# Semantic Types for Decomposing Evidence Assessment in Decisions on Veterans' Disability Claims for PTSD

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## ABSTRACT

This paper presents a semantic analysis for mining arguments or reasoning from the evidence assessment portions (fact-finding portions) of adjudicatory decisions in law. Specifically, we first decompose the reasoning into primary branches, using a rule tree of the substantive issues to be decided. Within each branch, we further decompose argumentation using two main categories: reasoning that deploys special legal rules and reasoning that does not. With respect to special legal rules, we discuss legal-presumption rules, sufficiency-of-evidence rules, and the benefit-of-the-doubt rule. Semantic anchors for this decomposition are provided by identifying the inferential roles of sentences – principally evidence sentences, finding-of-fact sentences, evidence-based-reasoning sentences, and legal-rule sentences. We illustrate our methodology throughout the paper, using data and examples from a dataset of veterans' disability claims in the U.S. for posttraumatic stress disorder (PTSD).

## CCS CONCEPTS

• **Information systems** → Decision support systems; Data mining; • **Applied computing** → Law;

## KEYWORDS

Semantic data, inference role, evidence assessment, fact finding, sentence-role type system, legal rule, argument mining, argumentation mining, computational argumentation

## 1 INTRODUCTION

This paper presents a semantic analysis for mining arguments or reasoning patterns from the evidence assessment portions of adjudicatory decisions in law. By "semantic analysis," we mean the process of relating sentences in the text to appropriate propositions in a pattern of reasoning or argument. By "reasoning" or "argument," we mean simply sets of propositions, one of which (the conclusion) can be reasonably believed to be true if the other propositions (the premises or conditions) are reasonably believed to be true [9]. Thus, our approach is compatible with many proposed frameworks for classifying argument types [14]. By "evidence assessment" we mean the reasoning of the trier of fact from the evidence in the legal record to the official findings of fact in an adjudicatory legal case.

Identifying the inferential roles of sentences within adjudicatory decisions presents special problems, because sentences in adjudicatory decisions typically have a wide variety of functions. These functions include: stating the procedural history of the case; stating the arguments of different parties on motions, and the rulings on those motions, and explaining the bases for those rulings; stating the potentially applicable legal rules, legal policies and principles, and providing citations to authority; summarizing the evidence presented and the arguments of the parties for how to assess the probative value of that evidence, and stating and explaining the tribunal's findings of fact; and announcing the final decision in the case.

Given so many functions of sentences within a decision, it can be extremely difficult to correctly classify the role of a specific sentence. For example, a sentence might state (in part) that *the veteran currently has posttraumatic stress disorder (PTSD)*, but

that clause might occur in a sentence that states the allegation of the veteran, the testimony of an expert witness, the content of a medical record, an applicable legal rule, an event in the procedural history, a ruling on a motion, or a finding of fact. Moreover, the decision might be written in such a way that threads of reasoning or argument overlap. Statements of legal rules might occur within the context of reporting evidence or reciting the fact-finding reasoning. Findings of fact might occur within the explanation of a ruling of law on a motion. In order to extract coherent argument patterns, we must be able to identify these different sentence roles and disentangle the overlapping threads of reasoning.

In this paper we report on our empirical investigations into these issues, using our analysis of a sample of publicly available decisions that adjudicate claims by military veterans in the United States for compensation for a service-related disability ("disability claims"). We focus on claims for posttraumatic stress disorder ("PTSD").

In Section 2, we briefly discuss prior work, with a focus on attribution relations and legal discourse models as necessary tools for mining sentence roles. In Section 3, we briefly discuss the dataset of veterans' disability claims. Sections 4-6 describe a progressive decomposition of the evidence assessment portions of decisions on such claims. Section 4 discusses generally the inferential types of sentences frequently found within evidence assessment, as well as the primary branches of reasoning or argument within PTSD cases. Section 5 provides examples of semantic types within evidence assessment when that assessment deploys special legal rules. Section 6 provides examples of semantic types for evidence assessment that does not deploy special legal rules. Finally, in Section 7, we conclude with an indication of future work.

## 2    PRIOR RELATED WORK: ARGUMENT MINING FROM JUDICIAL DECISIONS

This paper draws on many strands of prior work developing semantic types for mining reasoning or arguments for computational purposes. [14, 23] The decomposition of evidence assessment, however, depends upon identifying attribution relations and employing a legal discourse model, which we now discuss in more detail.

### 2.1    Attribution Relations

To identify the inferential roles of sentences and extract coherent argument patterns from adjudicatory decisions, an important sub-task is determining the subject or source to which we should attribute a stated proposition [17]. Attribution, in the context of argumentation mining, is the descriptive task of determining which actor is asserting, assuming or relying upon which propositions, in the course of presenting reasoning or argument. Although attribution is a classic problem area in natural language processing generally [8, 13, 17, 18], there has been limited work on attribution in respect to argument mining from legal documents. [11] reported on a project to annotate sentences in House of Lords judgments for their argumentative roles. Two tasks were to attribute statements to the Law Lord speaking about the case or to someone else (attribution), and to classify sentences as formulating the law objectively vs. assessing the law as favoring a conclusion or not favoring it (comparison). This work

extended the work of [19] on attribution in scientific articles. Unlike the adjudicatory decisions used in our study, the House of Lords judgments studied by [11] treated facts as already settled in the lower courts. A broader discussion of attribution within the context of legal decisions is found in [21].

An example of a sentence explicitly stating an attribution relation is: *The Board finds that the veteran currently has PTSD*. As illustrated in this example, **attribution relations** have at least three elements or predicate arguments [17]:

(A) The **attribution object**: the propositional content of a sentence that we attribute to some actor or source, expressed in normal form by an embedded clause (in the example, *the veteran currently has PTSD*);

(B) The **attribution subject**: the actor or source to which we attribute the propositional content of the sentence (in the example, *the Board*); and

(C) The **attribution cue**: the lexical anchor or cue that signals the attribution, and which provides us the grounds for making the attribution (in the example, *finds that*).

