The Content Domain of the Reasoning Construct as Found in Law Enforcement Job-Content Materials

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Logic-Based Taxonomies in Federal Selection Testing

- Colberg (1984) first proposed that verbal tests should be developed from taxonomies based on logic
  - Taxonomy defines the content domain of the Reasoning construct
- The taxonomy is a test blueprint that contains basic logical schemas (formulas)
  - each test question is based on a schema from the blueprint
  - each test represents a sampling from the schemas in the blueprint

Logic-Based Taxonomies in Federal Selection Testing

Major Logic-Based Taxonomies

- Colberg, 1983 — basic deductive schemas
- Colberg, 1989 — basic deductive schemas plus 11 illogical biases
- Nester, Reilly, Colberg, 1996 — basic deductive and inductive schemas plus illogical biases

Logic-Based Tests of Reasoning for Federal Personnel Selection

- Used since 1985
- Include the following examinations:
  - Contract Specialist Examination (1985)
  - Administrative Careers with America Examination (1990)
    - selections for 90+ occupations
  - Internal Revenue Agent Examination (1994)
  - ***Border Patrol Examination (1995)***
  - Immigration Officer Examination (1995)
  - Detention Enforcement Officer Examination (1997)
  - Customs Inspector and Canine Enforcement Officer Examination (1998)

Study of Law Enforcement Job-Content Materials

MOTIVATION FOR THE STUDY

- **Provide Important New Evidence of the Validity of the U.S. Border Patrol Logical Reasoning Test**

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METHOD OF THE STUDY

- **Compare the Content Domain of the Reasoning Construct in the USBP Logical Reasoning Test with the Content Domain of the Reasoning Construct in Job-Content Materials**

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REASONING CONSTRUCT

Taxonomy = Content Domain

x x x x x (schemas) x x x x x

x x x x x x x x x x x x x x x x x x x x x x x x x x x

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REASONING CONSTRUCT

Taxonomy = Content Domain

x x x x x (schemas) x x x x x

x x x x x x x x x x x x x x x x x x x x x x x x x x x

USBP Reasoning Test

Sample from the Schemas

x x x x x x x x

USBP Job-Content Materials

Include all the Schemas

x x x x x x x x x x x x x x x x x x x x x x

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METHOD OF THE STUDY

- Comparison
  - Use the Blueprint of Job-Related Foundational Thinking Skills to represent the USBP Logical Reasoning Test
    - Contains the explication of the content domain of the reasoning construct
  - Use the Border Patrol Handbook to represent Border Patrol Job-Content Materials
    - Examine the Border Patrol Handbook for Examples of the Content Domain of the Reasoning Construct in USBP Job-Content Material

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METHOD OF THE STUDY

- Border Patrol Handbook
  - **Primary Source of Border Patrol Policies and Procedures**
  - **Used Extensively by All Border Patrol Agents from Basic Training to Career's End**
  - **All Agents Are Given the Handbook upon Entering Service**
  - **All Agents Are Required to Insert New or Revised Pages in Their Handbook**

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METHOD OF THE STUDY

- Examine a random sample of pages from the Border Patrol Handbook
- Note all logical schemas in the information presented

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METHOD OF THE STUDY

- What are schemas?
  - **The formalized functions or processes of the construct of reasoning are known as schemas**
  - **All schemas are contained within one of two systems of logic, set logic and the logic of connectives**

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METHOD OF THE STUDY

- Deductive Reasoning
  - **Set Logic**
    - **Statements about Groups, Sets, or Categories**
  - **Logic of Connectives**
    - **Compound Logical Statements with Sentential Connectives**

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Example of Set Logic Schema

Question to audience: Is this conclusion valid or invalid?

Premise: No philosophers are wicked.

Conclusion: No wicked people are philosophers.

$(x)(S_x \triangle \sim P_x)$ Therefore, $(x)(P_x \triangle \sim S_x)$

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Example of Set Logic Schema

Question to audience: Is this conclusion valid or invalid?

Premise: Some of the biased reports are not up-to-date.

Conclusion: Some of the up-to-date reports are not biased.

$(\exists x)(S_x \wedge \sim P_x)$ Therefore, $(\exists x)(P_x \wedge \sim S_x)$

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Example of Set Logic Schema

- Syllogism

Premise: No philosophers are wicked.

Premise: Some Greeks are philosophers.

Conclusion: Some Greeks are not wicked.

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RESULTS OF THE STUDY

- "No person is disqualified from testifying as a witness." (20-4).

  Therefore, everyone is qualified to testify as a witness.

- $(x)(S_x \triangleq \sim\text{non-}P_x)$

  Therefore, $(x)(S_x \triangleq P_x)$

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

- "The fact that *not all aliens have language handicaps* must not be overlooked." (11-2).

  Therefore, some aliens do not have language handicaps

- $\sim(x)(S_x \triangle P_x)$

  Therefore, $(\exists x)(S_x \wedge \sim P_x)$

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

"As representatives of the Service, patrol agents should attempt to project a very positive image both on and off duty...." (3-1).

All representatives of the Service should attempt to project a very positive image both on and off duty.
All patrol agents are representatives of the Service.

