Interpretation of Imputed Behavior in ALIBI (1 to 3) and SKILL

FADEL FAKHER ELDEEN, TSVI KUFLIK, EPHRAIM NISSAN, GILAD PUNI, RONI SALFATI, YUVAL SHAUL, AUNI SPANIOLI

ALIBI is a program that analyzes an accusation and finds excuses (or, more generally, alternative explanations: not «alibis»). ALIBI analyzes an accusation, decomposes actions imputed, and then tries to exculpate the defendant, by separating ascertained events from deontic (i.e., legal or moral) interpretations, and by recomposing the constitutive elements yielded by the recursive decomposition of the actions, into a less reprehensible plan of action. ALIBI2 has, as interface, a parser that allows the input accusation to be stated as a set of simple English sentences. ALIBI3 includes an explicit mechanism to calculate costs of excuses and parts thereof in terms of deontic liability. SKILL is a program that extends justification to areas other than in the legal domain: skill in performing at some task is judged according to common-sense knowledge (including widespread prejudices) about the task, on classes of performers, and on the environment.

1. COMPUTER GENERATION OF EXCULPATORY EXCUSES

According to a Persian anecdote, a certain person was asked, one day, by one of his neighbors to lend him his rope. He replied, «I have spread millet on it». The neighbor wondered: «How can one spread millet on a rope?» The answer he got, was: «For an excuse, any reply would do».

Roles and addresses:
Dr. Ephraim Nissan (advisor & contact-author): Department of Mathematics & Computer Science, Ben-Gurion University of the Negev, P.O. Box 653 Beer-Sheva 84105, Israel.
Tsvi Kuflik (ALIBI): with the Israeli Air Force (on study leave in the U.S.).
Gilad Puni (ALIBI): 17/14 Kallanit St., Kfar Saba.
Roni Salfati (ALIBI2): 36/16 Ben-Yair St., Arad 80700.
Yuval Shaul (ALIBI2): 6 Ben-Yosef St., Bat-Yam 59401.
Auni Spanioli (ALIBI3): St. 202/10, Nazareth 16000.
Faadel Fakher Eldeen (SKILL): Majdal Shams, Golan Heights 12438.
(Haim 1956: p. 34). Any excuse would do, because the rope owner expected no punishment would come to him, from not having his excuse believed. He was not standing trial for a punishable charge. A felon would be more wary on proposing an excuse, once he (or she) is caught. What makes for an apt excuse, as opposed to an insipid one? The excuse of the anecdote, «I have spread millet on my rope», defies common sense, whereas «I have spread millet on my sheet»,

or

«I have spread bird lime on my rope», would make sense, instead, from the viewpoint of physical equilibrium, as well as of uses found for objects in civilization.

In this paper, we are concerned with the generation of justification for actions that are imputed because reprehensible. ALIBI, a planner coded in Prolog, generates and proposes pretexts (in the following, improperly termed «alibis»), for behavior reprehended and ascribed to a defendant, with whom ALIBI sides or identifies. (The malapropism «alibi» in the name of the system has been deliberately adopted, out of the advertising tactics of selecting the most easily recognized or catchy term in a domain, as an attention-getter.) ALIBI is not meant to simulate the way an earnest lawyer would try to defend his (or her) client: certain deontic constraints on delegated legal defense are violated. We are specifically interested in alternative interpretations of behavior; excuses the way ALIBI generates them can be considered to be:

– false excuses that a guilty defendant may concoct by him- (or her) self,

– or the actual way things happened, contradicting the incriminating interpretation.

Even delegated defense sometimes works that way, in very particular circumstances: one of the authors (E. Nissan) happened to describe the workings of ALIBI to a certain person who could tell, according to his own biography: a former Soviet physicist who now works on mathematical aspects of artificial intelligence in Tel Aviv, this man related that he had himself to perform the task of ALIBI: while still in Moscow, in less liberal times, as a refusenik, he had been put together with common criminals in prison, seemingly in order to break him psychologically. These inmates were all too happy to have a scientist to find excuses for them, so he had to comply. A defendant is likely to invent excuses. A lawyer should not. A cell mate of a defendant may have to. However, a lawyer still has to manoeuvre in the realm of interpretations, and from both perspectives – of the legal application, and of artificial intelligence (AI) – the mechanism of
justification in general certainly deserves to be researched computationally. Actually, such a topic of inquiry is relevant to other areas of AI, such as the automated generation of narratives. Much research has been reported, in the literature, about expert systems embodying legal knowledge. «One kind is based on a representation of the law and attempts to support reasoning with the law, while the other kind is based on practical experience of legal practitioners. Following [Susskind 87] we shall call the former an ‘academic’ system and the latter an ‘experiential’ system». (Schild 1989: Sec. 2).

