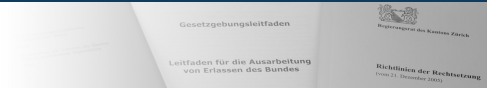


Designing a Controlled Natural Language for the Representation of Legal Norms

Stefan Hoefler and Alexandra Bünzli

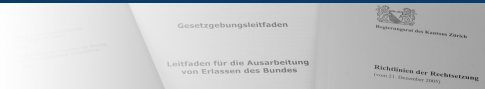
University of Zurich

Overview



- ① Motivation
- ② Design Requirements
- ③ Design Decisions
- ④ State of Development
- ⑤ Conclusion

Artificial intelligence & Law



Tasks

- ① How can **legal reasoning** be formalised?
- ② How can **legal knowledge** be formalised?

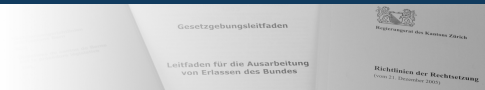
Problem

One of the main obstacles to progress in the field of artificial intelligence and law is the natural language barrier.

Since the raw materials of the law are embodied in natural language – cases, statutes, regulations, etc. – the designer of a knowledge-based legal information system today must translate them, by hand, into a formal language, just to get started.

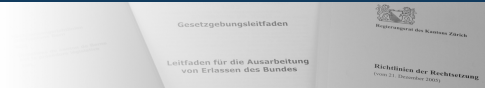
(McCarty 2007:217)

Problem



Legal texts (statutes, regulations, etc.) must be translated manually into formal representations.

Problem

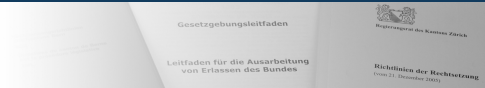


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Knowledge engineer

- familiar with formal representations
- no legal expertise

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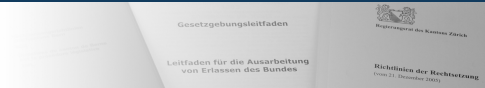
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Legal expert (lawyer)

- legal expertise
- not familiar with formal representations

Can controlled natural language bridge the gap?

Gesetzgebungsleitfaden
Leitfaden für die Ausarbeitung
von Erlassen des Bundes



Richtlinien der Rechtssetzung
(vom 21. Dezember 2001)

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Can we develop a controlled natural language that can serve as an **interlingua** between legal texts and formal representations?

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Can we design a controlled natural language for the representation of **legal norms codified in Swiss statutes and regulations?**

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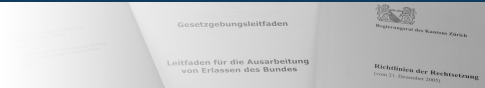
Controlled Legal German (CLG)

Can we design a controlled natural language for the representation of **legal norms codified in Swiss statutes and regulations**?

Requirements

- 1 CLG must be formal, i.e. have an unambiguous formal semantics.
- 2 Swiss legislative texts must be easy to translate into CLG.
- 3 CLG representations must be easy to verify for legal experts.

What formal semantics?



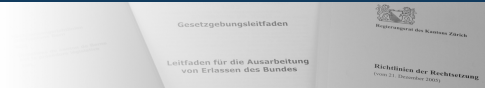
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Question: What form of logical representation shall CLG be mapped to?

Problem: Existing formats idiosyncratic; no standard available yet.

What formal semantics?



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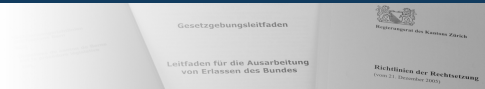
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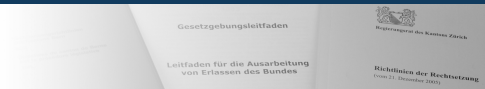
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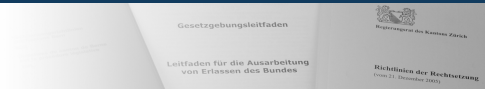
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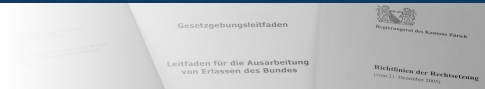
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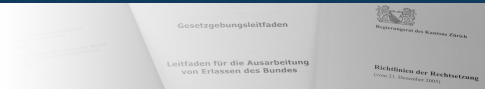
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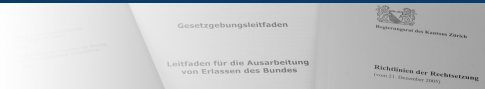
An incremental approach



Considerations

- Formal representations are always simplifications of some sort...
- ... but even with shallow representations, one can do useful stuff.

