Reaching Logical Conclusions in Court:

A General Structure for Inferential Lines of Reasoning

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One of the most important functions of an appellate court is to assess whether evidentiary lines of reasoning provide legally sufficient evidence to support the decision of the trial court. This assessment can consider several factors. These include logical relevancy, structural correctness of an argument form (e.g., validity or well-formedness), and probative weight. While judicial determinations of probative weight are largely subjective and a matter of degree, the qualities of logical relevancy and structural correctness of an argument form are objective determinations. These qualities are either present or not.

Despite their objective nature, however, making such determinations can be challenging for a court. Teaching law students how to minimize this challenge is one important goal of educating lawyers. This article proposes the use of a single general structure of inferential lines of reasoning (i.e., structure of proof) for this purpose.

One difficulty in evaluating lines of reasoning arises when a line of reasoning does not make clearly evident each of the logical connections between the premises offered and the conclusion at issue. This can occur, for example, when there are implicit missing premises that are necessary for the structural correctness of the line of reasoning. And, even if all of the necessary premises are explicitly stated, a

jumbled word or sentence order of the premises can obscure the presence of an accepted form of argument.

Another obstacle can be created by the party's use of a logical argument structure or form that is unfamiliar to the judge. Certainly, the court will be familiar with some of the typical syllogistic forms for deductive reasoning. But, there are multiple modes of logical inference (e.g., deductive, inductive, and presumptive) that can be used within many different types of argument schemes. Without knowing the correct design of the argument structure, the questions of logical relevancy and structural correctness are not easily resolved.

Law students are often not fully prepared to overcome these obstacles. One reason is that law students are usually not instructed in a rigorous application of formal or even informal logic. Twining (2006) observes that a comprehensive course of study in the science of proof has largely been absent in legal education.[1] And Woods (2007, p. 2) points out that "there remains a lot of resistance by lawyers and legal scholars to the analytical and methodological norms championed by logicians." Finally, even these norms have been undergoing significant changes in approximately the last 60 years through the development of informal logic. Such

[1] In recent years, there have been some law schools that offer science of proof law courses. Anderson, Schum, & Twining (2005) is a commonly used textbook for these courses.

changes, except in rare instances, have not reached the standard law school curriculum.

What would help to facilitate this learning in law school would be a single general structure of proof that (1) can accommodate different modes of inference and a wide-range of argument schemes; (2) uses a familiar reasoning pattern; (3) does not permit, through its structural scaffolding, missing necessary premises, an obscuring word order, or a faulty argument pattern; and, (4) makes all of the logical connections between each premise within a line of reasoning visible to the court so that logical relevancy and structural correctness are readily apparent. Recently, such a general structure of proof has been developed. (Laronge, 2009) (http://inferenceincourt.com/papers). This proof structure is named defeasible class-inclusion transitivity. And it relies upon a single mode of inference named *class-inclusion transitivity*. (Hintikka, 2004, p. 88).

As Groarke (1999) analogizes to the familiar parable of the Fox and the Hedgehog, a single mode of inference that always works like the hedgehog's single trick has distinct benefits over that of the 36 inference tricks of the fox. Further, defeasible class-inclusion transitivity provides a rigorous scaffolding of the premises and conclusion into a user-friendly canonical form that ensures structural correctness and a capacity to accommodate ancillary assumptions in the line of

logical reasoning. This structure of inference also makes every necessary logical connection between the premises explicit. In this way, there is no question about missing linkages in the chain of reasoning. Finally, since it relies upon a familiar mode of inference, a court can, perhaps, more easily judge the inference structure's correctness and probative weight capacity.

While the name class-inclusion transitivity may be unfamiliar, this mode of inference is one that most of us generally acquire during our normal cognitive development as young children. (Deneault & Ricard, 2006). As children, we typically learn that if A equals B and B equals C then A equals C. Defeasible class-inclusion transitivity follows this transitive pattern. So like a deductive syllogism, it is categorical in nature. But, contrary to deduction, the categories are not single word terms. Rather, they are the complex subject and complex predicate (i.e., including the verb) of each sentence that acts as a premise.[2]

By merely changing the categories or classes from simple subjects and simple predicates (i.e., terms without verbs) as used in deduction to subject phrases and predicate phrases which include the verb in a transitive order, this revised categorical structure can accommodate many form of logical reasoning including deductive, inductive, and presumptive as well as varied argument schemes within its

[2] The subject is who or what the sentence is about (i.e., doer or be-er). And the predicate is what is the subject does or is being (i.e., doing or being).

single structure. And this form of categorical reasoning can accommodate relational and conditional argument forms as well.