However, little has been done concerning the pre-legal phase of exculpation, which is the application of ALIBI. ALIBI is not meant to simulate the way

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1 In the realm of folklore studies and narratology other than computational, Jones (1979) considers a folktale as a set of versions, identified by the respective structures, as set against the cultural environment where the version was generated. Structures include a few levels of abstraction of narrative units: for recurring motifs, *motifemes* and *allomotif*s are defined, analogously to the notions, from linguistics, of morphemes vs. allomorphs, or phonemes (of phonophony) vs. allophones (of phonetics), and to the general notion, known from structuralism, of *emic* versus *etic* (*etic* items are realizations, mutually exclusive according to context, of an abstract *emic* entity). For example, the ways the step-mother tries to, or does, kill Snow White (by means of an apple, a comb, etc.) are allomotifs of the same motifeme. Jones criticizes more traditional structuralist approaches to the folktale, by Propp (1968) and Dundes (1975). What to Dundes is a motifeme, Propp terms a function. All of these approaches are relevant for computational investigation: the merit is of Vladimir Propp (1928) of having first devised a formal representation of classes of folktales, that is amenable to formal grammars. *Formal narratology* is important for automated story-telling. In the latter domain, Meehan (1976, 1977) developed TALE-SPIN, a simulator allowing for one active agent in stories, and based on the Yale approach to computational linguistics. Lebowitz (1983, 1985) described another story teller. Yazdani (e.g., 1982) proposed a model with five interacting processes: a plot maker, a world maker, a simulator, a narrator, and a text generator. The simulator he developed, ROALD, has a representation of the world with the involved characters. It is given the general guideline of the plot. A planner is associated with each character, and plans the actions which that character would like to carry out in the world. Those plans are thwarted (otherwise, there would be no story). The simulator has a problem solver, that takes as input the plans of all characters, and introduces props, distractions, and accidents, so that the actions of other characters are thwarted. ROALD’s overall goal is to make sure that the simulation follows the path required by the input plot. See a perspicacious review in (Yazdani 1989). Also in Britain, research has been done to assist writers in story generation: Parthemore’s (1990) JONATHAN, a program that assists a writer in developing a story structure, and, like previous work by Pemberton, is based on a story grammar (this approach takes care of structure, of the shape of the plot, whereas Meehan’s work we mentioned, focuses on semantic content, in line with the Yale tradition of natural-language processing). Of those researchers in automated story-generation, we mentioned thus far, Pemberton is the one whose background is in literary or folktale interests (in her case, a thesis on the story structure of French narrative poetry). A paper describing her story-generation work is (1989). Bringsjord (1990, 1991) and his group have been developing CINEWRITE, for generating the plot and character development of novels.
an earnest lawyer would try to defend his (or her) client: certain deontic constraints on delegated legal defense are violated. We are specifically interested in alternative interpretations of partially observed behavior; excuses the way ALIBI generates them can be considered to be: (i) false excuses that a guilty defendant may concoct by him- (or her ) self; or (ii) the actual way things happened, contradicting the incriminating interpretation.

The output of ALIBI looks like almost natural English, and is composed out of patterns of sentences with variables. The input, instead, is a sequence of Prolog predicates according to a certain pattern, in the first version of ALIBI: a list of imputed actions is fed into the system; it may be conceived as a much simplified «police report». The second version of the automated

**FIGURE 1. Input analysis in ALIBI2**

<table>
<thead>
<tr>
<th>ALIBI2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English parser</strong></td>
</tr>
<tr>
<td>Preliminary syntactic phase: generative grammar + parser</td>
</tr>
<tr>
<td>Semantic phase: deep case description of events</td>
</tr>
<tr>
<td>deep-case, or simplified predicate-based representation of the accusation</td>
</tr>
<tr>
<td>Action decomposition: visit of the composition-tree of actions</td>
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<tr>
<td>etc.</td>
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</tbody>
</table>
exculpator, ALIBI2, has been upgraded with a user interface, to enable the program to handle a subset of natural English. Moreover, in ALIBI2, the knowledge-base has been reorganized: what in the first version was the syntax of the input, has been made much more expressive, and has become an internal representation; as more complex input can be expressively afforded, now, heuristics can be added to the planner, to account for more complex situations. The parser, as presently structured, consists of the cascade of a merely syntactic phase, based on a generative grammar, and of another phase, where semantics comes in: an instance of an action is represented in a predicate, by having the parser fill values for deep cases (possibly with other kinds of information, too) as arguments, for which a pre-defined order is unnecessary. See *Figure 1*.

