E-Prime for Security: A New Security Paradigm

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ABSTRACT

This paper details a true and striking paradigm shift: the use of *E-Prime* for (at least) user-centered security, organizational/enterprise security policies and informal security policy modeling. In 1965, D. David Bourland, Jr. proposed E-Prime as an addition to Korzybski's *General Semantics*. Bourland defined E-Prime as that proper subset of the English language that omits any forms of the verb "to be." E-Prime seems desirable because two forms of the verb "to be" have structural problems with security implications that the use of E-Prime would eliminate. I first examine the rationale for E-Prime (reviewing the Sapir-Whorf hypothesis and the relevant parts of General Semantics), and then cover the basics of E-Prime. Next I examine the use of E-Prime with several "before and after" examples in the areas of user-centered security (Microsoft and ZoneAlarm software messages), organizational/enterprise security policy, and informal security policy modeling (including some examples from the U.S. Computer Security Act and the Clark-Wilson model); these examples show how E-Prime can make great improvements in eliminating bad structure and how its use can lead to an overall improvement in security. I then present some of the discussion that occurred at the New Security Paradigms Workshop. I conclude with some thoughts for other areas of promising future research, including roles and responsibilities, program management, risk management, planning and the security life cycle, assurance, disaster planning, incident handling, user awareness and training, support and operations, spam detection, security engineering, and automated E-Prime tools.

Keywords

Clark-Wilson, Disaster Planning, E-Prime, Enterprise Security Policy, Formal Methods, General Semantics, Incident Handling, Informal Security Policy Modeling, Information Assurance, Life Cycle, Modeling, Organizational Security Policy, Planning, Principle of Linguistic Relativity, Program Management, RBAC, Risk Management, Role-Based Access Control, Sapir-Whorf Hypothesis, Security Engineering, Security Life Cycle, Security Policy Modeling, Software Life Cycle SP800-12, Spam Detection, User Awareness, User Centered Security, User Support and Operations, User Training.

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1. INTRODUCTION

> "The purpose of Newspeak was not only to provide a medium of expression for the world-view and mental habits proper to the devotees of Ingsoc [English Socialism], but to make all other modes of thought impossible. It was intended that when Newspeak had been adopted once and for all and Oldspeak forgotten, a heretical thought — that is, a thought diverging from the principles of Ingsoc — should be literally unthinkable, at least as far as thought is dependent on words. Its vocabulary was so constructed as to give exact and often very subtle expression to every meaning that a Party member could properly wish to express, while excluding all other meanings and also the possibility of arriving at them by indirect method. This was done partly by the invention of new words and by stripping such words as remained of unorthodox meanings, and so far as possible of all secondary meanings whatever . . . A person growing up with Newspeak as his sole language would no more know that 'equal' had once had the secondary meaning of "politically equal," or that 'free' had once meant "intellectually free," than, for instance, a person who had never heard of chess would be aware of the secondary meanings attaching to 'queen' or 'rook.' There would be many crimes and errors which it would be beyond his power to commit, simply because they were nameless and therefore unimaginable."
>
> —George Orwell, *Nineteen Eighty-Four* [7]

This papers details a new security paradigm: a synthesis of E-Prime and information security, specifically, using E-Prime for user-centered security, organizational/enterprise security policy and informal security policy modeling. I state the underlying assumption here as "clarity improves security" because I believe that E-Prime used with information security would bring us greatly improved clarity at all (or almost all) levels.

Most people would consider this paradigm shift as fairly radical because it entails abandoning the natural language that we use for specifying security and communicating with users and replacing it with a slightly modified version of English (I presume that the same might happen for non-English language users when appropriate). Many people would also view this as a "hard sell" paradigm, but I believe that most practitioners in the field would have no problem using E-Prime after a very brief learning period. Users would not have to learn anything at all because we define E-Prime as a subset of English; they might notice an improvement in clarity.