As indicated, an attribution object is a proposition, an attribution subject is an actor or source, and an attribution cue is a word or phrase. The attribution cue functions as the linguistic evidence supporting an attribution relation [25]. The set of all attribution subjects in the attribution relations found within a text leads naturally to developing a legal discourse model.

### 2.2    A Legal Discourse Model

A **discourse structure** is a semantic representation of certain linguistic features of a discourse occurring in a text [25]. Such structures may include the typing of sentences by discourse role and discourse relations among sentences, as well as classification of types of discourse structures (such as topic structures, functional structures, or coherence structures [25]). **Discourse relations** can include relations among sentences used to form arguments [8]. For example, [12] studied discourse relations for annotating "argument compounds" in technical documents (e.g., product manuals). A **discourse model** is a data structure that a reader can use to understand the meaning and discourse-relevant features of the sentences in a document [5]. A discourse model includes not only information about named actors gleaned from the document itself, but also presuppositional information about possible actors and their properties, actions, and relations. This presuppositional information is the common ground of background information that is shared among writers and readers [5]. When attribution problems arise in normal discourse, the discourse model can assist the reader in making sense of the sentences of the author.

A **legal discourse model** is a discourse model that is useful when interpreting the static legal text as a product of a dynamic process of discourse [7]. It is a data structure that is shared at least by attorneys and judges, as well as by other interested participants, such that the author of a judicial decision can presuppose that an attorney reading the decision will be familiar with these actors, and with their properties, actions, and relations, or that it is fair to assume that the attorney can become familiar with them as the need arises. For a general discussion of legal discourse models, see [21].

A legal discourse model includes: (i) the actors and sources referred to in the decision (for example, the veteran or the court, or a medical record or an expert examiner); and (ii) for each such actor or source, the properties, relations, and other information that are relevant for some purpose (for example, whether a court is a trial court or an appellate court, and if an appellate court whether the rules adopted by it are binding on the tribunal that issued the decision being analyzed). The discourse model captures some of the presuppositional information needed to interpret the reasoning found within a decision, including the actors that are possible attribution subjects. The information in a legal discourse model might support, for example, the inference that a legal rule attributed within the decision to a specific court is therefore a norm binding on the tribunal issuing the decision, because that court exercises appellate jurisdiction over the tribunal.

## 3 THE DATASET OF PTSD DECISIONS

To investigate useful semantic types for identifying lines of argument or reasoning within evidence assessment, we analyzed fact-finding decisions that adjudicate disability claims by veterans for service-related PTSD. This dataset is being used in the LUIMA project being conducted by Carnegie Mellon University, Hofstra University, and the University of Pittsburgh [2, 3, 4, 10, 22]. This section outlines the statutory and regulatory structure, and the adjudicatory process, for decisions in the PTSD dataset, and as a by-product suggests part of a legal discourse model for analyzing the decisions.

Disability benefits for veterans of the United States Uniformed Services are administered by the U.S. Department of Veterans Affairs ("VA"). [1] The appropriate statutes are codified in the United States Code (e.g., 38 U.S.C., Chapter 11, on compensation for service-connected disability or death), and the implementing regulations of the VA are codified in the Code of Federal Regulations (e.g., 38 C.F.R. Part 3, concerning adjudication). Individual claims for compensation for a disability usually originate at a VA Regional Office ("RO") or at another local office across the country. [1, 16] If the claimant is dissatisfied with the decision of the RO, she may file an appeal to the Board of Veterans' Appeals ("BVA"). The BVA is an administrative appellate body that has the statutory authority to decide the facts of each case *de novo*. [16] The BVA must provide a written statement of the reasons or bases for its findings and conclusions, and that statement "must account for the evidence which [the BVA] finds to be persuasive or unpersuasive, analyze the credibility and probative value of all material evidence submitted by and on behalf of a claimant, and provide the reasons for its rejection of any such evidence." *Caluza v. Brown*, 7 Vet.App. 498, 506 (1995), *aff'd*, 78 F.3d 604 (Fed. Cir. 1996). The disability caseload of the BVA is heavy – e.g., the BVA issued 55,713 decisions in fiscal year 2015 [16; 6 p. 4], and usually the vast proportion of appeals (as much as 98%) involve claims for disability compensation [6 p. 1]. The veterans' claims dataset discussed in this paper contains annotated decisions of the BVA.

The veteran may appeal the BVA's decision to the U.S. Court of Appeals for Veterans Claims (the "Veterans Court"). [16] Either the claimant or the VA may appeal a Veterans Court decision to the U.S. Court of Appeals for the Federal Circuit, and from that decision to the U.S. Supreme Court. The Federal Circuit may only review questions of law, such as a constitutional challenge, or the interpretation of a statute or regulation relied upon by the Veterans Court [1, 16].

Given this legal framework, sentences in BVA decisions that state legal rules binding on the BVA often contain attributions to the United States Code, the Code of Federal Regulations, the U.S. Supreme Court, the Court of Appeals for the Federal Circuit, or to precedential decisions of the Veterans Court (that court also issues non-precedential decisions). Frequently, an attribution cue is a citation (within the same sentence or in the immediately following sentence) to the appropriate reporter (e.g., U.S.C., C.F.R., Fed.Cir.). Thus, attribution cues, together with a legal discourse model containing the appropriate rule-making actors, frequently help identify sentences that primarily state legal rules binding on the BVA.