An incremental approach



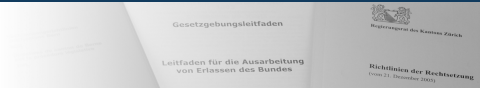
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- Map CLG onto a logical form that is
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Who must do what under which circumstances?

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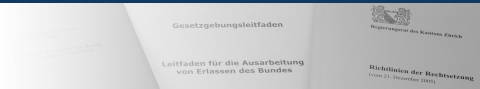
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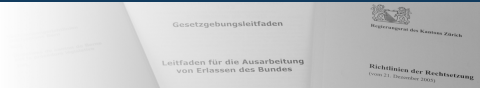
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An incremental approach



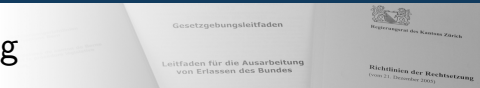
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- Ignore superstructures (for the moment).
- Add logical concepts incrementally during development.

Current semantic underpinning



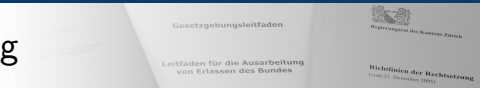
Art. 1 Abs. 1 BGG

Das Bundesgericht ist die oberste rechtsprechende Behörde.

'The Federal Supreme Court is the supreme judicial authority.'

$$\exists!xy : \text{federal_supreme_court}(x) \wedge \text{supreme_judicial_authority}(y) \wedge$$
$$\emptyset \exists e : \text{is}(e, x, y)$$

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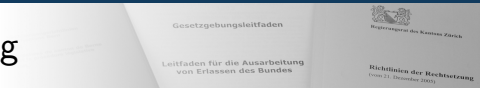
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Logical concepts included so far

- FOL + deontic concepts (obligation, permission, prohibition)
- existential, universal and counting quantifiers
- some constituents (Adj+N, adverbial phrases) are not yet analysed
- reification/quantification of events
- no temporal or intensional concepts yet

Current semantic underpinning



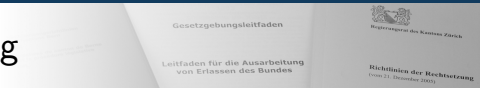
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Function words

- controlled semantics

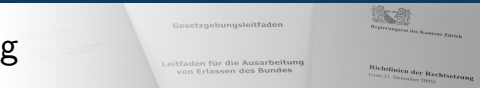
Content words

- user-defined semantics
- mapped onto atomic predicates

→ essential in the context of legal rule systems:

open-texturedness/vagueness of the concepts is maintained

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Designing the controlled natural language

Gesetzgebungseleitfad

leitfaden für die Ausarbeitung
von Erlässen des Bundes



Regierungsrat des Kantons Zürich

Richtlinien der Rechtssetzung
(vom 21. Dezember 2001)

Main task

- Controlling **ambiguous constructions and function words**

Methods

- ① prohibit their use
- ② assign them a default interpretation

Design decisions

- which constructions shall be allowed/prohibited?
- which readings shall be defined as default interpretations?

Designing the controlled natural language

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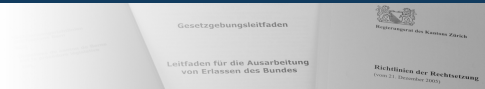
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Design requirements



Requirements II+III

CLG must facilitate two operations:

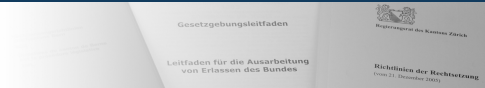
- 1 **translation**
of legislative texts into CLG (by knowledge engineers)
- 2 **verification**
of the CLG representation (by legal experts)

→ [Design requirements](#)

- 1 proximity to **conventional** legislative language
- 2 maximal **explicitness**

How can this be achieved?

Methods I



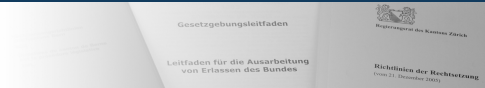
Method I: simulating domain characteristics

CLG construction and interpretation rules must reflect the **conventions of legislative language.**

Origins of these conventions

- ① pragmatics of the text domain
- ② historically grown frequency distributions
- ③ standards defined in official drafting guidelines
- ④ stylistic means artificially developed to improve readability

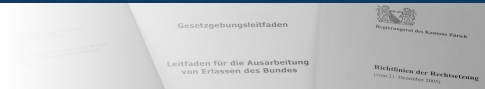
Methods II



Method II: providing syntactic sugar

CLG must provide ample **syntactic sugar**: constructions with default interpretations must have **explicit paraphrases**.