For the submission version of this paper, one of the NSPW reviewers asked, "What would a different future look like with this paradigm?" We would have a future with clearer security specifications, users more properly informed about security issues, and an overall improvement in the way people think about security issues.

Before getting to the new paradigm itself, I believe it necessary to cover the linguistic issues involved, so I first cover the The Sapir-Whorf Hypothesis, also known as the Principle of Linguistic Relativity, to show that language constrains the way we think.

After linguistic issues, a brief overview of the semantic issues seemed appropriate, so I next cover those portions of Korzybski's General Semantics concerned with structural problems with the verb "to be" because these directly led to the creation of E-Prime.

Next I cover E-Prime *per se* by giving details about Bourland and his invention of E-Prime. Bourland defined E-Prime as a version of the English language that lacks the verb "to be" in all its forms.

I then introduce the new paradigm and look at the security implications of using E-Prime in our field. Specifically, I look at the following areas in some depth with examples before and after rendering in E-Prime.

- User centered security. In particular, some examples from Microsoft and ZoneAlarm (a personal firewall).
- Organizational/Enterprise Security Policy with an example from NIST SP-800-12 [6].
- Informal Security Policy Modeling with examples from the U.S. Computer Security Act and the Clark-Wilson model.

I conclude the paper with some thoughts for future research, such as roles and responsibilities, program management, risk management, planning and the security life cycle, assurance, disaster planning, incident handling, user awareness and training, support and operations, spam detection, security engineering, and automated E-Prime compliance.

I also wrote this paper in E-Prime as a demonstration that its use does not limit expressiveness. You will find no forms of the verb "to be" in this paper other than those used as examples, quotations, or within quotes. I found it quite easy to write the paper in E-Prime.

2. A BRIEF HISTORY OF E-PRIME

> "Be All That You Can Be"
>
> —U.S. Army Recruiting Slogan

E-Prime developed as a synthesis and simplification of several seminal ideas. The Sapir-Whorf hypothesis introduced the Principle of Linguistic Relativity. Korzybski created General Semantics and noted problems with some forms of the verb "to be." Bourland then proposed E-Prime as a simplification of the English language, abstracting out *all* forms of the verb "to be" to make things easier in practice.

2.1 The Sapir-Whorf Hypothesis

> "We cut nature up, organize it into concepts, and ascribe significances as we do largely because we are parties to an agreement to organize it in this way — an agreement that holds throughout our speech community and is codified in the patterns of our language. The agreement is, of course, an implicit and unstated one, but its terms are absolutely obligatory; we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees."
>
> —Benjamin Whorf [10]

The Sapir-Whorf hypothesis [10] argues that language (along with society) mediates the way we think. This idea, in various forms, dates back to (at least) sixth century India (Bhartrihari) [1] and in the west dates to Wilhelm von Humboldt's 1820 essay *Über das vergleichende Sprachstudium in Beziehung auf die verschiedenen Epochen der Sprachentwicklung* ("On the comparative study of languages"), and in the early 20th century by Franz Boas in *The Mind of Primitive Man* [13]) to mention just a few.

In 1940, Benjamin Whorf wrote the following.

> "We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds — and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way — an agreement that holds throughout our speech community and is codified in the patterns of our language . . . all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar, or can in some way be calibrated." [10, pages 212–214]

Linguists sometimes refer to this as the *Principle of Linguistic Relativity* [16]. While considered controversial by some (*e.g.*, Noam Chomsky), we cannot deny the influence of this principle. For example, Douglas Engelbart [11] created things like hypertext, graphical user interfaces and mice under direct influence by this principle. Also, the existence of many artificial languages, such as Loglan [3, 14], Lojban [15], and Toki Pona [17] argue for the utility, if not the validity of the Sapir-Whorf hypothesis. Much fiction, such as George Orwell's great novel *Nineteen Eighty-Four* with its fictional Newspeak [7] (where if one cannot say something then one cannot think it) uses this idea as a recurrent theme. Also, consider the growing popularity of non-sexist language (gender-neutral language) as a modification of standard English.