The following phases are shared by all versions of ALIBI. Actions imputed are decomposed into constituent actions, recursively, according to common-sense knowledge stored in the knowledge-base. This process goes on until terminal actions are reached in the decomposition tree. The program spoils actions of connotational interpretations pertaining to *deontic* modalities (that is, *legality or morality*). For example, *stealing* is reduced to *taking* as in given objective circumstances. Then, from the elementary actions, ALIBI recomposes another tree, to form an alternative interpretation of the behavior imputed, that is legitimate or less reprehensible. For each interpretation generated, ALIBI composes and displays a verbal statement exposing the excuse; simplified natural English is generated by pasting canned text including variables that are assigned the suitable lexical value. See *Figure 2*.

*Figure 2. The process of justification with ALIBI*

```
Accusation
          ↓
Action decomposition
          ↓
Bare basic acts
          ↓
Recomposition into more innocent plans
```

Deontic considerations
Instead of just having incriminating excuses excluded by the planner, \textit{ALIBI3}, developed in 1990, includes a mechanism that explicitly computes a numeric score of liability for plans, or parts thereof, being generated. (Another difference of \textit{ALIBI3} with respect to the previous versions, is that these are in Prolog, whereas \textit{ALIBI3} has been recoded in Lisp).

The first version of \textit{ALIBI}, and several directions for further development, have been described in a previous paper by Kuflik, Nissan and Puni (1989). In the present paper, instead, we are going to emphasize the general concepts, and to point out those representational choices that were introduced after the first version of \textit{ALIBI}. Moreover, we are going to discuss justification in a broader context than the legal domain: in another program we developed in 1990, \textit{SKILL}, human skill in performing at some task is judged (based on an input description) according to common-sense knowledge (including widespread social prejudices) about the task, about classes of performers (professionals in specific domains, youngsters versus adults, men versus women, etc.), and about the environment.

2. EXAMPLES AND STRUCTURE OF PROCESSING

While the first version takes, as input, for example:

\begin{verbatim}
 done(rob,diamonds_pack,jeweller's_shop).
done(injure,sub-machine_gun,jeweller).
done(break,body,display_window).
done(sneak,display_window,jeweller's_shop).
done(take,diamonds_pack,jeweller's_shop).
\end{verbatim}

\textit{ALIBI2} accepts the equivalent English-like statement:

\begin{verbatim}
 the defendant robbed the diamonds_pack from a jeweller's_shop.
 be wounded the jeweller by a sub-machine_gun.
 be broke the display_window with his body.
 be sneaked into the jeweller's_shop through the display_window.
 be took_away the diamonds_pack from the jeweller's_shop.
\end{verbatim}

We intend to refine this, by allowing a more natural expression of nominal phrases, etc. As the input format is evolving, in the following we are going to expose examples, by stating their defining input informally.

Now, let us discuss the example. The defendant is charged with having robbed a pack of diamonds, at a jeweller's shop. He broke the display window, by throwing himself against it. Then, he sneaked inside the shop.
through the broken glass. On seeing the jeweller, the defendant fired with
a sub-machine gun and wounded the jeweller, and then took away the
pack of diamonds.

Excuses are necessary for several details of this accusation. Let us start
by the way the defendant entered the shop. First, he has the choice of
claiming that

- either he broke the window intentionally,
- or it was an accident.

If he claims it was an accident, as he was pushed, so he fell, then it is
sensible, perhaps, to have got in, in order to leave a note with one’s address.
That is, the defendant plays the righteous citizen.

Otherwise, he may admit he broke the window on purpose, because
inspired by heroic sentiments: he heard strange voices inside, so somebody
needed help, or a crime had to be prevented, and the defendant got in as
a savior. See Figure 3.

**Figure 3. I broke the window**

```
Because
(accident)  (play the hero)

... I was pushed  ... I heard strange voices inside

I got in ...

... To leave a note  ... To help
```

Now, an excuse is needed for the worst offense: the shooting of the
jeweller. If accident there was, then the defendant may have shot on falling.
Another possibility could have been if the defendant entered the shop in
the dark: if he claims he got in to help, then he may have mistaken the
jeweller for an evil-intentioned person unduly there.

Next, let us explain why the defendant took the jewels and run away.
The wounded jeweller was helpless. He could not guard his property by himself, and he needed medical care. The defendant took the jewels to guard them, with the intention of giving them back. Medical care is a special kind of help that can be given by qualified personnel: the defendant ran away to seek professional medical care. See Figure 4.

Here is another accusation, also first introduced in (Kuflik, Nissan and Puni 1989: Sec. 2): The defendant robbed a bank. He threatened the employee with a rifle (or, instead, with a knife), and snatched the money. An excuse is needed for the very fact of going around armed. ALIBI tries with this compound excuse: «I did not aim at the employee with the rifle». (or, respectively: «with the knife») and then, for the rifle: «I had the rifle because I went hunting» or: «because I was on vacation from the army». (However, the police could easily check the latter.) For a knife, ALIBI proposes the following excuse: «I held the knife because I was carrying it to a grinder to have it sharpened» and then: «The employee panicked and gave me the money».

