12}";
        $prompt1 = "$input{PROMPT1}";
        $prompt2 = "$input{PROMPT2}";
        $prompt3 = "$input{PROMPT3}";
        $prompt4 = "$input{PROMPT4}";
        $prompt5 = "$input{PROMPT5}";
        $prompt6 = "$input{PROMPT6}";
        $descr1 = "$input{DESCR1}";
        $descr2 = "$input{DESCR2}";
        $descr3 = "$input{DESCR3}";
        $descr4 = "$input{DESCR4}";
        $descr5 = "$input{DESCR5}";
        $descr6 = "$input{DESCR6}";
        $descr11 = "$input{DESCR11}";
        $descr12 = "$input{DESCR12}";
        $descr13 = "$input{DESCR13}";
        $prompt7g1 = "$input{PROMPT7G1}";
        $prompt7g2 = "$input{PROMPT7G2}";
        $prompt7g3 = "$input{PROMPT7G3}";
        $prompt7p1 = "$input{PROMPT7P1}";
        $prompt7p2 = "$input{PROMPT7P2}";
        $prompt7p3 = "$input{PROMPT7P3}";
        $q7_0 = "$input{q7_0}";
        $q7_1 = "$input{q7_1}";
        $q7_2 = "$input{q7_2}";
        $q7_3 = "$input{q7_3}";
        $q7_4 = "$input{q7_4}";
        $q7_5 = "$input{q7_5}";
        $q7_6 = "$input{q7_6}";
        $q7_7 = "$input{q7_7}";
        $q7_8 = "$input{q7_8}";
        $prompt8g1 = "$input{PROMPT8G1}";
        $prompt8g2 = "$input{PROMPT8G2}";
        $prompt8g3 = "$input{PROMPT8G3}";
        $prompt8p1 = "$input{PROMPT8P1}";
        $prompt8p2 = "$input{PROMPT8P2}";
        $prompt8p3 = "$input{PROMPT8P3}";
        $q8_0 = "$input{q8_0}";
        $q8_1 = "$input{q8_1}";
        $q8_2 = "$input{q8_2}";
        $q8_3 = "$input{q8_3}";
        $q8_4 = "$input{q8_4}";
        $q8_5 = "$input{q8_5}";
        $q8_6 = "$input{q8_6}";
        $q8_7 = "$input{q8_7}";
        $q8_8 = "$input{q8_8}";
        $prompt9p1 = "$input{PROMPT9P1}";
        $prompt9p2 = "$input{PROMPT9P2}";
        $prompt9p3 = "$input{PROMPT9P3}";
        $q9_0 = "$input{q9_0}";
        $q9_1 = "$input{q9_1}";
        $q9_2 = "$input{q9_2}";
        $q9_3 = "$input{q9_3}";
        $q9_4 = "$input{q9_4}";
```

```perl
  $q9_5 = "$input{q9_5}";
  $q9_6 = "$input{q9_6}";
  $q9_7 = "$input{q9_7}";
  $q9_8 = "$input{q9_8}";
  $prompt10p1 = "$input{PROMPT10P1}";
  $prompt10p2 = "$input{PROMPT10P2}";
  $prompt10p3 = "$input{PROMPT10P3}";
  $q10_0 = "$input{q10_0}";
  $q10_1 = "$input{q10_1}";
  $q10_2 = "$input{q10_2}";
  $q10_3 = "$input{q10_3}";
  $q10_4 = "$input{q10_4}";
  $q10_5 = "$input{q10_5}";
  $q10_6 = "$input{q10_6}";
  $q10_7 = "$input{q10_7}";
  $q10_8 = "$input{q10_8}";
  $in_coming = "$input{VALUE13}";
  @page_thirteen = get_all_page_values();
  $array_size = scalar(@page_thirteen);
  call_me_to_test5($descr13, $array_size, $page_thirteen[0]);
}