In a nutshell: to a greater or lesser degree, language constrains the way we think.

2.2 General Semantics

> "The little word is has its tragedies: it names and identifies different things with the greatest innocence; and yet no two are ever identical, and if therein lies the charm of wedding them and calling them one, therein too lies the danger.

> "Whenever I use the word *is*, except in sheer tautology, I deeply misuse it; and when I discover my error, the world seems to fall asunder, and the members of my family no longer know one another."
>
> —George Santayana [9, page 123]

The reader should not confuse Alfred Korzybski's *General Semantics* [5] with the very different field of semantics. Among many other things outside the scope of this paper, Korzybski claimed that we humans appear epistemologically limited by both the structure of our nervous systems and the structure of our languages. As such, people only know the phenomenal world as abstractions (sense-data and linguistic indicators). This means that perception and language can often mislead us. Korzybski terms one of the common ways this misleads people a *lack of similarity of structure*. He stressed that we should consciously take control of our abstraction process.

Korzybski wrote that two uses of the verb "to be" had particularly faulty structure: the "is of identity" and the "is of predication." For example, the statement "The computer is blue" has no observer; the statement "I see the computer as blue" appears more correct in modern scientific terms due to our knowledge about the relationship of the wavelength of light to color and the function of the retina and the brain.

2.2.1 The "Is of Identity"

> "The subject-predicate form, the 'is' of identity, and the elementalism of the Aristotelian system are perhaps the main semantic factors in need of revision, as they are found to be the foundation of the insufficiency of this system and represent the mechanism of semantic disturbances, making general adjustment and sanity impossible."
>
> —Korzybski [5, page 371]

Consider the statement "Greenwald is a fool." We note that a clear structural problem exists: people may think Greenwald a fool, but Greenwald has many more attributes than just foolishness (*e.g.*, "Greenwald is a person," "Greenwald is a computer scientist"). Put another way, we cannot consider "Greenwald" and "fool" as equivalent/identical. The statement "Greenwald appears foolish to me" has better structure.

Korzybski proposed solving this problem by denying identity via the continuous awareness that (in this case) we consider "Greenwald" much more than what we call him. In other words, Greenwald does not belong in the verbal universe, but in the nonverbal one. Korzybski expressed this idea with his famous premise, "The map is not the territory; The word is not the thing defined" [5, pages 747–761] (note that his premise contains the verb "to be," indicating that Korzybski did not advocate totally eliminating the verb[1]).

2.2.2 The "Is of Predication" and the Lack of Observers

> "The belief or unconscious conviction that all propositions are of some subject-predicate form — in other words, that every fact consists of some thing having some quality — has rendered most philosophers incapable of giving any account of the world of science and daily life."
>
> —Bertrand Russell [8, page 24]

Consider the statement "Greenwald is modest." The statement has no observer, so Korzybski would consider that an error in structure. Korzybski would consider the alternate statement "Greenwald appears modest to me" to have a better structure.

Most grammarians consider having no observer a bad thing. For our example, exactly *who* considers Greenwald modest? I consider this an important missing datum.

Worse yet (much worse!), the example attaches an Aristotelean "essence" to Greenwald. In this example, Greenwald has the "essence" of modesty. Such medieval logic conflicts with our modern operational view of the Universe. We do not want or need any "essences" or "spooks" or other metaphysical (hence, unprovable) things in science[2].

As one reviewer of the submission version of this paper noted, for security in particular, forcing the use of an observer causes designers and implementors to explicitly consider an entity that may have an impact on the system. We might reap *great* benefits by the explicit placement of observers into security specifications and designs.

2.3 E-Prime

> "It depends what the meaning of 'is' is."
>
> —U.S. President Bill Clinton (the chief law-enforcement official in the U.S.) attempting to defend himself against a charge of perjury, 1998.