Therefore, all patrol agents should attempt to project a very positive image both on and off duty.

Study of Law Enforcement Job-Content Materials

METHOD OF THE STUDY

- Deductive Reasoning
  - **Set Logic**
    - **Statements about Groups, Sets, or Categories**
  - **Logic of Connectives**
    - **Compound Logical Statements with Sentential Connectives**

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METHOD OF THE STUDY

- **Logic of Connectives**
  - **Statements with Connectors**
    - **Conditional Statements**
    - **"-Junctive" Statements**

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METHOD OF THE STUDY

- **Conditional Statements**
  - **If this legislation is passed, then the agency will receive special funding.**
  - p = this legislation is passed
  - q = the agency will receive special funding
  - **p ⟁ q**

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METHOD OF THE STUDY

- **Disjunctive Statement**
  - **Either the new position will be funded or the new software will be purchased.**
  - p = the new position will be funded
  - q = the new software will be purchased
  - **$p \vee q$**

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METHOD OF THE STUDY

- **Conjunctive Statement**
  - **The contract is signed and the merchandise has been delivered.**
  - p = the contract is signed
  - q = the merchandise has been delivered
  - **$p \wedge q$**

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

"Illegal establishments ... should be entered only when official business requires it." (3-1).

Therefore, if an illegal establishment should be entered, then official business requires it.

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

"Contents exempt under the Freedom of Information Act … shall not be divulged to unauthorized persons, except when excerpts therefrom are specifically authorized by the Commissioner." (1-8).

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RESULTS OF THE STUDY

Therefore, if contents exempt under FOIA are divulged to unauthorized persons, then the divulgence of the excerpts therefrom should have been specifically authorized by the Commissioner.

~p, unless q

therefore, p ⊃ q

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

"If the witness has already been convicted, or if punishment is barred, the privilege ceases to be applicable." (20-8).

Therefore, if the privilege is applicable, then the witness has not already been convicted and the punishment is not barred.

Study of Law Enforcement Job-Content Materials

RESULTS OF THE STUDY

- Random sample from every chapter
- Every page sampled contained multiple schemas. All three logics (2-set, 3-set, and connective) were represented extensively in the pages sampled.
  - Report presents many examples from all three categories of logic

Study of Law Enforcement Job-Content Materials

- *Taxonomy displays the content domain of the reasoning construct*
- *USBP Logical Reasoning Test Samples from Taxonomy*
- *USBP Handbook contains numerous schemas from all parts of the content domain*
- *The convergence is one-to-one*
- *Proves that the reasoning tasks that U.S. Border Patrol Agents are required to master are the same reasoning tasks that are assessed in the instrument used to select entry-level U.S. Border Patrol Agents*

EXECUTIVE SUMMARY

The Convergence of the Content Domain of the Reasoning Construct as Found in U.S. Border Patrol Job-Content Materials and as Sampled in the U.S. Border Patrol Verbal and Logical Reasoning Test

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The purpose of this study is to document the convergence of the content domain of the reasoning construct as found in Border Patrol job-content materials and as sampled in the U.S. Border Patrol Verbal and Logical Reasoning Test. Demonstrating the convergence provides important evidence of the validity of the U.S. Border Patrol Verbal and Logical Reasoning Test. The convergence proves that the reasoning tasks that U.S. Border Patrol Agents are required to master are the same reasoning tasks that are assessed in the test.

In this study, the Border Patrol Handbook is used to represent Border Patrol job-content materials. The Border Patrol Handbook serves as the primary source of Border Patrol policies and procedures and is used extensively by all Border Patrol Agents, from basic training to the end of an Agent's career. All Agents are given the Handbook upon entering service, and all Agents are required to insert new or revised pages in their Handbook as they are published.

This study is organized into three parts. Part I defines the construct of reasoning. Part II provides an analysis of the content domain of the reasoning construct as found in the Border Patrol Handbook and includes a sampling of the logical schemas present in the Border Patrol Handbook. Part III displays the sampling of the content domain of the reasoning construct in the U.S. Border Patrol Verbal and Logical Reasoning Test.

The numerous examples provided in this study demonstrate that the content domain of the reasoning construct is represented pervasively in the Border Patrol Handbook. The U.S. Border Patrol Verbal and Logical Reasoning Test is shown to sample the schemas from the content domain of the construct of reasoning. Thus, there is a one-to-one convergence between the content domain of the reasoning construct as found in the Border Patrol Handbook and in the U.S. Border Patrol Verbal and Logical Reasoning Test.

The Convergence of the Content Domain of the Reasoning Construct as Found in U.S. Border Patrol Job-Content Materials and as Sampled in the U.S. Border Patrol Verbal and Logical Reasoning Test

Introduction

The purpose of this study is to document the convergence of the content domain of the reasoning construct as found in Border Patrol job-content materials and as sampled in the U.S. Border Patrol Verbal and Logical Reasoning Test. Demonstrating the convergence provides important evidence of the validity of the U.S. Border Patrol Verbal and Logical Reasoning Test. The convergence proves that the reasoning tasks that U.S. Border Patrol Agents are required to master are the same reasoning tasks that are assessed in the U.S. Border Patrol Verbal and Logical Reasoning Test.