To illustrate, consider a simple argument to compare a deductive syllogism with defeasible class-inclusion transitivity:

Premises: 1. *The **apple** is **red**.*
2. ***Red** is a **color**.*
Conclusion: *So the **apple** is a **color**.*

Despite fitting within a standard deductive syllogism structure, the reasoning is faulty. This is because ***red*** is not "essentially predicated" of an apple. Red is not fundamental to the nature of an apple. Rather, it is nonessential or accidental. To the contrary, fruit would be essentially predicated of an apple. This red apple example can be depicted in a metaphoric drawing to show its nested categorization structure, which fails to provide a valid structure in this instance.

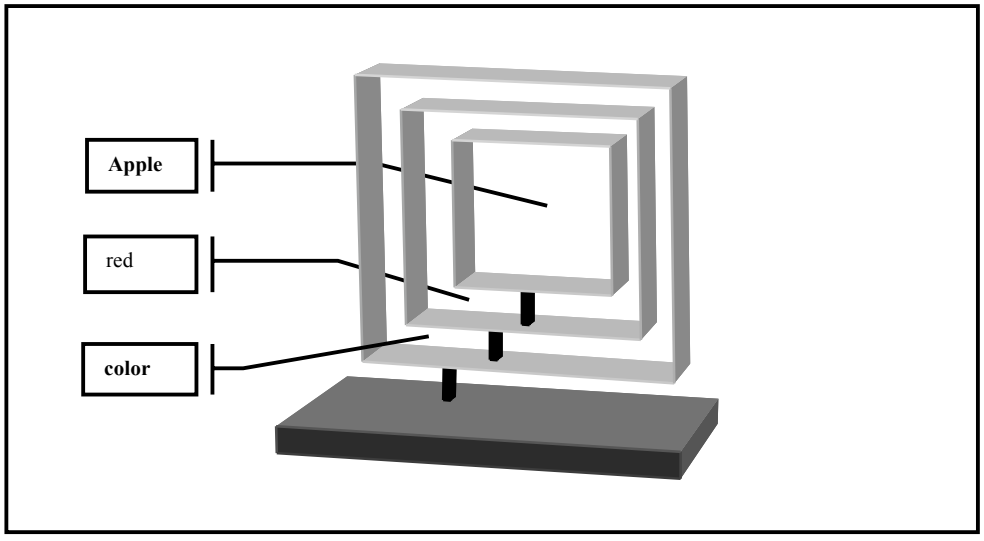

Figure 1

To ensure a structurally correct logical inference a defeasible class-inclusion transitivity structure can be used instead:

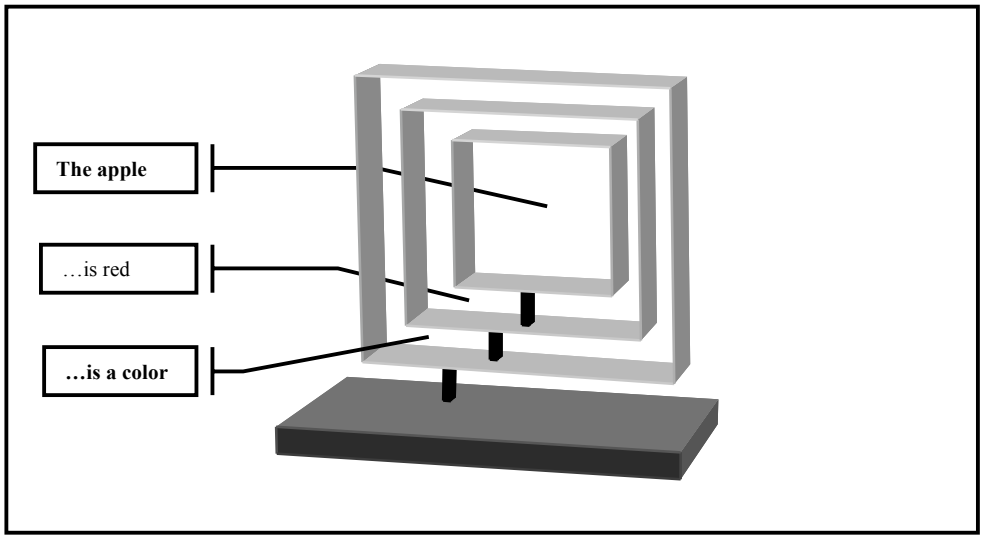

Figure 2

The structurally correct argument can now be stated as follows:

Premises: 1. *The apple* ***is red****.*
2. ***Any that is red*** *is a color.*
Conclusion: *So the apple is a color.*

While the second premise is not true in this instance, the inference structure is now correct since if the premises were acceptable to some degree then the inference step would necessarily reach a conclusion that was acceptable to some degree.

This argument can also be depicted in the standard defeasible class-inclusion transitivity template:

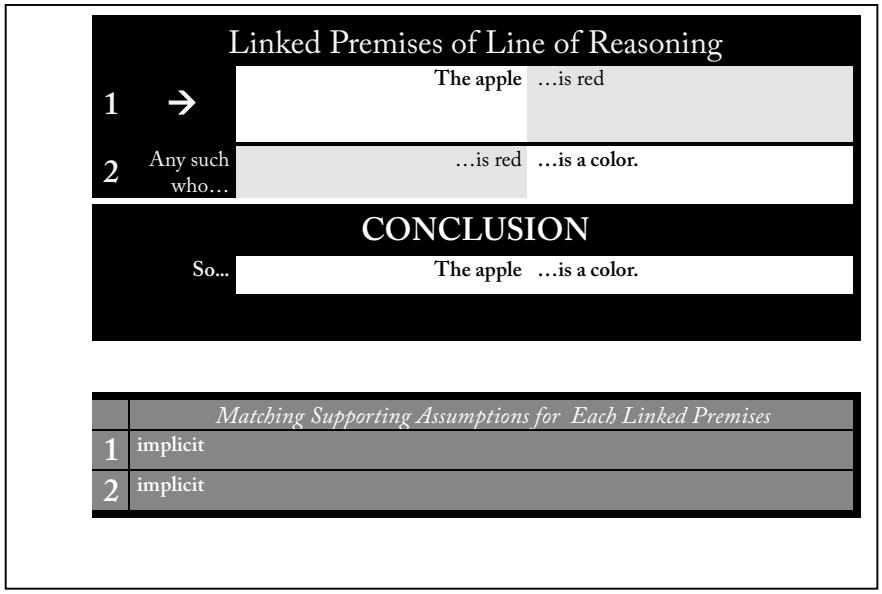

Figure 3

An understanding and appreciation of the power of this structure is, perhaps, best garnered through a review of a series of actual cases as described below.

Distinguishing Supporting Assumption from Inference Steps

State of Oregon v. Micah Dale Bivens, 191 Or App 460, 83 P.3d 379 (2004)

The issue in *Bivens* was whether the evidence was legally sufficient to permit the jury to make a reasonable inference that the defendant's child "personally saw or through some other first-hand sense or sensation was conscious of and recognized" that the defendant slapped their mother (i.e., Payne) as this assault occurred. *Bivens* at ?? The court describes the state's line of reasoning as follows:

> "As earlier noted, the state had no direct evidence of what the children saw or otherwise perceived; the state's case as to what C 'witnessed' was purely circumstantial. In attempting to prove that element circumstantially, the state relied on two predicate facts: the children's presence in the house at the time of the assault and the ease with which activities in one area of the house could be easily seen and heard elsewhere in the house.
> *Bivens* at ??.

From these predicate facts, the state argued that the children heard the argument and fight. And that, thus, they heard the open-hand slap. The details of the state's argument can be regimented into a canonical defeasible class-inclusion transitivity pattern. There are three basic guidelines that provide the scaffolding:

1. The subject of the conclusion is made the subject of the first premise.

2. The complex predicate of the conclusion is made the complex predicate of the last premise.

3. The complex predicate of each premise is made the subject of the following premise.

So, for example, the subject of the conclusion is "**the children**" so it is placed in the template as the subject of the first premise. And the predicate of the conclusion, "**heard the open-hand slap**" is placed in the template as the predicate of the final premise. By regimenting the remaining portions of the line of reasoning as described in guideline 3, the argument fits into the inferential template. Figure 4.