## 4 PRIMARY SEMANTIC TYPES FOR DECOMPOSING EVIDENCE ASSESSMENT

This section of the paper discusses important semantic types for sentences found within the evidence assessment portions of BVA decisions, based on the sentence's inferential role. These sentence types then provide the anchors for mining the reasoning and arguments from the decision. The section also discusses finding-of-fact sentences as primary anchors for decomposing evidence assessment into component branches of reasoning.

For purposes of argument mining, evidence assessment generally contains three functional parts: the **conclusion** (a finding of fact on a rule condition); the **foundations** for the reasoning (the evidence in the legal record, such as the testimony of a lay witness, the opinion of an expert witness, or exhibits such as a medical record, a photo, or a published scientific study); and the **reasoning** from the foundations to the conclusion. Performing a semantic analysis that decomposes evidence assessment into its component arguments requires identifying the inferential roles of sentences within this general framework.

### 4.1 Sentence Types Common within Evidence Assessment

We classify sentence roles in a BVA decision using the ten semantic types listed in Table 1. [23] For each of these semantic types, we develop **protocols** (providing criteria and methods) for identifying and annotating each type of sentence. We use such protocols to train annotators, to review the accuracy of annotations, and to guide the development of software programming for automating the annotation process. [23] This section discusses in more detail four sentence types commonly found in the fact-finding portions of BVA decisions: evidence sentences, finding-of-fact sentences, evidence-based reasoning sentences, and legal-rule sentences.

*4.1.1 Evidence Sentence or Clause.* An "evidence sentence" is a sentence that primarily states the content of the testimony of a witness, states the content of documents introduced into evidence, or describes other evidence. Evidence sentences provide foundations for findings of fact. An example of a statement of evidence is: "*The examiner who conducted the February 2008 VA mental disorders examination opined that the Veteran clearly had a preexisting psychiatric disability when he entered service.*" [BVA #1303141] Note the function of attribution in assigning an

evidence-stating role to this sentence: *opined that* is the attribution cue, with *the examiner who conducted the February 2008 VA mental disorders examination* being the attribution subject. Often, however, there is no attribution cue internal to an evidence sentence, but the attribution is based on the context in which the sentence appears (e.g., within a paragraph devoted entirely to recounting the testimony of a specific witness).

**Table 1. Ten Semantic Types of Sentence or Clause Found in Judicial Decisions, Based on Reasoning Roles [23]**

|     |     |
| --- | --- |
| i. | **Citation** sentence or clause |
| ii. | **Legal-rule** sentence or clause |
| iii. | **Legal-policy** sentence or clause |
| iv. | **Policy-based-reasoning** sentence or clause |
| v. | **Ruling or holding** sentence or clause |
| vi. | **Rule-based-reasoning** sentence or clause |
| vii. | **Evidence** sentence or clause |
| viii. | **Finding-of-fact** sentence or clause |
| ix. | **Evidence-based-reasoning** sentence or clause |
| x. | **Procedural-fact** sentence or clause |

*4.1.2 Finding-of-Fact Sentence or Clause.* A "finding-of-fact sentence" (also "evidence-based-finding sentence," or simply "finding sentence") is a sentence that primarily states an authoritative finding, conclusion or determination of the trier of fact. An example is: "*The most probative evidence fails to link the Veteran's claimed acquired psychiatric disorder, including PTSD, to active service or to his service-connected residuals of frostbite.*" [BVA #1340434] This sentence provides an attribution cue (*the most probative evidence fails to*) that signals that it is a conclusion of the fact finder, and the result of weighing the probative value of the evidence. Although it does not explicitly mention the attribution source, we can infer from the cue and context that it is the Board. Other finding sentences are more explicit in their attribution – e.g., "*The Board finds that the occurrence of the Veteran's in-service stressor events is credibly supported in the record.*" [BVA #1514581]

*4.1.3 Evidence-Based-Reasoning Sentence or Clause.* An "evidence-based-reasoning sentence" is a sentence that primarily reports the trier of fact's reasoning in making the findings of fact. Such reasoning normally involves an assessment of the credibility and probative value of the evidence, and may also include application of substantive or process rules, and occasionally even legal policies. An example is: "*Also, the clinician's etiological opinions are credible based on their internal consistency and her duty to provide truthful opinions.*" [BVA #1340434] More examples are provided in sections 5 and 6.

*4.1.4 Legal-Rule Sentence or Clause.* A "legal-rule sentence" is a sentence that primarily states one or more legal rules in the abstract, without stating whether the conditions of the rule(s) are satisfied in the case being decided. Legal rules provide important

building blocks for arguments about the issues of fact to be decided by the fact finder. As we will discuss in Section 5, they provide structure and elements for evidence-based reasoning. An example of a BVA sentence stating a legal rule is the first sentence in the following quotation:

> *Generally, service connection requires (1) medical evidence of a current disability, (2) medical evidence, or in certain circumstances lay testimony, of in-service incurrence or aggravation of an injury or disease, and (3) medical evidence of a nexus between the current disability and the in-service disease or injury. See Shedden v. Principi, 381 F.3d 1163, 1167 (Fed. Cir. 2004); see also Hickson v. West, 12 Vet. App. 247, 253 (1999); accord Caluza v. Brown, 7 Vet. App. 498 (1995).*

[BVA #1302554] Notice that the trailing citation sentence provides an attribution cue that this rule originated with the Federal Circuit as its subject or source, also with earlier decisions by the Veterans Court.