Can we expect that most developers and users will maintain a continuous awareness of the structural problems of the "is of identity" and the "is of predication?" Of course not. As a remedy, David Bourland proposed totally eliminating the verb "to be" from the English languages and called this simplifying modification *E-Prime.*

2.3.1 Types of the Verb "To Be"

The verb "to be" has the following functions in the English language (where, for the sake of simplicity, I designate the copula with "is").

1. **Identity**, of the form *noun "is" noun* (*e.g.*, Greenwald is a person).
2. **Predication**, of the form *noun "is" adjective* (*e.g.*, Greenwald is modest).
3. **Auxiliary,** of the form *noun "is" verb* (*e.g.*, Greenwald is writing; Greenwald is shot by an irate linguist).

[1] One of the reviewers of the submission version of this paper requested a translation of Korzybski's famous premise into E-Prime, which seems like a good idea for the purposes of illustration: "The map and the territory it defines do not equal one another; The word and the thing it defines do not equal one another." Many other alternate translations exist.

[2] I consider the reasons why most operationalists consider medieval type thinking (Aristotelean essences, Thomism, *etc.*) undesirable for scientific activities beyond the scope of this paper.

4. **Existence**, of the form *noun "is"* (*e.g.*, There is Greenwald).

5. **Location**, of the form *noun "is" place* (*e.g.*, Greenwald is at NSPW).

Bourland, like Korzybski, sees the identity and predication functions as pernicious. For the sake of simplicity he advocates eliminating all forms of the verb "to be." Note that we can easily replace the existence and location form with the verb "exists" (*e.g.*, "A Greenwald exists," "Greenwald exists in the bed.").

Before the reader assumes this outlandish, consider that this dichotomy between the "bad" and "good" categories of the verb "to be" reflects the fact that approximately 20% of the Earth's population speaks a native language that lacks a verb that exactly corresponds to the "bad" version of the English verb "to be." Examples include Mandarin, Hungarian, Arabic, and Russian (Hebrew contains two separate forms of the verb "to be" that correspond to the two categories).

For example, an expert in the Russian language transliterated the Russian verb "to be" as "BYT′" (I define 'Y' as a hard 'E' and 'T′' as a soft 'T') and noted that Russian contains no "is" of identity or predication. Exact translations would render the first two example sentences from Russian as "Greenwald person" and "Greenwald modest."

This surely indicates the *practical possibility* of doing without the verb "to be."

2.3.2 Forbidden Verbs in E-Prime

As an aid to the reader, Table 1 lists some of the verbs (and contractions) that E-Prime forbids. For clarity, I include some allowable verbs in Table 2. (Both of the above lists after [12].)

Ain't
Am
Are
Aren't
Be
Been
Being
They're
Hain't
He's
I'm
It's
Is
Isn't
You're
She's
Was
Wasn't
Were
Weren't
We're

Table 1: Forbidden Verbs in E-Prime

Become
Has
Have
I've
You've
Do
Does
Doing
Did
Can
Could
Will
Would
Shall
Should
Ought

Table 2: Some Allowable Verbs in E-Prime

2.3.3 Other Benefits of E-Prime

- Using E-Prime makes it much harder to write in the passive voice and progressive aspect[3], which most stylists and style guides consider indications of bad or sloppy writing. Bourland considers this one of the greatest contributions of E-Prime. Coupling bad or sloppy writing with a security context seems to me a perfect recipe for disaster. As Bourland writes in [2]:

  > For example, many writers of technical and scientific papers forget that objectivity resides in the persons conducting the various experiments, etc., rather than in the passive forms used in reporting the results. I know of two instances in which scientists applied E-Prime to their complete report because this technique actually forced them to make explicit some important early details. One instance involved the failure of a sensor on a satellite, and the other concerned the fact that contractor personnel did not switch on a certain antenna. In both instances early versions of the reports in question said something like, "The data were not available."