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Part I. The Construct of Reasoning

Reasoning is the single most important skill necessary for the performance of almost every job in the economy (Hunter, 1983). The occupation of law enforcement officer is no exception, as numerous job-analytic studies demonstrate (Hirsh, Northrop, & Schmidt, 1985; O'Leary, Rheinstein, & McCauley, 1990). Documentation of the importance of reasoning in the occupation of Border Patrol Agent can be found in Pollack, Gast, Beatty, Kimball, and Malik's (1997) study of supervisory and managerial Border Patrol Agents, and in Callen's (1995) study of journey-level Border Patrol Agents.

The primacy of the reasoning construct in the job-analytic studies should not be surprising. In every job where employees must make decisions, make judgments, or apply concrete rules to contingent situations, no mere automaton will do. The Border Patrol Handbook clearly expresses the utmost importance of reasoning skills in the occupation of Border Patrol Agent:

> While electronic intrusion devices contribute greatly toward control of the nation's border, the individual "sign-cutting" patrol agent will never be obsolete. Therefore, sign cutting must be mastered by every patrol agent. (7-1). Becoming aware of sign requires coordination of all the senses and of deductive reasoning. (7-2). (The page numbering system of the Border Patrol Handbook lists the chapter number followed by the chapter page number.)

The content domain of the construct of reasoning has been systematically defined for use in the development of reasoning tests by Colberg (1984, 1989). The formalized functions or processes of the

construct of reasoning are known as schemas. Since the days of Aristotle, when reasoning was first formalized and systematically studied, it has been recognized that all schemas are contained within one of two systems of logic, set logic and the logic of connectives (what Aristotle called "hypotheticals"). Set logic deals with categorical statements about classes or "sets" of things, and the logic of connectives deals with connective statements.

While the basic schemas of reasoning contained within set logic can be divided into two branches, two-set logic and three-set logic, both branches deal with categorical statements. Categorical statements are statements about two sets in which one set is predicated of another set using quantifiers such as "all," "none," and "some." Two-set logic entails the implication and equivalence of the categorical statement. Three-set logic entails the transitivity of implication and equivalence from one categorical statement to another categorical statement when the two statements have one set in common.

Connective statements are compound sentences. The statements that comprise a connective statement are logically related to one another by connectives (e.g., "and," "or," and "if…then…"), which are also contained within the connective statement. The logic of connectives entails the implication and equivalence of connective statements. The logic of connectives also entails the transitivity of implication and equivalence from one connective statement to another connective statement when both connective statements contain a statement in common.

Part II. Schemas Found in Job-Content Materials

During a law enforcement operation, officers first gather available relevant information, and then make judgments based on this information. A logical schema, like an operation, includes a premise or premises (the available relevant information of the operation) and a conclusion (the judgment of the operation). In most training situations, premises (relevant information) are in the training materials and students show a mastery of the materials by demonstrating that they can draw correct conclusions from the premises. In this part of the study, the presence of the logical premises of the construct of reasoning in the Border Patrol Handbook is documented by providing specific passages from the Handbook in which schemas from both set logic and the logic of connectives are found. It is through documenting the presence of logical premises in the Handbook that the direct applicability of the reasoning assessment in the U.S. Border Patrol Verbal and Logical Reasoning Test to the job of Border Patrol Agent is demonstrated.

The examples provided in this study by no means exhaust the schematic content of the Handbook. On practically every page of the Handbook at least one (usually several) quantifier or connective is represented. In order to demonstrate the pervasive presence of schemas, at least one example from each chapter of the Handbook is given. (Because Chapter 13 is sensitive material that is exempt from FOIA requests, no examples from that chapter are given.)

The content of the Border Patrol Handbook can be loosely divided into two categories, definitions and operations. As the examples of two-set logic and three-set logic demonstrate, the material in the Handbook in which terms are defined or described makes extensive use of categorical statements. The examples of connective statements exemplify how the material in which operations or procedures are set forth makes extensive use of connective statements.

A. Two-Set Logic

There are four basic statements in two-set logic: the A statement, the E statement, the I statement, and the O statement. The A statement signifies that all the members of one set are included in a second set.

An example of the A statement is "All Germans are European." The most common indicators of the A statement are the quantifiers "all," "every," "each," and "any," and the adverb "always." The E statement signifies that no members of one set are included in a second set. An example of the E statement is "No Federal convicts are law enforcement officers." The most common indicators of the E statement are the quantifiers "no" and "none" and the adverb "never." The I statement signifies that some members of one set are included in a second set. An example of the I statement is "Some members of Congress are lawyers." The O statement signifies that some members of one set are not included in a second set. An example of the O statement is "Some of the employees are not full-time employees."

One final point about categorical statements needs to be made. The logical quantifier is sometimes tacit in categorical statements. It is not uncommon for the quantifier "all" to be tacit in the expression of definitions or descriptions of terms. For example, "Border Patrol Agents are Federal law enforcement officers" is logically equivalent to "All Border Patrol Agents are Federal law enforcement officers." Whether the quantifier is expressed or tacit, the logic of the statement remains the same.