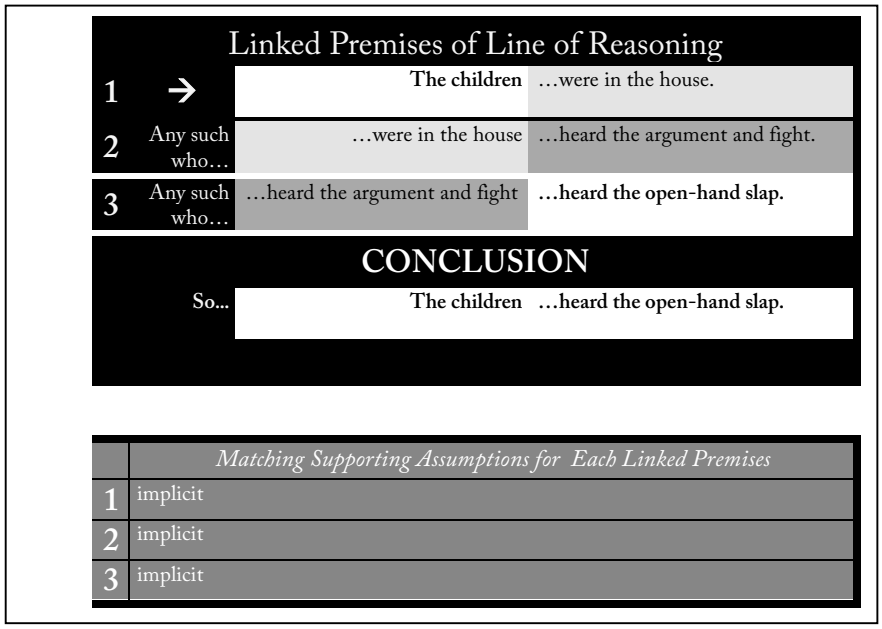

Figure 4

The court found this reasoning incomplete stating, "the state's line of logic requires several additional intermediate inferences." Bivens at ??. These are as follows:

(a) "The open hand slap made a distinctive sound."
(b) "[T]he sound of the slap rose above the noise of the

argument."
(c) "C, at age five, was sufficiently mature to distinguish the assaultive conduct from other aspects of the fight."
(d) "[T]he children and the five-year old in particular paid attention to the fight."

Bivens at ??.

While the court characterizes these statements as "additional intermediate inferences," from a more precise logical perspective, these statements are not intermediate inferences. There are no additional leaps that need to be made in the prosecution's line of reasoning since it follows a standard logical form. More accurately, these four statements are necessary supporting assumptions that must have an appropriate level of acceptability for premise 3 to have sufficient probability of being true to meet the burden of proof. This more complete argument is depicted as follows:

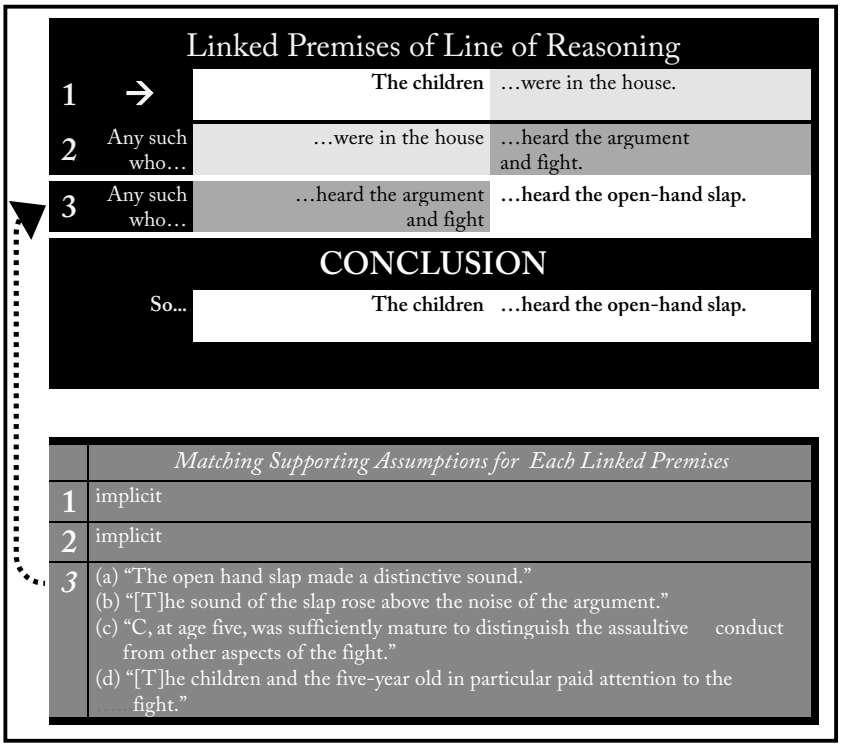

Figure 5

This line of reasoning can also be illustrated from a metaphoric perspective of the judge attempting to cross the perceived gap perceived at the nexus of predication of the conclusion. This nexus is where the subject meets the predicate phrase in the sentence. Two additional predicate phrases together with the main conclusion construct three premises that form the path that connects the subject of the conclusion to the predicate phrase of the conclusion. This series of predicate phrases can be metaphorically conceived as stepping-stones for the judge to reach the end of the conclusion while carrying a sufficient degree of acceptability. And the supporting assumptions, which the court characterizes as intermediate inferences, can be visualized as underlying support where appropriate. The supporting assumptions for premises one and two are left implicit by the court. In essence, any conclusion can be unzipped at the nexus of predication and the complex predicates can be unpacked to form the inferential line of reasoning with the associated supporting assumptions.

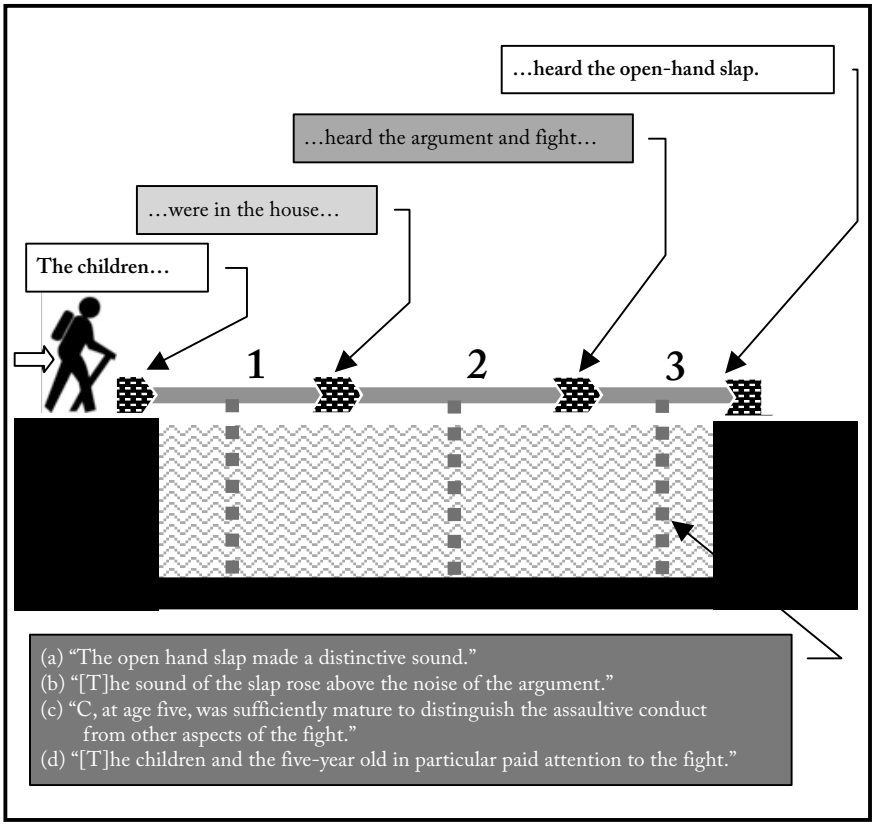

Figure 6

By applying a rigorous and robust structuring of the line of reasoning, the nature of its weaknesses becomes clearer. In this instance, the court finds the acceptability of these supporting assumptions speculative and holds that the evidence is legally insufficient to permit a reasonable inference that C witnessed the slap. Without sufficient acceptability of these supporting assumptions, premise 3 does not have sufficient probative weight bearing capacity to permit the judge to cross over to complete the conclusion linkage. Figure 7.