## 4.2 Finding-of-Fact Sentences as Primary Anchors within Evidence Assessment

The governing substantive legal rules provide the means of decomposing the evidence assessment of a decision. Those rules state the conditions under which the BVA is required to order compensation, or is prohibited from ordering compensation. A legal rule can be represented as a set of propositions, one of which is the conclusion and the remaining propositions being the rule conditions [22, 15]. We represent a legal rule by placing the conclusion at the top of an indented list of its conditions, with each condition preceded by a symbol for the logical connective operating between it and the conclusion [23]. Each condition can function in turn as a conclusion, with its own conditions listed below it. The resulting nested sets of conditions has a tree structure – with the entire representation of the applicable legal rules being called a "rule tree" [22]. Figure 1 presents a partial rule tree that lists the primary rule conditions for proving that a veteran claimant has PTSD that is "service-connected" – i.e., causally connected to a stressor (dangerous or traumatic event) that occurred during active service. In terms of logical connectives, Figure 1 shows that a claimant can prove (and must prove) a service-connected disability by proving all of three primary conditions (those preceded by the symbol for a necessary conjunct, "**&■**"). Moreover, if that disability happens to be PTSD, then there are specific conditions (preceded by the symbol for disjunction, "**V**") for proving each of these three primary conditions. As a result, in a BVA decision on a disability claim for PTSD, we expect the fact-finding reasoning to be organized around arguments and reasoning on these three PTSD rule conditions, and we use findings of fact on these three conditions to anchor our decomposition of the evidence assessment text.

In general, a rule tree integrates all the relevant rules from statutes, regulations, and case law into a single, computable system of legal rules. The main branches of the tree identify all the primary issues of fact (primary propositions to be decided) for deciding a disability claim. A BVA decision supplies the findings of fact on these rule conditions, in determining whether enough of them are satisfied in the specific case so that the veteran claimant is entitled to compensation. Thus, in analyzing the evidence

assessment portion of a BVA disability decision, we first create semantic types for findings of fact under each of the three primary issues.

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The veteran has a disability that is "service-connected."

    **&■ [1 of 3]** The veteran has "a present disability."

       **V [1 of …]** The veteran has "a present disability" of posttraumatic stress disorder (PTSD), supported by "medical evidence diagnosing the condition in accordance with [38 C.F.R.] § 4.125(a)."

       **V [2 of …]** …

    **&■ [2 of 3]** The veteran incurred "a particular injury or disease … coincident with service in the Armed Forces, or if preexisting such service, [it] was aggravated therein."

       **V [1 of …]** The veteran's disability claim is for service connection of posttraumatic stress disorder (PTSD), and there is "credible supporting evidence that the claimed in-service stressor occurred."

       **V [2 of …]** …

    **&■ [3 of 3]** There is "a causal relationship ["nexus"] between the present disability and the disease or injury incurred or aggravated during service."

       **V [1 of …]** The veteran's disability claim is for service connection of posttraumatic stress disorder (PTSD), and there is "a link, established by medical evidence, between current symptoms and an in-service stressor."

       **V [2 of …]** …

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**Figure 1. Partial Rule Tree (List of Legal Rule Conditions) for Proving That a Veteran Has a Service-Connected Disability, and Specifically PTSD (Citations Omitted).**

There are important heuristics in identifying the appropriate finding-of-fact sentences. First, the rule tree shown in Figure 1 shows that in order to find for the veteran, the BVA must make positive findings of fact on all three prongs of the *Shedden* rule (also formulated in the quotation in Section 4.1.4 above). As a corollary, in order to deny the veteran's claim, the BVA must make a negative finding of fact on at least one of those three prongs. In a sample of 20 representative BVA decisions involving a claim of PTSD, we investigated the frequency of findings on the three *Shedden* prongs, with the results shown in Table 2. The entries in Table 2 suggest how difficult the search for these findings can be. The cases sometimes make findings on "psychiatric disability including PTSD," and sometimes make separate findings for PTSD and for "psychiatric disability other than PTSD." Moreover, when a claim is denied, a decision can present a variety of patterns with respect to the three *Shedden* prongs. For example, there might be one, two or three negative findings, involving a variety of the three prongs; some prongs might have no finding at all. Finally, particularly in cases where the claim is denied, some findings might be implicit in the text or assumed for purposes of adjudication (for example, in assuming a present diagnosis of PTSD arguendo, and then focusing the discussion on a negative finding for Prong 2, the occurrence of an in-service stressor).

A difficulty is that a finding of fact might well employ much of the same wording as a statement of the rule itself, or as a ruling or holding employing the rule, so finding-of-fact sentences must be distinguished from legal-rule sentences. Confusion between these types of sentences must be kept acceptably low.

# 5 DECOMPOSING EVIDENCE ASSESSMENTS THAT DEPLOY SPECIAL LEGAL RULES

In decomposing evidence assessment beyond the three primary findings of fact discussed in Section 4.2, we have found it useful to distinguish assessments that are organized around special types of legal rules from assessments that are not. This section discusses semantic types within that first category – and specifically those assessments that deploy legal-presumption rules, sufficiency-of-evidence rules, and the benefit-of-the-doubt rule. Section 6 discusses the decomposition of evidence assessment when it does not deploy such legal rules.

## 5.1 Legal-Presumption Rules

*5.1.1 Legal-Presumption Rules Defined.* A legal rule might establish a "presumption" – that is, a conditional rule with a defeater, of the general form: **if** proposition $p$ (the "basic fact" or "triggering condition") is true, **then** proposition $q$ is **presumed** to be true (the "presumed fact"), **unless** proposition $r$ is true (the "defeater proposition"). [20] A legal presumption important in proving *Shedden* Prong 2 is the "presumption of soundness," which derives from the following statutory provision, 38 U.S.C.A. § 1111 (2017):

> [E]very veteran shall be taken to have been in sound condition when examined, accepted, and enrolled for service, except as to defects, infirmities, or disorders noted at the time of the examination, acceptance, and enrollment, or where clear and unmistakable evidence demonstrates that the injury or disease existed before acceptance and enrollment and was not aggravated by such service.