Many of the examples of schemas of two-set logic are passages in which terms are defined or described. The dissemination of this sort of information naturally takes the form of categorical statements. Because the Handbook provides a great deal of information about definitions and descriptions of various occupations and tasks, the Handbook makes extensive use of categorical statements.

Examples

Example I: "(The Border Patrol Handbook) will prove helpful in many situations, but it is not intended to provide complete instructions for every situation." (Foreword).

This example includes an I statement ("many" is logically equivalent to "some") followed by a negated A statement. Moreover, the writer expects the reader to infer the O statement from the negation of the A statement: it is not intended to provide complete instructions for every situation; therefore, there are some situations for which the Border Patrol Handbook does not provide complete instructions.

Example II: "Each (sector) is organized and staffed to be flexible and relatively self-sufficient, equipped to operate as an independent unit in accomplishing its mission. (1-2).

This passage is an example of the A statement which uses the quantifier "each."

Example III: "… no patrol agents engaged in the apprehension or detention of aliens or other violators shall be assigned to work alone in known areas of unusual danger to personal safety." (1-5).

This passage is an example of the E statement. It is worth noting the double disjunction: apprehension or detention (of aliens or other violators).

Example IV: "While no hard and fast rule can be made, those making assignments should understand that no regulation requires that patrol agents always work in pairs." (1-5).

The passage contains two E statements.

Example V: "While it is unquestionably hazardous for a patrol agent to work alone on some assignments..." (1-5).

This passage is an example of the I statement.

Example VI: "All publications issued to Service officers must be kept up to date…" (1-9).

This passage is an example of the A statement.

Example VII: "Pursuant to Section 287, patrol agents have authority without warrant: … (t)o execute any warrant or other process issued by any officer under any law regulating the admission, exclusion, or expulsion of aliens…" (2-2, 2-3).

This passage exemplifies the frequency of the occurrence of the A statement in the Handbook. The quantifier "any," which is equivalent to the quantifier "all," is used three times in one sentence. The sentence also contains the disjunctive "or" twice.

Example VIII: "Our national credo holds that all persons must be treated fairly and humanely and that no one should be subjected to mistreatment or exploitation." (3-1).

This sentence contains an A statement, an E statement, and a disjunction.

Example IX: "Training is a continuing process in which patrol agents may acquire the ability to handle various situations, some of which present new and difficult problems." (3-1).

This sentence includes an I statement.

Example X: "Public relations is not an exact science. Although there are no basic formulas, no mathematical yardsticks, or very few rules and regulations, some obvious guideposts will create good public relations for the Service and inevitably reflect favorably on each of its employees." (4-1).

This passage contains the following quantifiers: no (twice), very few, some, and each. Each phrase that contains a quantifier could be separated from the others as an explicit categorical statement.

Example XI: "In every area of the country, certain types of insects and animals come out only at night" (7-3).

This passage is an example of the A statement.

Example XII: "All sites must be located with sufficient slowing and stopping space." (9-4).

This passage is an example of the A statement.

Example XIII: "All areas where persons hide and wait to board outgoing trains should be systematically checked." (10-11).

This passage is an example of the A statement.

Example XIV: "The fact that not all aliens have language handicaps must not be overlooked." Within this passage is the negated A statement "all aliens have language handicaps." (11-2).

The negated A statement is equivalent to the O statement "some aliens do not have language handicaps."

Example XV: "No person is disqualified from testifying as a witness." (20-4).

This passage is an example of an E statement. It uses two negatives (no and disqualified) to relate a positive message: everyone is qualified to testify as a witness. The positive sentence is the logical equivalent of the negative sentence and is known as its obverse.

Example XVI: "Most police agencies freely and promptly cooperate with the Service." (21-4).

This sentence is an example of a categorical statement that uses the intermediate quantifier "most." This sentence logically implies the following statements: "some police agencies freely and promptly cooperate with the Service" and "some police agencies do not cooperate freely and promptly with the Service"—an I and an O statement.

Example XVII: "Any person with specific knowledge of an immigration or criminal violation is a potential informant." (22-1).

This sentence is an A statement that uses the quantifier "any."

Example XVIII: "All patrol agents are expected ... to take an active part in gathering all information available to them in the areas in which they work." (23-3).

This sentence is an example of the A statement.

Example XIX: "All patrol agents are responsible for completely understanding and adhering to the Service policy that permits the use of firearms." (24-3).

This sentence is an example of the A statement.

Example XX: "Only factory ammunition procured or approved by the Service may be carried in sidearms and cartridge loops." (24-1).

This sentence is equivalent to the following A statement: "All ammunition that may be carried in sidearms and cartridge loops is factory ammunition that has been procured or approved by the Service."

B. Three-Set

Three-set logic is the logic of the traditional syllogism. The traditional syllogism is based on any two of the four basic statements of two-set logic. In material concerning laws or regulations, almost all of the syllogisms have the A statement as one of their two premises. The most common syllogism is based on two A statements. For example, "all helicopter pilots for the Border Patrol are Border Patrol Agents" and "all Border Patrol Agents have graduated from the Border Patrol Academy" are each A statements. If we understand these statements and their relationship to each other, we are able to draw valid conclusions from them. For example, the statement "all helicopter pilots for the Border Patrol have graduated from the Border Patrol Academy" is a valid conclusion. Also, the statement "some graduates of the Border Patrol Academy are helicopter pilots for the Border Patrol" is a valid conclusion. An invalid conclusion would be "all graduates of the Border Patrol Academy are helicopter pilots for the Border Patrol."