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Procedure

source text



conventional representation in CLG

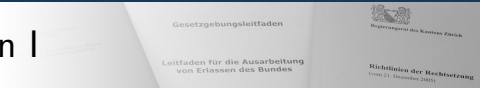


explicit representation in CLG

easier if CLG resembles source lang.

deterministic

Pragmatics of the text domain I



Norms contain two basic types of modality:

- **obligation**: *müssen* ('must'), *haben zu* ('have to'), no modal verb
- **permission**: *dürfen* ('may'), *können* ('can')

In CLG semantically equivalent:

- Radfahrer **müssen** einen Helm tragen.
'Cyclists **must** wear a helmet.'
- Radfahrer **haben** einen Helm **zu** tragen.
'Cyclists **have to** wear a helmet.'
- Radfahrer tragen einen Helm.
'Cyclists wear a helmet.'

$\circ \forall x : cyclist(x) \rightarrow \exists ey : helmet(y) \wedge wears(e, x, y)$

Pragmatics of the text domain II

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Richtlinien der Rechtssetzung
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Example

Radfahrer **müssen** mindestens einen Rückstrahler tragen.

'Cyclists **must** wear at least one reflector.'

Pragmatics of the text domain II

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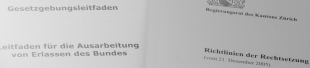
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Interpretation rule

Modal verbs have wide scope over the whole sentence.

Pragmatics of the text domain III

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Interpretation rule

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Explicit paraphrase

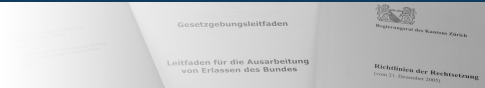
Es ist obligatorisch, dass Radfahrer mind. einen Rückstrahler tragen.

'It is obligatory that cyclists wear at least one reflector.'

Alternatives

- *Es ist vorgeschrieben, dass* ('it is prescribed that')
- *Es ist zwingend, dass* ('it is coercive that')
- ...

Frequency distributions I



§ 67 Abs. 2 Regulation of the University of Zurich

Ein Mitglied der Universitätsleitung führt den Vorsitz.

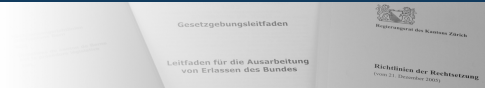
'**A member** of the university board takes the chair.'

§ 8 Abs. 7 Regulation of the University of Zurich

Ein Titel [...] kann [...] entzogen werden, wenn die Inhaberin oder der Inhaber die Interessen der Universität ernsthaft verletzt.

'**A title** can be revoked if the holder seriously violates the interests of the university.'

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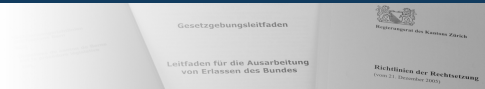
$\exists x : member(x) \wedge \dots$

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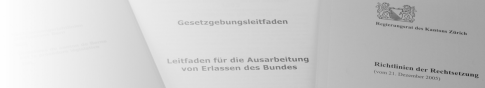
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Frequency distributions II

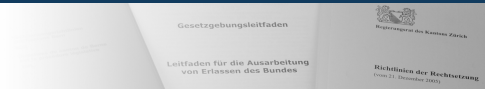


§ 3 Abs. 3 Regulation of the University of Zurich

Dienstleistungen sind [...] kostendeckend in Rechnung zu stellen.

'**Services** have to be charged so that the costs are covered.'

Frequency distributions II



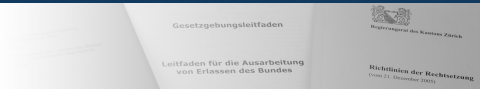
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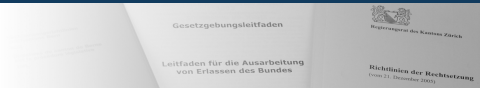
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Indefinite noun phrases are interpreted as universally quantified in vorfeld position and as existentially quantified elsewhere.

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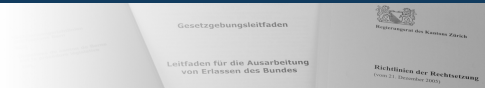
§ 2 Abs. 4 Regulation of the University of Zurich

Besondere Veranstaltungen können auch für eine breite Öffentlichkeit angeboten werden.