- E-Prime also helps with disambiguation, one of security's *desiderata*. Many have noted that E-Prime makes it more difficult to lie or to engage in disingenuousness. E-Prime often helps eliminate redundant language. One reviewer of the submission version wondered if E-Prime would make it more difficult to create and use cover stories (an important aspect of security in some circles). I don't think so, as it would only make it harder to create ambiguous cover stories.

- As Bourland writes, "The verb 'to be' carries with it a huge intellectual momentum of completeness, finality, and time independence" [2]. Consider his example statement, "The earth is flat." Bourland notes that the statement adequately describes the earth for some *restricted purposes* and therein

[3] We form the progressive aspect by combining the auxiliary verb "to be" with some present participle (word + "ing") to show an unfinished action, such as the canonical example "The rain was beating down." Most grammarians consider this wrong and recommend a change to the *simple past* form such as "The rain beat down."

lies the danger: people often do not seem aware of these restrictions (or abstractions). I believe this especially true in the security field where we continuously make special abstractions (*e.g.*, "Users are not human but are instead proxy programs," "Trust should not be transitive"[4]).

- Bourland also notes in [2] that the verb "'to be' carries with it archaic associations and implications of permanence and static existence that we do not find in the 'real world.'"

As an aside, when using E-Prime one cannot ask certain pseudo-questions; in particular, questions of extremely high abstraction such as "What is man?" True questions of a lower order of abstraction appear possible in E-Prime, such as "What characterizes man or woman uniquely?"

3. E-PRIME FOR SECURITY

"Math is hard!"

—Barbie

I propose that we use E-Prime for any English statements used in the following security areas.

1. User-Centered Security.
2. Organizational/Enterprise Security Policy.
3. Informal Security Policy Modeling.
4. Other areas, that I have not explored in this paper (detailed in the conclusions section).

3.1 User-Centered Security

"Garbage In, Gospel Out" (GIGO).

—A more recent (and sardonic) meaning for GIGO

Zurko defined *User-Centered Security* as the relationship between human users and security mechanisms [20, 19, 18].

Consider the following real-life examples of security-related messages and their rendering into E-Prime.

3.1.1 Microsoft's Network Connections Program

The following message regularly appears on my computer when it connects to my ISP.

> Earthlink sjg6@gate.net is now connected

The message has structural problems related to the "is of predication." In particular, it has no observer and it makes a temporal statement of current fact, when it should make a statement about *a new event*. As I write this, several hours have passed since the message appeared, yet the truth-value of the message remains unchanged. If we render the message in E-Prime, we wind up with a more accurate, more informative, and more easily comprehensible statement:

> The Network Connections Program reports that Earthlink sjg6@gate.net has just connected.

3.1.2 ZoneAlarm's Blocked Intrusion Messaging

ZoneAlarm (a product of ZoneLabs.com) runs as a personal firewall on many computers. It gives many informational messages that it sometimes expects users to act upon. Some examples follow with criticisms within brackets (I will not usually note examples that contain passive voice — it seems a particular plague in the security field).

1. This is a record of your security activity. *[Identity.]*
2. You're protected by ZoneAlarm! *[Predication. When? Forever?]*
3. No further setup is necessary. . . *[Predication. By whom?]*
4. 8545 Intrusions have been blocked since install. *[Predication. No observer; exactly who or what does the blocking?]*
5. 601 of those [intrusions] have been high-rated. *[Identity.]*
6. MailSafe is on. *[Predication. No observer.]*
7. Basic MailSafe is enabled. *[Predication. No observer.]*
8. Your computer is hidden and protected from hackers. *[Auxiliary. No observer.]*
9. Sharing is not allowed. *[Predication. No observer.]*
10. This setting is recommended for the Internet Zone. *[Auxiliary. Recommended by whom?]*
11. Anti-virus security status is not being monitored. *[Auxiliary. Not "being" monitored by whom?]*

The above examples rendered in E-Prime follow.