As with the examples provided for two-set logic, many of the examples of schemas of three-set logic are passages in which terms are defined or described. Because the Handbook often provides information about terms in multiple sentences, the Handbook contains numerous pairs of categorical statements which have a set in common, and thus form the basis for a syllogism.

It should be reiterated that in the expression of categorical statements, the quantifier is sometimes tacit. It is not uncommon for the quantifier "all" to be tacit in the expression of definitions or descriptions of terms. Just as "each," "any," "every," are equivalent to "all," so too is the statement in which "all" is understood but not expressed explicitly.

Examples

Example I: "At the Central Office level, the Associate Commissioners, Assistant Commissioners, and General Counsel have delegated authority for conducting their respective operational activities. As one of these officers, the Assistant Commissioner, Border Patrol, is responsible for planning, organizing, coordinating, directing, and controlling enforcement programs designed to prevent the smuggling and illegal entry of aliens into the United States, and to apprehend persons guilty of such violations." (1-2).

This passage is an example of a syllogism based on two A statements. In the first sentence, the authority of certain positions at the Central Office level, including Assistant Commissioners, is established. In the second sentence, it is established that the Assistant Commissioner, Border Patrol, is one of those at the Central Office level with delegated authority. The second sentence goes on to express what must follow: the Assistant Commissioner, Border Patrol, has delegated authority to conduct operational activities, which are enumerated in the passage.

Example II: "Patrol agents must thoroughly familiarize themselves with the types of Service files as well as with their creation, maintenance, and closing. Patrol agents must study this material and know what files and information are available." (1-8).

This passage is an example of two A statements, both having the set "Patrol Agents" in common. In the Border Patrol Handbook, the most frequent occurrence of two categorical statements that have a set in common is two A statements. It occurs frequently because the Handbook uses multiple sentences to define and/or describe laws, Agents, rules, etc. Almost every time two sentences in the Handbook begin with the same set (e.g. Patrol Agents), the basis for this type of syllogism is present.

Example III: "Patrol agents are immigration officers recommended by the Commissioner and appointed by the Attorney General in accordance with laws and Office of Personnel Management regulations. Pursuant to Section 287, patrol agents have authority without warrant: … (ten items are listed)." (2-2).

This passage is example of a syllogism based on two A statements.

Example IV: "As representatives of the Service, patrol agents should attempt to project a very positive image both on and off duty…" (3-1).

This passage is example of a syllogism based on two A statements.

Example V: "As enforcement officers, border patrol agents are particularly dependent on the good will and cooperation of the public to insure the continual receipt of useful information." (3-5)

This passage is example of a syllogism based on two A statements.

Example VI: "As representatives of the U.S. Government, patrol agents are obligated to conduct themselves in a dignified and worthy manner while effectively accomplishing their assigned tasks." (3-5).

This passage is example of a syllogism based on two A statements.

Example VII: "As representatives of the Service, agents must conduct themselves in a professional manner, regardless of the circumstances." (4-4).

This passage is example of a syllogism based on two A statements.

Example VIII: "Effective methods of dealing with aliens do not include any elements of the 'third-degree.' Those methods are a poor substitute for skill and training and will not be tolerated." (4-5).

The first sentence is an E statement. The second statement is an A statement. The two sentences have the set "methods using the 'third-degree'" in common. We could rephrase the passage in the following way. "No methods that use the 'third-degree' are effective methods of dealing with aliens. All methods that use the third-degree are a poor substitute for skill and training and will not be tolerated."

Example IX: "No persons (aliens or persons believed to be aliens), however, can be compelled to answer questions that may be self-incriminating or that may be used against them in a court of law. While no time limit is placed on interrogations, no persons (aliens or

persons believed to be aliens) should be subjected to questioning for so long, or under such adverse conditions, as would constitute duress." (5-4).

This passage contains two E statements which have the statement "aliens or persons believed to be aliens" in common. The inclusion of this passage as an example might seem unwarranted because nothing can be validly concluded from two E statements, (i.e., two E statements cannot be the basis for a valid syllogism). However, knowing when a conclusion is unsupported by the premises is an essential component of reasoning. In order to master reasoning, one must know what does and does not follow from given premises.

Example X: "Detailed maps of areas for which offices are responsible are necessary. These maps can be used to depict areas to be covered, and to reflect the dates and results of coverage at specific locations. These maps also are useful in coordinating operations with Service aircraft and defeating the organized efforts of some employers, who utilize scanners and two-way radios to harbor illegal aliens and hamper Service operations." (8-2).

This passage is an example of three A statements, any two of which could be used in a syllogism.

Example XI: "Jails and public institutions, such as city and county hospitals, should be routinely checked." (11-2).

This passage is an example of two syllogisms based on A statements.

Example XII: "Many public and private records are available for use in locating and identifying deportable aliens. Public records are maintained by federal, state, county, and municipal agencies." (11-7).