The triggering condition for the presumption is that a disease or injury manifests in service, and a question arises as to whether it preexisted service. In such a situation, if the disease or injury was not noted upon entry to service, then the presumption of soundness applies. *Gilbert v. Shinseki*, 26 Vet.App. 48, 55 (CAVC 2012), *aff'd*, 749 F.3d 1370 (Fed.Cir. 2014). There is one defeating condition, however: if the VA proves "by clear and unmistakable evidence that a disease or injury manifesting in service both preexisted service and was not aggravated by service." *Id.* Thus, the case law interprets the statutory presumption as shifting the burden of proof to the VA, and imposing on the VA a high standard of proof and sufficiency of evidence ("clear and unmistakable evidence").

If the presumption of soundness is triggered and the burden of proving the defeater shifts to the VA, then the agency has to prove two conditions in order to rebut the presumption: (a) that "the injury or disease existed before acceptance and enrollment," and (b) that "the injury or disease … was not aggravated by such service." The Court of Appeals for Veterans Claims, in *Horn v. Shinseki*, 25 Vet.App. 231, 235 (CAVC 2012), elaborated that the VA may prove the second condition "by establishing, with clear

and unmistakable evidence, that there was no increase in disability during service or that any 'increase in disability [was] due to the natural progress' of the preexisting condition." Because the court in *Horn* uses the verb "may prove," it is not explicit whether there could be a third alternative way of proving aggravation, so on this text we interpret these as merely alternative methods within an incomplete set.

These elaborated legal rules are represented in the partial rule tree shown in Figure 2. We attach the rules for the presumption of soundness to *Shedden* Prong 2 using the weak disjunctive "**V**"

because the presumption is merely one alternative method of proving *Shedden* Prong 2.

*5.1.2    Example: BVA #1525217.* In that case, the veteran claimed a service connection for a psychiatric condition, to include PTSD. The Board ruled in the veteran's favor on the claim as a whole. In reaching that outcome, the Board made an explicit positive finding with respect to *Shedden* Prong 2:

> *Next, the evidence of record makes at least equally likely that the Veteran manifested symptoms of his condition during*

**Table 2. Findings of Fact on the Three *Shedden* Prongs in a Sample of BVA PTSD Disability Decisions. Possible Values = Positive Finding (for the Veteran); Negative Finding (against the Veteran); No Finding. A value entered in parentheses indicates that the value is implicit or assumed for purposes of adjudication, or that the basis for the value is uncertain.**

| BVA Citation Number | Ultimate Finding | *Shedden* Prong 1 (Present PTSD) | *Shedden* Prong 2 (In-Service Stressor) | *Shedden* Prong 3 (Causal Link) |
|---|---|---|---|---|
| 1302554 | Denied | (Negative Finding) | Negative Finding | (Negative Finding) |
| 1303141 | Denied | PTSD*– Neg. Finding Psych.Dis.*- Positive Finding | PTSD*– No Finding Psych.Dis.*- Negative Finding | PTSD*– No Finding Psych.Dis.*- No Finding |
| 1315144 | Denied | (Positive Finding) | Negative Finding | Negative Finding |
| 1316146 | Denied | PTSD*– Neg. Finding Psych.Dis.*- Positive Finding | PTSD*– Neg. Finding Psych.Dis.*- Negative Finding | PTSD*– Neg. Finding Psych.Dis.*- Negative Finding |
| 1316336 | Denied | PTSD*– Neg. Finding Psych.Dis.*- Positive Finding | PTSD*– No Finding Psych.Dis.*- Negative Finding | PTSD*– No Finding Psych.Dis.*- Negative Finding |
| 1334312 | Denied | (Positive Finding) | Negative Finding | No Finding |
| 1343153 | Denied | PTSD*– Pos. Finding Psych.Dis.*- Positive Finding | PTSD*– Pos. Finding Psych.Dis.*- Negative Finding | PTSD*– Neg. Finding Psych.Dis.*- Negative Finding |
| 1400029 | Denied | Negative Finding | Positive Finding | No Finding |
| 1413417 | Denied | PTSD*– Neg. Finding Psych.Dis.*- (Positive Finding) | PTSD*– No Finding Psych.Dis.*- Negative Finding | PTSD*– No Finding Psych.Dis.*- Negative Finding |
| 1431031 | Denied | (Positive Finding) | Negative Finding | No Finding |
| 1445540 | **Remanded** | No Finding | No Finding | No Finding |
| 1455333 | **Granted** | Positive Finding | Positive Finding | Positive Finding |
| 1505726 | Denied | Negative Finding | Negative Finding | (Negative Finding) |
| 1514581 | Denied | Positive Finding | Positive Finding | Negative Finding |
| 1525217 | **Granted** | Positive Finding | Positive Finding | Positive Finding |
| 1526599 | Denied | Negative Finding | No Finding | No Finding |
| 1608262 | Denied | Negative Finding | No Finding | No Finding |
| 1613894 | Denied | PTSD*– (Pos. Finding) Psych.Dis.*- Positive Finding | PTSD*– Neg. Finding Psych.Dis.*- Negative Finding | PTSD*– No Finding Psych.Dis.*- Negative Finding |
| 1630016 | **Granted** | (Positive Finding) | Positive Finding | Positive Finding |
| 1630402 | **Granted** | Positive Finding | Positive Finding | Positive Finding |

\*  This decision provided distinct findings for PTSD and for a psychiatric disability other than PTSD.

> *service. ... Because the Veteran is presumed sound at service entrance, and because the presumption of soundness is not rebutted, the psychiatric condition that manifested in service is deemed service-incurred.*

What occurs within the space of the ellipsis in the above quotation is the Board's recitation of the relevant evidence and the application of the complex set of rules about the presumption of soundness (see Sub-section 5.1.1).