1. ZoneAlarm presents this as a record of your security activity.
2. ZoneAlarm now protects you!
3. You do not have to do further setup. . .
4. ZoneAlarm blocked 8545 Intrusions since install.
5. ZoneAlarm considers 601 of those intrusions as high-rated.
6. MailSafe appears on according to ZoneAlarm.
7. ZoneAlarm has enabled Basic MailSafe.
8. ZoneAlarm has hidden and protected your computer from hackers.
9. ZoneAlarm does not allow sharing now.
10. ZoneAlarm recommends this setting for the Internet Zone.
11. Currently, ZoneAlarm does not monitor Anti-virus security status (alternately: Anti-virus security status not currently monitored by ZoneAlarm).

[4]Rendering these examples in E-Prime gives "We assume proxy programs represent human users" and "As an assumption, we forbid the use of transitive trust "

The examples rendered in E-Prime appear more clear, have clearly defined observers, and show a reduction in passive voice and ambiguity. Note that alternate versions of the E-Prime renderings exist.

One of the reviewers of the submission version of this paper also noted that the E-Prime rendering would make remote debugging much easier because when the user reported the exact message that caused her to worry, we would have a much better idea of her current conditions.

3.2 Organizational/Enterprise Security Policy

> "Ceci n'est pas une pipe" ("This is not a pipe").
>
> –Rene Magritte, *The Betrayal of Images*

We usually define organizational/enterprise security policy as something along the lines of "senior management's directives to create a computer security program, establish its goals, and assign responsibilities." [6]. Other definitions exist, but this one will suffice for the scope of this paper.

Consider the following sample security objective from Chapter 5 (Computer Security Policy) of NIST Special Publication 800-12 [6].

> Only individuals in the accounting and personnel departments are authorized to provide or modify information used in payroll processing.

Note that it contains the "is of predication" and lacks an observer. Now consider the E-Prime rendering.

> Upper management authorizes only individuals in the accounting and personnel departments to provide or modify information used in payroll processing.

In the E-Prime version, due to the necessary addition of an observer to eliminate the "is of predication," the user may now clearly understand that upper management mandates the security objective. This may have important implications for user compliance and understanding.

One reviewer of the submission version of this paper wrote that "big businesses [indeed, bureaucracy in general] seems to thrive on having no clear lines of responsibility. Having clear accountability obvious would add to jobs where complaints would be targeted to." Perhaps using E-Prime would give us this side-benefit.

3.3 Informal Security Policy Modeling

We generally define an informal security policy model as a rigorous model, in a natural language, of an organizational/enterprise security policy.

3.3.1 Computer Security Act Example

Consider the following definition of "sensitive information" from the U.S. Computer Security Act as quoted in [6].

> . . . any information, the loss, misuse, or unauthorized access to or modification of which could adversely affect the national interest or the conduct of federal programs, or the privacy to which individuals are entitled under section 552a of title 5, United States Code (the Privacy Act), but which has not been specifically authorized under criteria established by an Executive Order or an Act of Congress to be kept secret in the interest of national defense or foreign policy.

We see three examples of the use of the verb "to be:" predication and two auxiliary. Now consider the following improvements in the E-Prime rendering (I have not tried to untangle the original!).

> . . . any information, the loss, misuse, or unauthorized access to or modification of which could adversely affect the national interest or the conduct of federal programs, or the privacy to which section 552a of title 5, United States Code (the Privacy Act) entitles individuals, but which criteria established by an Executive Order or an Act of Congress does not specifically authorize for secret treatment in the interest of national defense or foreign policy.

While the original seems difficult to read, the E-Prime version seems less so, appears slightly more succinct, and has a concrete observer.

3.3.2 The Clark-Wilson Model

Most people in our field regard the Clark-Wilson model [4] as a landmark seminal security policy model that everyone in the field should know and study. Consider how taking three of the Clark-Wilson well-formed transformation constraints and rendering them in E-Prime may improve the definitions (I could have done all of the constraints, but these three suffice).