This passage is an example of an I statement and an A statement, where the set "public records" is held in common by the I and A statements.

Example XIII: "Many public and private records are available for use in locating and identifying deportable aliens. Private records are maintained by social and welfare agencies, unions, and business firms." (11-7).

This passage is an example of an I statement and an A statement, where the set "private records" is held in common by the I and A statements.

Example XIV: "Some public records may be examined on request. At the opposite extreme, some public records cannot be examined except by court order." (11-7).

This passage has an I statement and an O statement, and both statements have the set "public records" in common. This example is important for the same reason that Example IX is important—an I and an O statement cannot be the basis for a valid syllogism.

Example XV: "Shipping agents are the first persons at ports to know when vessels are expected, either coastwise or from foreign (ports). Because they represent the owners, shipping agents are made parties to all matters concerning the vessels." (12-3).

This passage contains three A statements which contain the set "shipping agents." (1) Shipping agents are the first persons at ports to know when vessels are expected, either coastwise or from foreign ports. (2) Shipping agents represent the owners. (3) Shipping agents are made parties to all matters concerning the vessels. Any two of the statements can be used to make a syllogism.

Example XVI: "Principals are the persons who have primary responsibility for the success of operations. They maintain continuous liaison with the other conspirators. Principals share in a major portion of the profits and, in many instances, escape prosecution because they seldom take part in the actual smuggling." (14-4).

As stated previously, multiple definitions and descriptions of a set are the basis of syllogisms based on two A statements. In the passage quoted, there are several statements that include the set "principals" and that could be used in a syllogism.

Example XVII: "Smugglers are in charge of the physical operation of conveying aliens across the international boundary. Smugglers are responsible for gathering various operatives, such as recruiters, guides, transporters, and harborers." (14-4).

This passage contains two A statements, both of which contain the set "smugglers."

Example XVIII: "Recruiters operate directly under the smugglers. Recruiters make the original contact with aliens." (14-4).

This passage contains two A statements, both of which contain the set "recruiters."

Example XIX: "All pilots are required to maintain current instrument (IFR) and night experience as outlined in Part 61 of the Federal Aviation Regulations (FAR). All pilots are required to pass semi-annual flight proficiency check rides applicable to their positions and types of aircraft flown." (15-2, 15-3).

This passage includes two A statements that contain the set "pilots."

Example XX: "By regulation, the Attorney General has delegated administrative enforcement authority to the Commissioner, who in turn has redelegated authority to immigration officers. The term "immigration officer" includes, among others, immigration inspectors, border patrol agents, and investigators." (17-1).

This passage is a syllogism based on two A statements. The first sentence means that all immigration officers have been delegated administrative enforcement authority from the Commissioner (who has been delegated administrative enforcement authority from the Attorney General). The second sentence means that all Border Patrol Agents (among others) are immigration officers. The unstated conclusion is that all Border Patrol Agents have been delegated administrative enforcement authority from the Commissioner.

C. Connectives

The logic of connectives entails two types of connective statements: conditional statements and conjunctive and disjunctive statements. These two types of connective statements can be embedded in

one another. For example, a conditional statement can be embedded within a disjunctive statement, and a conjunctive statement can be embedded within a conditional statement.

The basic conditional statement is the "if-then" statement—if statement "p," then statement "q." For example, "if this legislation is passed, then the agency will receive special funding." The "if-then" statement can be expressed in many ways. For instance, "q, if p," "when p, then q," "p only if q," or "not p unless q." When a conditional statement and its converse are both true, the statements are sometimes written together as a biconditional statement. For example, "p if q" and "p only if q" can be condensed into "p if and only if q." Just as syllogisms can be derived from categorical statements that have a set in common, so too can syllogisms be derived from connective statements that have a statement in common.

The basic disjunctive statement is "p or q." For example, "Either Initiative 8 or Initiative 9 will receive funding." The basic conjunctive statement is "p and q." For instance, "The military and the civilian Federal employees will receive a 3.9% raise."

As was said above, the content of the Border Patrol Handbook can be loosely divided into two categories, definitions and operations. The examples of connective statements provided in this section exemplify how the material in which operations or procedures are set forth makes extensive use of connective statements. Because a great deal of the Handbook is devoted to establishing operational procedures, connective statements are found throughout the Handbook. In the Handbook, connective statements are expressed in many ways. The basic "if p, then q" statement is expressed as "when p, then q," "q, if p," "not-p, unless q," and many other ways. It should be noted that in most cases, "then" is left tacit, which in no way degrades the logic of the connective statement.

<u>Examples</u>

Example I: "The Handbook is to be turned in when an officer leaves the Service or is permanently assigned to duties not connected with Border Patrol." (Foreword).

This sentence is an example of a complex schema being used in ordinary parlance. This sentence is a conditional sentence that contains a disjunction—if p or q, then r. We can rephrase the sentence to make its logical structure more obvious: If an officer leaves the Service or if an officer is permanently assigned to duties not connected with Border Patrol, then the officer is to turn in his or her Handbook.

Example II: "When a Handbook is turned in, a sector supervisor shall audit it before sending it to the Border Patrol Academy." (xi).