'**Specific events** can also be offered to a broader public.'

$\exists x : \text{event}(x) \wedge \dots$

Frequency distributions III

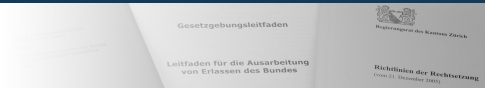


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Frequency distributions III



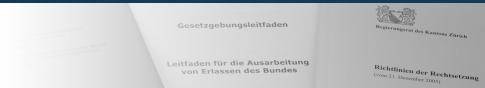
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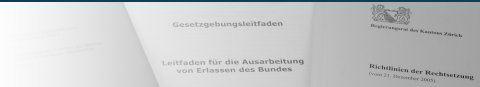
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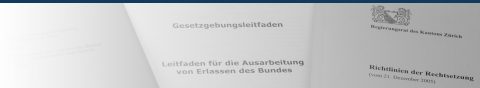


Rephrase (e.g. as a passive construction)

Der Vorsitz wird **von einem Mitglied** der Universitätsleitung geführt.

'The chair is taken **by a member** of the university board.'

Frequency distributions III



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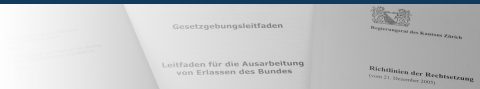
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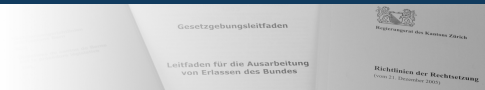
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Additional advantage:

The subject now correctly designates what the norm is **about**.

Drafting guidelines



Example from the drafting guidelines of the canton of Zurich

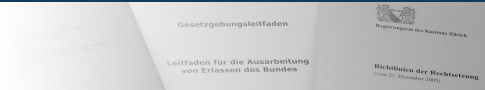
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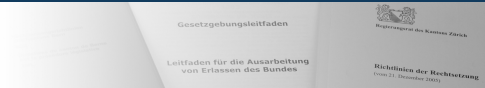
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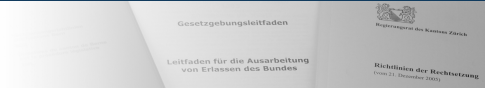
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Stylistic conventions I

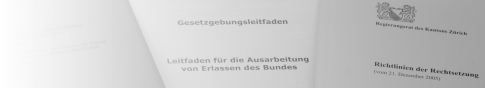


Art. 20 Abs. 3 BGG

In Fünferbesetzung entscheiden sie ferner über Beschwerden gegen referendumpflichtige kantonale Erlasse und gegen kantonale Entscheide über die Zulässigkeit einer Initiative oder das Erfordernis eines Referendums.

'In a composition of five, they further decide on appeals against cantonal decrees that are subject to referendum and against cantonal decisions on the admissability of an initiative or the necessity of a referendum.'

Stylistic conventions I



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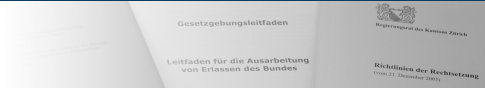
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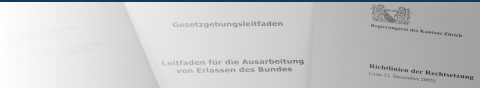
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Explicit paraphrase?

→ exploit structures provided by conventional legislative language

Stylistic conventions II



Rephrase as an explicit enumeration

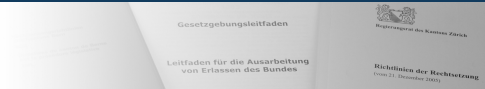
In Fünferbesetzung entscheiden sie ferner über Beschwerden gegen:

- referendumspflichtige kantonale Erlasse;
- kantonale Entscheide über die Zulässigkeit einer Initiative;
- kantonale Entscheide über das Erfordernis eines Referendums.