- Constraint C1.

  > C1: (Certification) All IVPs must properly ensure that all CDIs are in a valid state at the time the IVP is run.

  Note the use of the "is of identity" and the "auxiliary is." Now consider the E-Prime rendering.

  > C1': (Certification) All IVPs must properly ensure that all CDIs currently occupy a valid state at the start of the IVP run.

  This seems a much more clear explication of the goal for this Clark-Wilson constraint.

- Constraint E1.

  > E1: (Enforcement) The system must maintain the list of relations specified in the rule C2, and must ensure that the only manipulation of any CDI is by a TP, where the TP is operating on the CDI as specified in some relation.

  Note the use of the "is of identity" and the "auxiliary is." Now consider the E-Prime rendering.

> E1': (Enforcement) The system must maintain the list of relations specified in the rule C2, and must ensure that only a TP manipulates any CDI, where the TP operates on the CDI as specified in some relation.

This version appears easier to read, and more clear.

- Constraint C3.

> C3: The list of relations in E2 must be certified to meet the separation of duty requirement.

Note the use of the "auxiliary is" and how there the constraint has no observer (exactly who does the certification?) Now consider an E-Prime rendering.

> C3': The security officer, system owner, and system custodian must certify the list of relations in E2 so that they meet the separation of duty requirement.

This appears significantly better to me. During the workshop, Carla Marceau noted that E-Prime rendering caused disambiguation of the constraints!

4. WHAT HAPPENED AT THE WORKSHOP

In this section I hope to give a fair rendering of some of the events and discussion that ensued during my presentation at the workshop. Highly interactive presentations at NSPW seem the norm, and mine appeared to me as no exception.

N.B.: I have translated the NSPW scribe's notes into E-Prime. I take responsibility for any errors.

My presentation involved a bit of trickery that I shall not describe since I might need it again. The trickery took advantage of Bob Blakley; Bob seemed unharmed (knowing Bob as I do, I chose him as a subject due to his good nature). The legerdemain seemed necessary to me so that I could make a strong point about the nature of human perception, and in fact Michael Franz first noted the irregularity (he gets bragging points). Several attendees told me afterwards that I "messed" (they did not use that exact word) with their minds. I intended to!

Bob Blakley made the point that we can think of things that we cannot say, but that doing so presents great difficulties for most people. Michael Franz referenced Wittgenstein (in his Tractatus) on thinking the unthinkable.

Konstantin (Kosta) Beznosov gave an example of abstraction control, specifically when people discuss UML diagrams with indexical indefinite pronouns, (*e.g.*, , "this thing," "that thing") because UML seems natively abstraction poor to him.

Hilary (Holly) Hosmer pointed out that Spanish has two verbs for "to be" and Greek has several.

Michael Locasto thought my example sentence, "The computer is blue," appeared unambiguous. Bob Blakley disagreed violently. So do I, but I believe anyone's perception of ambiguity depends on their universe of discourse, reality map, assumptions (or what have you). Clearly, if two such exceptionally clear-thinking people do not agree on the ambiguity of such a simple statement then we certainly have a problem!

Sean Peisert asked if John Wilkins' Philosophical Language[5] would illuminate things. I don't know, but I think it a great question well beyond the scope of this paper.

At one point during the discussion, several people at once mentioned Bertrand Russell's "Turtles all the way down" anecdote (about infinite cosmological recursion). I can't quite recall why this seemed so important at the time, but I include it for completeness.

Bob pointed out that the problem of a lack of an observer arose during CORBA security design: "We had to impose a rule that the only sentence form in which 'trust' was permissible was 'X is trusted by Y for Z."'

George Danezis pointed out that ID management systems consider it very important to know not only the name of an individual, but who calls the individual that name, because the relationship between the namer and the named creates the actual basis for trust.