This sentence is an example of a conditional embedded within a conditional. The first conditional is "When a Handbook is turned in, a sector supervisor …"

Example III: "If (the Handbook is) complete, he shall enter, on the line following the last TM inserted, the word 'complete' followed by the date and his initials. If incomplete, a memorandum listing the missing pages shall accompany the Handbook to the Academy." (xi).

Each of these sentences is a conditional if-then statement. Together, they form the basis for a connective syllogism because they have the logical statement "the Handbook is complete" in common (the statement is negated in the second sentence, but it is still present in both sentences).

Example IV: "These instructions are also keyed to corresponding regulations, or, if there are none, directly to pertinent parts of the statute." (1-6).

This short passage is schematically complex. It contains a disjunction, a conditional statement, and an E statement.

Example V: "Contents exempt under the Freedom of Information Act are printed on blue pages and shall not be divulged to unauthorized persons, except when excerpts therefrom are specifically authorized by the Commissioner." (1-8).

This passage is an example of a logical equivalent to the "if-then" statement. An if-then statement can be expressed as "not-p, unless q." Treating "except when" as "unless," we see that the passage is a clear example of "not-p, unless q." We can rephrase the sentence to show its "if-then" character: "if contents exempt under the Freedom of Information Act are divulged to unauthorized persons, then the divulgence of the excerpts therefrom should have been specifically authorized by the Commissioner."

Example VI: "When patrol agents leave the Service, they [publications issued to Service officers] are to be returned with other Government property." (1-9).

This passage is an example of an "if-then" statement, where "when" is used instead of "if."

Example VII: "Numerous provisions of Title 18 of the U.S. Code also come within the investigative jurisdiction of the Service when violations of them relate to proceedings arising under the immigration and nationality laws." (2-1).

This passage is an example of the "if-then" conditional statement where "when" is used instead of "if." The "if" clause comes after the "then" clause in the sentence, even though the "if" clause comes before the "then" clause logically. Also, the "then" clause is an I statement because "numerous" is logically equivalent to "some."

Example VIII: "Pursuant to Section 287, patrol agents have authority without warrant: … (t)o arrest aliens entering or attempting to enter the United States in violation of the immigration laws, or to arrest any aliens in the United States if there is reason to believe they are in violation of any such laws and are likely to escape before arrest warrants can be obtained…" (2-2).

The overall logical structure of the phrase after the colon is "p or q." The statement "p" is "to arrest aliens entering or attempting to enter the United States in violation of immigration laws" and contains a disjunction. The statement "q" is "to arrest any aliens in the United States if there is reason to believe they are in violation of any such laws and are likely to escape before arrest warrants can be obtained" and is a conditional statement.

Example IX: "Generally, private persons may make an arrest when a crime (felony or misdemeanor) is committed or attempted in their presence, or when the person arrested has committed a felony, even though not in their presence." (2-3).

The overall logical structure of this statement is a disjunction within a conditional statement—if p or q, then r. The statement "p" is the first phrase that begins with "when" and contains a disjunction within a disjunction. The statement "q" is the second phrase that begins with "when." The statement "r" is "private persons may make an arrest."

Example X: "If the person committing such acts uses a deadly or dangerous weapon, the penalty is a maximum fine of $10,000 and/or 10 years imprisonment." (2-3).

The passage is an example of an "if-then" statement. The "then" clause contains an inclusive "or" disjunction. It could be rephrased as "the penalty is a maximum fine of $10,000 or 10 years imprisonment, or both."

Example XI: "Illegal establishments and places held in disrepute should be entered only when official business requires it." (3-1).

The logical structure of this sentence is "p, only if q," which is equivalent to "if p, then q."

Example XII: "If not in uniform, patrol agents must present official credentials and insure there is an understanding of the identification, as well as the purpose of the interview. Even if in uniform, patrol agents must show credentials if requested to do so." (4-4).

This passage contains two conditional sentences, and both have the statement "in uniform" in common, thus forming the basis for a syllogism. The passage has the logical form: if not-p, then q; if p, then (q, if r).

Example XIII: "When occupying or leaving a position on both operations, patrol agents should be careful not to reveal their presence." (6-3).

This sentence has the structure "if p or q, then r."

Example XIV: "If interpreters are employees of the Service, no oath is necessary. They are simply identified for the record. If interpreters are not Service employees, they should be identified and qualified for the record—i.e., questioned with respect to their ability to speak and translate into English the language of the person being questioned, and vice versa." (16-2, 16-3).

The passage can be symbolized in the following way: If p, then q; if not-p, then not-q. The passage taken as a whole is logically equivalent to a biconditional (i.e., p if and only if q).

Example XV: "If the yellow copy of the I-94 from the I-213 is forwarded to the Central Office, the cancelled I-95A is attached to it. If the yellow copy is not forwarded to the Central Office, the cancelled I-95A is attached to the original I-213." (18-7).

This passage contains the basis for a connective syllogism. Both sentences are conditional sentences, and both contain the statement "the yellow copy of the I-94 from the I-213 is forwarded to the Central Office," one statement being in affirmative form and the other being in negative form.

Example XVI: "The burden is on the Service in criminal investigations because if sufficient admissible evidence is not available at trial, the prosecution will fail." (19-1). The phrase "if sufficient admissible evidence is not available at trial, the prosecution will fail" is an example of an if-then conditional statement.