sub page_14_routine {

  $value1 = "$input{VALUE1}";
  $value2 = "$input{VALUE2}";
  $value3 = "$input{VALUE3}";
  $value4 = "$input{VALUE4}";
  $value5 = "$input{VALUE5}";
  $value6 = "$input{VALUE6}";
  $value11 = "$input{VALUE11}";
  $value12 = "$input{VALUE12}";
  $value13 = "$input{VALUE13}";
  $prompt1 = "$input{PROMPT1}";
  $prompt2 = "$input{PROMPT2}";
  $prompt3 = "$input{PROMPT3}";
  $prompt4 = "$input{PROMPT4}";
  $prompt5 = "$input{PROMPT5}";
  $prompt6 = "$input{PROMPT6}";
  $descr1 = "$input{DESCR1}";
  $descr2 = "$input{DESCR2}";
  $descr3 = "$input{DESCR3}";
  $descr4 = "$input{DESCR4}";
  $descr5 = "$input{DESCR5}";
  $descr6 = "$input{DESCR6}";
  $descr11 = "$input{DESCR11}";
  $descr12 = "$input{DESCR12}";
  $descr13 = "$input{DESCR13}";
  $descr14 = "$input{DESCR14}";
  $prompt7g1 = "$input{PROMPT7G1}";
  $prompt7g2 = "$input{PROMPT7G2}";
  $prompt7g3 = "$input{PROMPT7G3}";
  $prompt7p1 = "$input{PROMPT7P1}";
  $prompt7p2 = "$input{PROMPT7P2}";
  $prompt7p3 = "$input{PROMPT7P3}";
  $q7_0 = "$input{q7_0}";
  $q7_1 = "$input{q7_1}";
  $q7_2 = "$input{q7_2}";
  $q7_3 = "$input{q7_3}";
  $q7_4 = "$input{q7_4}";
  $q7_5 = "$input{q7_5}";
  $q7_6 = "$input{q7_6}";
  $q7_7 = "$input{q7_7}";
  $q7_8 = "$input{q7_8}";
  $prompt8g1 = "$input{PROMPT8G1}";
  $prompt8g2 = "$input{PROMPT8G2}";
  $prompt8g3 = "$input{PROMPT8G3}";
  $prompt8p1 = "$input{PROMPT8P1}";
  $prompt8p2 = "$input{PROMPT8P2}";
  $prompt8p3 = "$input{PROMPT8P3}";
  $q8_0 = "$input{q8_0}";
  $q8_1 = "$input{q8_1}";
  $q8_2 = "$input{q8_2}";
  $q8_3 = "$input{q8_3}";
  $q8_4 = "$input{q8_4}";
  $q8_5 = "$input{q8_5}";
  $q8_6 = "$input{q8_6}";
  $q8_7 = "$input{q8_7}";
  $q8_8 = "$input{q8_8}";
  $prompt9p1 = "$input{PROMPT9P1}";
  $prompt9p2 = "$input{PROMPT9P2}";
  $prompt9p3 = "$input{PROMPT9P3}";
  $q9_0 = "$input{q9_0}";
  $q9_1 = "$input{q9_1}";
  $q9_2 = "$input{q9_2}";
  $q9_3 = "$input{q9_3}";
  $q9_4 = "$input{q9_4}";
```

```perl
    $q9_5 = "$input{q9_5}";
    $q9_6 = "$input{q9_6}";
    $q9_7 = "$input{q9_7}";
    $q9_8 = "$input{q9_8}";
    $prompt10p1 = "$input{PROMPT10P1}";
    $prompt10p2 = "$input{PROMPT10P2}";
    $prompt10p3 = "$input{PROMPT10P3}";
    $q10_0 = "$input{q10_0}";
    $q10_1 = "$input{q10_1}";
    $q10_2 = "$input{q10_2}";
    $q10_3 = "$input{q10_3}";
    $q10_4 = "$input{q10_4}";
    $q10_5 = "$input{q10_5}";
    $q10_6 = "$input{q10_6}";
    $q10_7 = "$input{q10_7}";
    $q10_8 = "$input{q10_8}";
    $in_coming = "$input{VALUE14}";
    @page_fourteen = get_all_page_values();
    $array_size = scalar(@page_fourteen);
    call_me_to_test4($descr14, $array_size, $page_fourteen[0]);
}

sub mail_out_info {

    my ($mailman) = @_;
    $MAIL_MACHINE = "scimail.uwaterloo.ca";
    $from_account = "sempson";
    $mailprog = '/usr/bin/mail';
    open (MAIL2, "|$mailprog $mailman\n") || die "Cannot open $mailprog!\n";
    print MAIL2 "x-www-protocol: HTTP/1.1\n";
    print MAIL2 "x-www-remote-host: scimail.uwaterloo.ca\n";
    print MAIL2 "x-www-remote-addr: 129.97.4.100'}\n";
    print MAIL2 "From: $from_account\n";
    print MAIL2 "To: $mailman";
    print MAIL2 "Subject: MSci 311 Final Bonus Activity\n";
    print MAIL2 "MIME-Version: 1.0";
    print MAIL2 "\n";