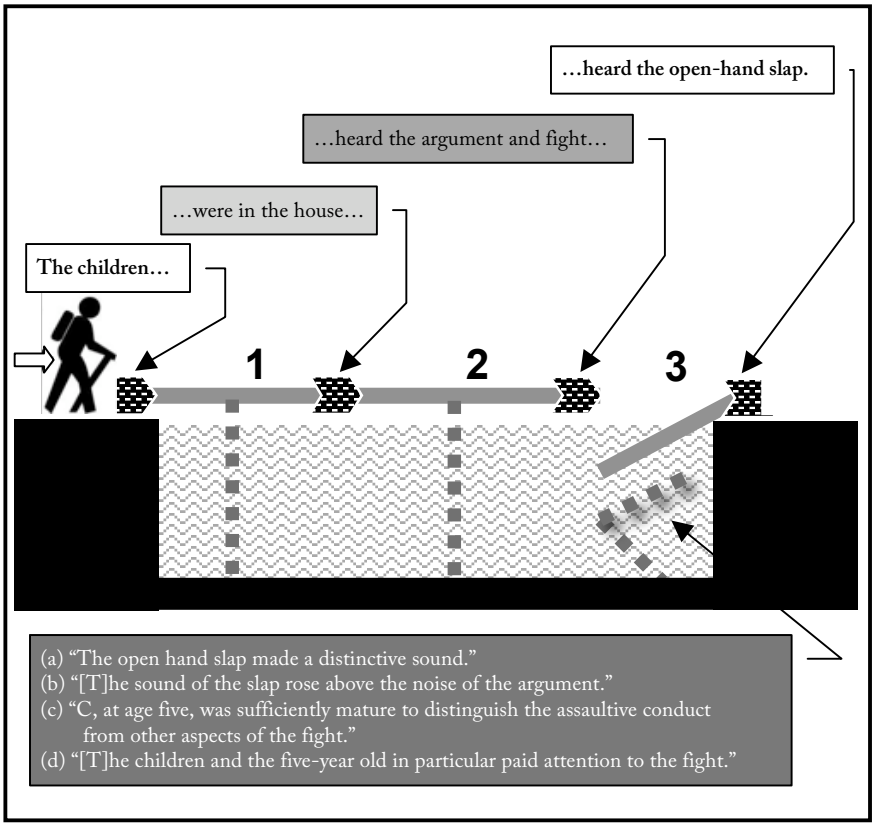

Figure 7

Without evidence of the supporting assumptions for the third premise, the inference leap from the complex predicate "heard the argument and fight" to "heard the open-hand slap" is too great for this court. It is a subjective determination of probative weight. Structurally the argument is correct.

Piling Inference Upon Inference

United States v. Lopez, 514 U.S. 549 (1995)

The United States Supreme Court has discussed the risks of reaching a conclusion based on piling inference upon inference. In *Lopez*, the issue was whether the Gun-Free School Zone Act was within the scope of the Commerce Clause. Portions of the dissent of Justice Breyer, illustrate the possible height of such a pile.

Linked Premises of Line of Reasoning			
1 →		**The Gun-Free School Zone Act…**	…forbids knowingly possessing a firearm knowingly in a school zone.
2	Any such that	…forbids knowingly possessing a firearm knowingly in a school zone…	…will reduce the number of firearms carried to school by students.
3	Any such that	…will reduce the number of firearms carried to school by students…	…will reduce the amount of gun-related violence in schools.
4	Any such that	…will reduce the amount of gun-related violence in schools…	…will reduce the number of dropouts and victims of gun-related violence who typically have suffered academically.
5	Any such that	…will reduce the number of dropouts and victims of gun-related violence who typically have suffered academically…	…will improve the quality of education in schools.
6	Any such that	…will improve the quality of education in schools…	…will improve the functional and technological literacy of students.
7	Any such that	…will improve the functional and technological literacy of students…	…will improve the functional and technological literacy of workers.
8	Any such that	…will improve the functional and technological literacy of workers...	…will improve the business competitiveness of employers in interstate and foreign commerce.
9	Any such that	…will improve the business competitiveness of employers in interstate and foreign commerce ...	**…falls within the scope of the Commerce Clause.**
CONCLUSION			
	So...	**The Gun-Free School Zone Act…**	**…falls within the scope of the Commerce Clause.**

to be continued…