Example XVII: "If the witness has already been convicted, or if punishment is barred (by the expiration of a statute of limitation or by full statutory immunity), the privilege ceases to be applicable." (20-8).

This passage has the logical structure of "if p or q, then r."

Example XVIII: "Patrol agents may perform liaison in foreign territories only when assigned to do so by the Chief Patrol Agent." (21-6).

In this sentence, "only when" is logically equivalent to "only if." The logical structure of this sentence is "p only if q," which is equivalent to "if p, then q."

Example XIX: "Whenever informants testify in a Service or judicial proceeding, a transcript should be placed in their Service files." (22-8).

This sentence is a conditional "if-then" statement. In this sentence, "whenever" is the logical equivalent of "if."

Example XX: "Patrol agents should burn obsolete memorandums, operations instructions, schedules, or printed matter intended for their use. If such disposal is not feasible, documents should be thoroughly torn." (23-9).

The second sentence in the passage quoted here is a conditional "if-then" statement.

Part III. Schemas Found in Test of Reasoning for Entry-Level Border Patrol Agent Positions

We denoted the basic schemas of reasoning in two-set and three-set logic and in the logic of connectives. The U.S. Border Patrol Verbal and Logical Reasoning Test samples the content domain of the reasoning construct by sampling these schemas.

There are two series of the U.S. Border Patrol Verbal and Logical Reasoning Test. Each series contains twenty unique reasoning items, for a total of forty items for both series. These items are categorized below in order to show that the U.S. Border Patrol Verbal and Logical Reasoning Test samples the content domain of the construct of reasoning. These categories clearly demonstrate that the content domain of the reasoning construct as sampled by the U.S. Border Patrol Verbal and Logical Reasoning Test is identical to the content domain of the reasoning construct as found in the Border Patrol Handbook. Future series of the U.S. Border Patrol Verbal and Logical Reasoning Test will follow the schematic design of the original two series.

A. Two-Set

The U.S. Border Patrol Verbal and Logical Reasoning Test contains two-set items. The items are based on the A statement, the E statement, the I statement, and the O statement. The U.S. Border Patrol Verbal and Logical Reasoning Test also makes use of the T statement, which contains the quantifier "most."

B. Three-Set

The U.S. Border Patrol Verbal and Logical Reasoning Test contains three-set items. The items are based on two A statements, an A statement and an E statement, an A statement and an I statement, an A statement and an O statement, and an I statement and an E statement. The U.S. Border Patrol Verbal and Logical Reasoning Test also contains items based on an A statement and a T statement.

C. Connectives

The U.S. Border Patrol Verbal and Logical Reasoning Test contains connective items. The items are based on the "if-then" conditional statement, the disjunctive statement "p or q," two conditional statements, and a disjunctive statement and a conditional statement.

Conclusion

As the numerous examples provided in this study bear witness, the content domain of the reasoning construct is represented pervasively in the Border Patrol Handbook. The Handbook contains numerous schemas from all parts of the content domain (i.e., set logic and the logic of connectives). The U.S. Border Patrol Verbal and Logical Reasoning Test samples the schemas from the content domain of the construct of reasoning. As this study has clearly demonstrated, there is a one-to-one convergence between the content domain of the reasoning construct as found in the Border Patrol Handbook and in the design of the U.S. Border Patrol Verbal and Logical Reasoning Test.

References

Border Patrol Handbook, Restricted document (Revised 1985). Washington DC: U.S. Immigration and Naturalization Service.

Callen, N.F. (1995). *A job analysis and task-ability linkage study of the occupation of U.S. Border Patrol Agents* (PRDC 96-01). Washington, DC: U.S. Office of Personnel Management, Employment Service Group, Personnel Resources and Development Center.

Colberg, M. (1984). Towards a taxonomy of verbal tests based on logic. *Educational and Psychological Measurement, 44*, 113-120.

Colberg, M. (1989). *Taxonomy for verbal reasoning questions used in the written test portion of the Administrative Careers With America examining program*, Restricted document. Washington, DC: U.S. Office of Personnel Management, Office of Personnel Research and Development.

Hirsh, H. R., Northrop, L. C., Schmidt, F. L. (1985). *Validity generalization results for law enforcement occupations*. (OSP-85-2). Washington, DC: U.S. Office of Personnel Management, Office of Staffing Policy.

Hunter, J.E. (1983). *Test validation for 12,000 jobs: An application of job classification and validity generalization analysis to the General Aptitude Test Battery (GATB)*. Washington, DC: U.S. Department of Labor, Division of Counseling and Test Development, Employment and Training Administration.

O'Leary, B. O., Rheinstein, B. J., & McCauley, D. E., Jr. (1990). *Job analysis of professional and administrative occupations*. U.S. Office of Personnel Management, Office of Personnel Research and Development.

Pollack, D.M., Gast, I.F., Beatty, G.O., & Malik, L.M. (1997). *Development and validation of promotion and diagnostic assessments for Supervisory Border Patrol Agents at the Immigration and Naturalization Service*. Washington, DC: U.S. Immigration and Naturalization Service, Research and Development Division.