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The veteran has a disability that is "service-connected."

&■ **[1 of 3]** …

&■ **[2 of 3]** The veteran incurred "a particular injury or disease … coincident with service in the Armed Forces, or if preexisting such service, [it] was aggravated therein."

   **V [1 of …]** The presumption of soundness is established and unrebutted.

      &■ **[1 of 2]** An injury or disease manifested in service.

      &■ **[2 of 2]** The injury or disease was not "noted at the time of the examination, acceptance, and enrollment."

      **REBUT** The VA proves by "clear and unmistakable evidence … that the injury or disease existed before acceptance and enrollment and was not aggravated by such service."

         &■ **[1 of 2]** The VA proves by "clear and unmistakable evidence … that the injury or disease existed before acceptance and enrollment."

         &■ **[2 of 2]** The VA proves by "clear and unmistakable evidence … that the injury or disease … was not aggravated by such service."

            **V [1 of 2]** The VA proves by "clear and unmistakable evidence" … that "there was no increase in disability during service."

            **V [2 of 2]** The VA proves by "clear and unmistakable evidence" … that "any 'increase in disability [was] due to the natural progress' of the preexisting condition."

   **V [2 of … ]** …

&■ **[3 of 3]** …

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**Figure 2. Partial Rule Tree (List of Legal Rule Conditions) for Using the Presumption of Soundness to Prove *Shedden* Prong 2 (In-service Incurrence or Aggravation) (Citations Omitted).**

The first necessary condition for establishing the presumption of soundness is that an injury or illness manifested in service (see Figure 2). The Board examined a service treatment record (STR) from December 1983 (the veteran served on active duty from May 1981 to May 1985). The Board concluded that "the December

1983 treatment for depression establishes (a) treatment for a mental health condition during service (depression), and (b) a stressful event (the impending death of his father)."

The second necessary condition for establishing the presumption of soundness is that the injury or disease was not noted at the time of examination, acceptance, and enrollment (see Figure 2). On the basis of a physical examination at entrance in May 1981, the Board concluded that "[f]or purposes of this appeal, a mental health condition was not 'noted' at service entrance."

Given findings on these two conditions, the presumption of soundness was triggered, and the burden is shifted to the VA to prove the defeater proposition by "clear and unmistakable evidence" (see Figure 2).

The first necessary condition that the VA must prove is that the veteran's depression (the disease that manifested during service) existed before acceptance and enrollment into active service (see Figure 2). Ultimately, the Board concluded that "[t]here is not clear and unmistakable evidence establishing the preexistence of a psychiatric condition." The Board provided various supporting reasons for this finding, including that there was no contemporaneous evidence prior to service, and that "there is only circumstantial evidence indicating a preexisting psychiatric condition" (providing examples of such circumstantial evidence). We have in this decision some indication of how to argue that such evidence is "circumstantial," and therefore not "clear and unmistakable."

Even assuming arguendo that the veteran's depression preexisted service, the second necessary condition that the VA must prove to rebut the triggered presumption of soundness is that it was not aggravated during service. The Board concluded that "[t]here is also no clear and unmistakable evidence establishing that his psychiatric condition, if preexisting, was not aggravated during service." In order to reach this finding, the Board needed to (and did) discount as not "clear and unmistakable evidence" a record of a September 2011 VA examination that seemingly explicitly found the contrary ("NOT aggravated beyond natural progression," emphasis in original). Ambiguities in the report undermined its probative value, as well as the examiner's use of the qualifiers "tends" and "contraindicate," which "suggest that this conclusion was not undebatable."

The Board therefore found that the VA had failed to rebut the triggered presumption of soundness, and that the veteran had therefore satisfied *Shedden* Prong 2. We discuss this example in detail here to illustrate how legal-presumption rules can structure the assessment of the evidence.

## 5.2 Sufficiency-of-Evidence Rules

*5.2.1 Sufficiency-of-Evidence Rules Defined.* "Legal sufficiency of the evidence" (or simply "legal sufficiency" or "sufficient evidence") is a fundamental concept in US jurisprudence related to adjudication, whether by courts or by administrative tribunals. Such rules may be established by statute, or by regulation, or by appellate case law. These rules are intended to advance the rule of law by imposing a minimum standard on the types of evidence that could reasonably support a finding of fact in a case. An important example for veterans'

claims is provided by the regulations in 38 C.F.R. § 3.304(f), which provide rules for whether or under what conditions "the veteran's lay testimony alone may establish the occurrence of the claimed in-service stressor." These specific regulations are triggered only if there was a diagnosis of PTSD during service (§ 3.304(f)(1)), the veteran engaged in combat with the enemy (§ 3.304(f)(2)), the claimed stressor is related to the veteran's fear of hostile military or terrorist activity (§ 3.304(f)(3)), the veteran was a prisoner-of-war (§ 3.304(f)(4)), or the claim is based on in-service personal assault (§ 3.304(f)(5)).

*5.2.2 Example: BVA #1334312.* In that case, the veteran claimed a service connection for various disabilities, including "an acquired psychiatric disability, to include … PTSD." The Board denied the claim. The Board made an explicit negative finding with respect to *Shedden* Prong 2:

> As to the PTSD issue specifically, the Veteran's own reports, which is [sic] *the only evidence favorable to his claim of entitlement to service connection for a psychiatric disability, are not sufficient to satisfy the requirement of credible supporting evidence of the occurrence of any reported in-service stressor.*

The Board found that none of the special provisions in 38 C.F.R. § 3.304(f) applied in that case. Then, citing *Cohen v. Brown*, 10 Vet.App. 128, 145 (1997), the Board stated:

> *In cases such as this, credible supporting evidence of the occurrence of the stressor must be provided by someone other than the Veteran and cannot be provided solely by after the fact medical nexus evidence.*

Because there was no additional evidence satisfying this rule, the Board ruled that it "must deny the appeal as to entitlement to service connection for a psychiatric disorder, to include … PTSD." Under the legal rules as the Board understood them, it had no discretion to weigh the evidence relevant to the occurrence of an in-service stressor, because there was insufficient evidence to support such fact-finding, as a matter of law.