Kosta asked how languages without the verb "to be" express the progressive aspect. I did not know for certain at the time, but it turns out according to Victor Raskin that many languages lack the progressive aspect. In any event, I consider this outside the scope of this paper.

Michael Franz thought that by replacing "is" with "seems" in some examples that I added an extra dimension of vagueness. We discussed this in some depth. Having thought about this for some time I have concluded that perhaps sometimes vagueness does happen, but in such cases I think the vagueness belongs. In effect, the vagueness (if any) becomes explicit. At least, it seems that way to me.

Regarding error messages, Mary Ellen Zurko (Mez) thought that while average users would not understand most error messages, a help desk would understand the E-prime version much better than the English version.

Kosta discussed the use of viewpoints in software design and drew an analogy to predication. Bob thought that doing predication can help designers decide whether anyone really cares about the message.

David Thompson noted that the average Atlantic Canadian reads at a grade 6 level and understands 75% of material read. Therefore, "less and simpler" may equate to "better."

Kosta and Mez note that a lack of predication may sometimes deliberately arise in an attempt to avoid accountability. Other people outside the workshop also made this comment when I discussed the idea with them.

George Danezis noted that a danger still exists that policy writers will attribute nonexistent but named entities. For example, "The security policy requires that . . ." as if the security policy could take the place of a rational or accountable actor. I agree with George, but must note that we should not consider E-Prime a panacea.

[5] *An Essay towards a Real Character and a Philosophical Language* (London, 1668)

Kosta wanted automated translation to E-prime (Brian Snow also, via email) and I originally noted this in my list of future research areas. Bob noted that such an automated system would require guidance by a human who would have to fill in the missing nouns. We can envision something like dialog windows that pop-up automatically for a "fill in the blanks" action. However, this seems like a *very hard* natural language processing (NLP) problem/task.

Very shortly after my presentation, Carla Marceau informed me that my translation had disambiguated the example Clark-Wilson constraints! I had not realized this and it mildly astonished me.

Finally, a brief discussion with several workshop participants translated Greenwald's First Law[6] into "87.65% of all statistics appear made up" - certainly a more precise, although rhetorically weaker, statement!

5. CONCLUSIONS AND DISCUSSION

> "The limits of my language indicate the limits of my world."
>
> —Ludwig Wittgenstein (Tractatus Logico-Philosophicus, 1921)

I have examined in detail only three security areas where E-Prime may offer improvements: user-centered security, organizational/enterprise security policy, and informal security policy modeling. I hope I have shown that E-Prime makes great improvements in eliminating bad structure in these areas, and also shown how its use can lead to an improvement in overall security.

Other areas for future research might include roles and responsibilities, program management, risk management, planning and the security life cycle, assurance, disaster planning, incident handling, user awareness and training, support and operations, spam detection, security engineering, and automated E-Prime compliance. I would like to add more about how E-Prime would benefit these areas, but I must leave that for future research.

One reviewer of the submission version of this paper brought up the idea of "buy in," mentioning that educators would first have to learn and adopt this manner of speaking or specifying security constraints before the students adopt E-Prime. The same reviewer also wanted to see a plan for teaching E-Prime in academia or industry, but this seems outside the scope of this paper. This reviewer also brought up the issue of knowing how to speak in E-Prime and that it might form a temporary exclusive "club." This cannot really happen, since anyone who knows English can understand E-Prime.

Many people wonder about the difficulty of learning E-Prime. My experience shows (for me) that writing in E-Prime seems fairly easy. I find speaking in E-Prime much harder. Trying to think in E-Prime seems to me very hard. Changing my *umwelt* to one congruent with E-Prime has not yet happened (for me). Writing in E-Prime for security reasons appears the most critical need at this time, and I believe most people in our field will find that fairly easy after a little practice. In addition, it seems to me we could easily create tools that check writing for "E-Primality."

[6]"87.65% of all statistics are made up" - first used by me at NSPW 1996

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