'In a composition of five, they further decide on appeals against:

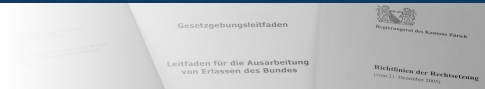
- cantonal decrees that are subject to referendum;
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State of development I



At the moment, CLG comprises about two dozen construction and interpretaton rules, addressing phenomna such as:

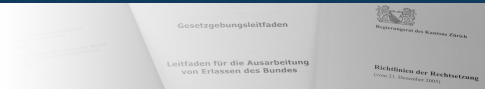
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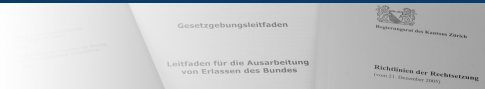
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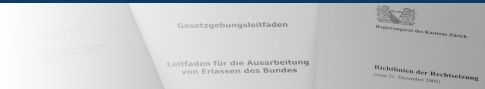
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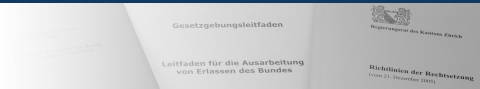
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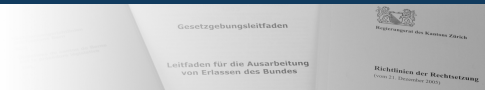
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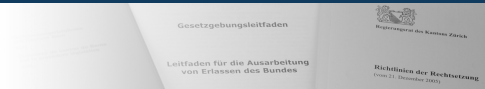
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(articles, domain-specific function and content words)
- **referential ambiguities**
(pronouns, relational nouns)
- **functional ambiguities**
(arising from the relatively free German word order)

State of development II



Syntax

- sentence patterns for simple norms and for legal definitions
- only present tense
- only canonical word order
- active and passive voice
- prepositional phrases only attach to verbs
- subordinate clauses restricted to conditional and relative clauses
- no genitive attributes (exception: the agent of nominalised verbs)
- no particles (*dennoch, also, auch, nur, ...*)
- negation only permitted at specific positions

Challenges ahead: e.g. bridging references

Gesetzgebungsleitfaden

Leitfaden für die Ausarbeitung
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Regierungsrat des Kantons Zürich

Richtlinien der Rechtssetzung
(vom 21. Dezember 2001)

Art. 55 Abs. 1 Employee Regulation ETH

Bei der Geburt eines Kindes hat der Angestellte Anspruch auf eine einmalige Zulage von 530 Franken.

'Upon the birth of a child, the employee is entitled to a one-time allowance of 530 francs.'

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- Approximately 216,000 children are born every year.

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- Approximately 216,000 children are born every year.
- The employee is entitled to an allowance of 530 francs per child being born.

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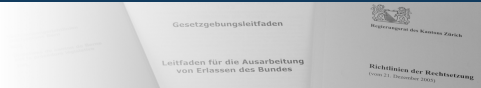
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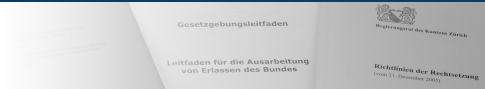
- Approximately 216,000 children are born every year.
- The employee is entitled to an allowance of 530 francs per child being born.
- Therefore, the employee is entitled to an annual allowance of 114,480,000 francs.

Key points

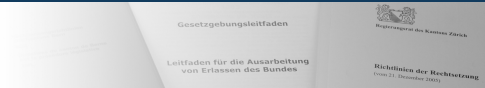
- We are exploring the potential of the employment of controlled natural language as an **interlingua** between legal texts and formal representations.
- To facilitate the translation of the source texts into the controlled language, the controlled language has to **resemble conventional legal language**.
- To facilitate its verification, **explicit paraphrases** for language constructs with default interpretations must be available.
- To fulfil these two requirements, we
 - ① ensure that our construction and interpretation **rules reflect conventions and frequency distributions** of legal language, and
 - ② endow our controlled natural language with ample **syntactic sugar**.



Lessons to be learnt

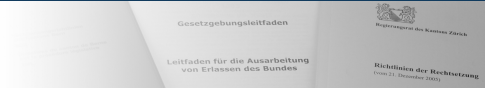


Lessons to be learnt



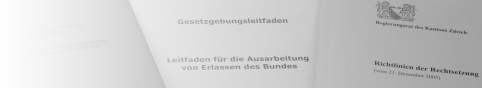
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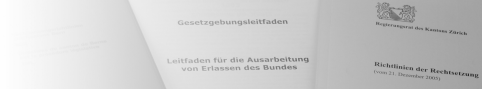
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- ④ It is not always possible to provide explicit paraphrases without resorting to **extra-linguistic means** such as brackets etc.
- ⑤ Translating a legislative text into a controlled natural language helps understanding its meaning properly.
→ Even if we cannot perform automated legal reasoning (yet), *a controlled legal language can serve as a **tool for clarification** in legislative drafting and/or legal training.*