## 5.3 The Benefit-of-the-Doubt Rule

*5.3.1 Benefit-of-the-Doubt Rule Defined.* Normally, in US law, the burden of proof (the "risk of nonpersuasion") is on the plaintiff, petitioner or claimant – the party seeking to prove that it is entitled to compensation. In cases governed by the preponderance-of-the-evidence standard of proof, this means that as a matter of law an issue of fact must be decided against the plaintiff, petitioner or claimant if the evidence is in equipoise. The statute governing veterans claims, however, reverses this normal burden of proof, and places the burden of persuasion on the VA: "When there is an approximate balance of positive and negative evidence regarding any issue material to the determination of a matter, the Secretary [of Veterans Affairs] shall give the benefit of the doubt to the claimant." 38 U.S.C.A. § 5107(b) (2017); *see* 38 C.F.R. § 3.102 (2017); *Ortiz v. Principi*, 274 F.3d 1361, 1364-66 (Fed.Cir. 2001); *Gilbert v. Derwinski*, 1 Vet.App. 49, 55 (1990).

*5.3.2 Example: BVA 1525217.* In that case, the Board explicitly used the benefit-of-the-doubt rule, first in respect to individual factual issues and then in respect to the set of issues as whole, ultimately finding as follows:

> *For these reasons, after resolving all reasonable doubt in the Veteran's favor, the evidentiary record is in relative equipoise as to all material elements of the claim. Therefore, service connection is warranted for a psychiatric disability, variously diagnosed as schizoaffective disorder, bipolar disorder, and PTSD, and the claim must be granted.*

In applying the benefit-of-the-doubt rule, the Board was constrained to find for the veteran on the evidence of record.

## 6 DECOMPOSING EVIDENCE ASSESSMENTS THAT DO NOT DEPLOY SPECIAL LEGAL RULES

This section discusses several patterns of evidence assessment that do not deploy legal rules such as legal-presumption rules, sufficiency-of-evidence rules, or the benefit-of-the-doubt rule. When such rules do not determine the outcome of the fact-finding, the fact finder has discretion to assess the probative value of the evidence. For purposes of decomposing argumentation, therefore, we must look for patterns of evidence assessment that we find employed by the Board when it is exercising its fact-finding discretion. This section discusses several such patterns.

In deciding an issue as a matter of fact, the Board must consider "all information and lay and medical evidence of record in a case." 38 U.S.C.A. § 5107(b) (2017). The Board must weigh the probative value of all "competent" evidence that is in the evidentiary record and is relevant to that issue. A lay witness, for example, is competent to testify only to that which she has "actually observed," and of which she has "personal knowledge"; "[g]enerally, lay testimony is not competent to prove that which would require specialized knowledge or training." *Layno v. Brown*, 6 Vet.App. 465, 469-70 (1994). For example, the Board might rule that the Veteran "has not shown that he is competent to render" an opinion as to whether "his psychiatric disability is related to service," because "it is a matter of complexity that requires specialized knowledge which the Veteran has not been shown to possess." [BVA 1316336] Whether testimony is competent and thus "may be heard and considered by the trier of fact" is a question of law, whereas determining the weight and credibility of that testimony is a question of fact going to the probative value of the evidence. *Layno*, 6 Vet.App. at 469.

## 6.1 Probative-Value Factors for Types of Evidence Source

*6.1.1 Probative-Value Factors Defined.* We are finding that patterns emerge in the cases concerning the factors that are relevant in assessing the probative value of each type of evidence source. Sometimes a statute or regulation, or appellate case law, may determine that a list of factors is relevant to a specific issue. For example, the Court of Appeals for Veterans Claims has stated that it is "the factually accurate, fully articulated, sound reasoning for the conclusion, not the mere fact that the claims file was reviewed, that contributes the probative value to a medical opinion." *Nieves-Rodriguez v. Peake*, 22 Vet.App. 295, 304 (2008). Otherwise, fact finders themselves can evolve sets of factors that are predictive of patterns of evidence assessment in similar circumstances.

Our working hypothesis is that, for any specific type of evidence source that is typically found in veterans claims cases, there is a list of factors that the Board typically employs in determining both the "credibility" and the degree of probative value of the evidence. At a minimum, the evidence must be "credible" ("worthy of belief" or "trustworthy"), and a testifying witness must be "credible" (i.e., her testimony must be "believable") (Black's Law Dictionary, 10<sup>th</sup> ed., 2014). Beyond mere credibility, the probative value of a specific item of evidence is sometimes also assessed in isolation from other evidence, using a list of relevant factors.

*6.1.2    Example: BVA 1316336.* In that case, the Veteran claimed entitlement to a determination of service connection for a psychiatric disability, to include PTSD. The Board denied the claim. With regard to PTSD specifically, the Board made a negative finding on *Shedden* Prong 1 ("*the Board finds the Veteran does not have PTSD*"), so made no findings on the other two prongs (see Table 2). With regard to "a psychiatric disability other than PTSD," the Board found adequate evidence for such a disorder (*Shedden* Prong 1), but found against the veteran on Prongs 2 and 3. In the Board's reasoning supporting the negative finding on Prong 2, we find discussion of various relevant factors.