    $boundary = "====" . time() . "====";

    print MAIL2 'Content-Type: multipart/alternative;';
    print MAIL2 "\n";
    print MAIL2 '      boundary="', $boundary, '"';
    $boundary = '--'.$boundary;
    print MAIL2 "\n\n";
    print MAIL2 "$boundary\n";
    print MAIL2 'Content-Type: text/plain;';
    print MAIL2 '      charset="iso-8859-1"';
    print MAIL2 "\n";
    print MAIL2 "Content-Transfer-Encoding: 7bit";
    print MAIL2 "\n";
    print MAIL2 "To_:   $mailman\n";
#   print MAIL2 "\n\n";
    print MAIL2 "Hi,\n\n";
    print MAIL2 "Your data for the MSci 311 Final Exam Bonus Activity has been submitted. Thank you for participating. We will be evaluating this in the next couple of days. Assuming that you have taken this task seriously, you can expect to receive 3 bonus marks added to your grade on the final exam. Have a great summer!\n\n";
    print MAIL2 "The Faculty of Engineering\n";
    print MAIL2 "University of Waterloo\n";
    print MAIL2 "www.eng.uwaterloo.ca\n\n";

    print MAIL2 "$boundary";
    print MAIL2 "\n";
    print MAIL2 'Content-Type: text/html;';
    print MAIL2 '      charset="iso-8859-1"';
    print MAIL2 "\n";
    print MAIL2 "Content-Transfer-Encoding: quoted-printable";
    print MAIL2 "\n\n";
    print MAIL2 '<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4=2e0 Transitional//EN">';
    print MAIL2 "\n";
    print MAIL2 "<html><head><title>MSci 311 Final Exam Bonus Activity</title></head>";
    print MAIL2 "<body><p>";
    print MAIL2 "<h4>Hi</h4>";
    print MAIL2 "\n\n";
    print MAIL2 "<p>Your data for the MSci 311 Final Exam Bonus Activity has been submitted. Thank you for participating. We will be evaluating this in the next couple of days. Assuming that you have taken this task seriously, you can expect to receive 3 bonus marks added to your grade on the final exam. Have a great summer!<p>";
    print MAIL2 "\n\n";
    print MAIL2 "<p><b>The Faculty of Engineering";
    print MAIL2 "\n";
    print MAIL2 "<br>University of Waterloo</b>";
    print MAIL2 "\n";
    print MAIL2 '<br><a href=3d"http://www.eng.uwaterloo.ca">www.eng.uwaterloo.ca</a></p>';
    print MAIL2 "\n";
    print MAIL2 "</body></html>";
    print MAIL2 "\n";
    print MAIL2 "$boundary--";
    print MAIL2 "\n";
    close (MAIL2);
```

```perl
}

sub go_to_start {

  if ($page_type eq "") {
    start_of_output_head();
    start_of_output();
    get_and_print_example();
    end_of_output();
  } else {
    if ($page_type eq "page1") {
      page_1_routine();
    } else {
      if ($page_type eq "page2") {
        page_2_routine();
      } else {
        if ($page_type eq "page3") {
          page_3_routine();
        } else {
          if ($page_type eq "page4") {
            page_4_routine();
          } else {
            if ($page_type eq "page5") {
              page_5_routine();
            } else {
              if ($page_type eq "page6") {
                page_6_routine();
              } else {
                if ($page_type eq "page7") {
                  page_7_routine();
                } else {
                  if ($page_type eq "page8") {
                    page_8_routine();
                  } else {
                    if ($page_type eq "page9") {
                      page_9_routine();
                    } else {
                      if ($page_type eq "page10") {
                        page_10_routine();
                      } else {
                        if ($page_type eq "page11") {
                          page_11_routine();
                        } else {
                          if ($page_type eq "page12") {
                            page_12_routine();
                          } else {
                            if ($page_type eq "page13") {
                              page_13_routine();
                            } else {
                              if ($page_type eq "page14") {
                                page_14_routine();
                              }
                            }
                          }
                        }
                      }
                    }
                  }
                }
              }
            }
          }
        }
      }
    }
  }
}

$DATA_DIR = "/u/sempson/public_html/thesis/research/data";
$poll_info = "$DATA_DIR/user_data.txt";
$poll_list = "$DATA_DIR/list_data.txt";
@clean_me = ("");
@answer_array = ("");
@return_array = ("");
$pick_type = ("");
$pick_nums = ("");
$pick_userid = ("");
$your_user = "$ENV{'REMOTE_USER'}";
$page_type = "$input{PAGE_TYPE}";
$number_of_list_items = 9;
$page_number_print = get_page_number();
$test_if_can = find_user();
if ($test_if_can eq "True") {
  $test_if_did = find_data();
  if ($test_if_did eq "False") {
    go_to_start();
  } else {
```

```
      have_got_you_already();
  }
} else {
  have_not_got_you();
}
exit(0);
```