With respect to the veteran's own reports concerning traumatic in-service events (witnessing a helicopter crash involving casualties, witnessing public executions or mutilations while in Kuwait City, experiencing military sexual trauma), the Board discounted the testimony based on the following factors. First, the veteran's various reports over the years contained inconsistent details about events, including his reports about his involvement with the helicopter crash, his reports about the military sexual trauma, and his reports about the date of onset of his psychiatric symptoms. Second, the veteran's reports of in-service psychiatric symptoms were not corroborated by his service medical or personnel records. Third, there were in the record "highly probative medical findings of over-endorsement of symptomatology" (the numerous post-service examination records began to record concern that the veteran had "a long history of over-reporting symptoms"). The veteran's reports were often contained in post-service treatment records, created at the time of seeking treatment, or in VA examination records. Taking these factors into account, the Board found that the veteran's reports of in-service symptoms, while competent on the issue, were "not probative evidence" of either an in-service onset or in-service aggravation of a psychiatric disability.

*6.1.3    BVA 1630016.* In that case, the veteran alleged a service connection for an acquired psychiatric disorder to include PTSD. Unlike the result in BVA 1316336, discussed in Section 6.1.2 above, the Board here made a positive finding on *Shedden* Prong 2, based in part on the veteran's own testimony and prior reports in the post-service medical history. Ultimately, the Board concluded that a "service connection for PTSD with depression is warranted." As to consistency within the veteran's own reports, the Board noted as part of the basis for its decision the veteran's "credible assertions," reasoning that "[t]he Veteran has consistently reported that he was sexually assaulted by two servicemen during service in July 1976." Although the veteran's service treatment records were "negative for treatment of, or a diagnosis of any acquired psychiatric disorder," the Board reasoned that "the Veteran's stressor is not the type of situation

that would be documented in the official record (he was sexually assaulted and threatened by his superior not to tell anyone about it)."

Moreover, the lay statement of a longtime friend of the veteran provided an "eyewitness account of a drastic change in the Veteran's behavior before service compared to his behavior after service." Finally, the finding was "supported by two competent medical opinions," one by a VA examiner in July 2013 and the other by the veteran's Vet Center counselor in November 2014. The Board cited the Federal Circuit in *Menegassi v. Shinseki*, 638 F.3d 1379 (Fed.Cir. 2011) for the legal rule that a medical opinion based on a post-service examination may be used to corroborate the occurrence of an in-service stressor. The Board summarized:

> *In summary, the most probative evidence of record supports a finding that the Veteran's PTSD and major depression resulted from an in-service stressor. This is supported by a two* [sic] *competent medical opinions, and the eyewitness account of a drastic change in the Veteran's behavior before service compared to his behavior after service and the Veteran's credible assertions.*

## 6.2    Comparative Assessment Patterns for Pairings of Evidence Sources

*6.2.1    Comparative Assessment Defined.* "Preponderance of the evidence" is the standard of proof used by the Board in deciding factual issues in veterans' claims cases (see Section 5.3 above). The preponderance standard of proof has led to patterns of comparative evidence assessment in BVA decisions. The heuristic of the Board often is to compare the probative value of two items of evidence that are directly conflicting with each other, and to determine by various relevant factors which item of evidence "weighs more" (has more probative force) than the other one. We also look for patterns where the Board (or a court) explicitly states that a certain <u>type</u> of evidence tends to have greater probative value than another <u>type</u> of evidence.

*6.2.2    Example: BVA 1505726.* In that case, the veteran claimed a service connection for an acquired psychiatric disorder, to include PTSD, based on alleged military sexual trauma. In denying the claim, the Board provided the following explanation:

> *Overall, the September 2013 VA psychiatric examination in particular was very thorough, supported by explanations, and considered the Veteran's history and relevant longitudinal complaints. It also considered the lay and buddy statements of record. This VA opinion, supported also by the other evidence listed above, outweighs the findings of the April 2013 private psychological evaluation on the issue of whether the Veteran has a PTSD diagnosis in accordance with DSM-IV from alleged sexual assaults.*

The first sentence of this quotation also contributes several factors as considered relevant in assessing the probative value of a psychiatric examination.

*6.2.3    Example: BVA 1302554.* In denying a claim for an acquired psychiatric disorder, including PTSD, the Board reasoned:

> *The Board is of the opinion that the contemporaneous treatment records during service have the greatest probative*

*value as to the Veteran's mental status at that time. This is particularly true when weighed against lay statements such as those given by the Veteran or in various written statements from persons who knew him during and after service.*

Such a comparison of contemporaneous records with later reports or testimony is a recurring pattern within BVA cases.

## 7 CONCLUSION AND FUTURE WORK

This paper presents a methodology for conducting a semantic analysis of the evidence assessment portions (fact-finding portions) of adjudicatory decisions, providing examples throughout the paper drawn from our analysis of decisions on veterans' disability claims. We use a substantive rule tree to decompose issues of fact into sub-issues, and use protocols to identify the finding-of-fact sentences under each sub-issue (rule condition). Within those substantive branches of reasoning, we further decompose evidence assessment using special legal rules and recurring probative-value factors.

This methodology requires continuing work in several directions. First, we are in the process of making the veterans' claims dataset publicly available [23], and we will continue to add annotated decisions to that dataset. Collective scrutiny of the wide diversity of expression in such documents is the only way to ensure that we are employing adequate semantic types and doing so correctly. Second, we will continue to elaborate our protocols for manually annotating those documents, to ensure consistency and accuracy of the annotations, and to provide suggestions for developing software to automatically assist in the annotation task. Third, we will continue to collaborate with researchers who are developing software for analyzing the meaning of legal documents. As we develop our insights into the semantic types that lawyers and judges find useful in mining arguments from such documents, we are increasingly aware of the need to bring artificial intelligence to bear when analyzing the vast and growing corpus of legal decisions.

## ACKNOWLEDGMENTS

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