ALIBI resorts to common-sense knowledge on the workings and the effects of threatening. See Figure 5. Armed threat involves holding an arm. It is even more flagrant if the victim is aimed at with that arm. The effect is having the victim understand he or she is in a dilemma: to prevent being harmed, the victim is expected to comply. A major effect of threat is fear, which can lead an employee to hand the money without further ascertaining the intentions of the defendant. Several excuses are needed for armed threat.

2 Soldiers or hunters happen to be armed, as do policemen. However, they would not enter a bank armed (a policeman would do, if he perceives an emergency there). In certain countries (e.g., the United States), citizens can carry weapons legally: thus, the setting and the legal system in force there are important for explanation. In certain countries (Israel and Switzerland), citizens are called into reserve duty years after they were discharged from their military service; this makes it more plausible for a man to carry arms, but the police would immediately check with the army, and ALIBI does not envisage such a step currently. Anyway, common-sense knowledge that depends on the country can be added into the program. Another topic is acquiring such knowledge from observation. A cognitively interesting example follows, based on a personal experience of this writer (E. Nissan), who recalls recently seeing a soldier, carrying a semiautomatic rifle, queueing at a bank teller, in the center of Beer Sheva, Israel. In this particular case, however, the circumstances were all important: it was two days before the Gulf War break deadline, in mid January 1991 (after which, missile attacks on Israeli cities started). This writer was queueing to draw money in order to buy some standard (however ineffective) material afor anti gas and anti debris room sealing at home. That virtually was everybody’s preoccupation, so the common sense of that particular situation was that on such a day, even prospective robbers have better to do than robbing a bank; presumably it was sharing that view, that the bank personnel closed an eye on the semiautomatic rifle, and took the risk.
and the acceptance of its effects, unless the defendant chooses to admit he intended to threat the victim. The defendant did not try to dispel the fear of the employee, but he can claim he did not notice this emotional state in the victim (playing the absent-minded one, on this point, is in agreement with having forgotten about the arm he was carrying). If the defendant had asked for a loan, then being offered money by the employee is not surprising.

In *ALIBI*2, processing is structured as follows. *(a)* An English parser analyzes the input accusation. There is a preliminary syntactic phase, *(a1)*, where components involved are a generative grammar of a subset of English, and a parser. Then, *(a2)* a semantic phase is triggered, that generates a deep-case (or simplified) predicate-based representation of the accusation. This is the output of *(a)*, and the input of *(b)*: HOW, the action decomposition module. A deep-case semantic description of an array of actions matched against events in the accusation. Actions, as described, are either elementary, or compound (such as *get_in_unlawfully*). By visiting, in se-

**FIGURE 4. Excuses for the worst offenses**

I shot and wounded
The jeweller because …

---

**excuse:**

… I fell and …

---

... The gun fired accidentally

---

**effect:**

jeweller helpless

---

needs guard needs medical care

---

**excuse:**

I took the jewels to guard them and then return them

---

**excuse:**

I ran away to seek qualified help
mantic memory, the composition tree of actions, HOW decomposes the accusation, by separating bare basic acts from deontic factors: for example, «stealing» is reduced to «taking» as in given circumstances. This, in turn, is the input of (c): recomposition into (relatively) innocent plans. This is done in two phases: (c1), that has the COLLECT_EFFECTS module take care of the effects of actions, and (c2), the excuse finding process, that has module WHY recursively invoke module EXPLAIN.

For example, let us reconsider threat (that we already met with in the examples discussed), from the viewpoint of the internal workings of the system. The semantic memory accessed by HOW includes a description of «threatening by means of a weapon (gun or knife)»: this compound action is assumed as constituted by the sequence of actions «aim» and «hold», if the accusation imputes, among actions performed by the defendant, having threatened the victim by using a weapon as instrument; if this is the case indeed, then the effect is defined, that the victim is «frightened» (under the

**Figure 5. Armed threat: conditions, effects, and goals of justification trials**

```
Armed threat

Evidence:
- hold an arm

More evidence:
- aim

Effect:
- let the victim understand that he/she has the choice...
  - or
  - ... to comply...
  - ... to suffer harm

Then, try to justify

(1) Walking around the armed.
(2) Holding the arm.
(3) Not dispelling the victim's rational & emotional state.
(4) Accepting the effects of the victim's compliance.
```
default assumption the victim was aware of the threat). Then, that effect is used by the COLLECT_EFFECTS module, to explain why the victim gave in. As we have seen, the excuse ALIBI tries, is that the defendant was carrying the weapon for an innocent purpose, and, possibly forgetting about its presence, was innocently talking to the victim, and was unaware the latter acted by feeling threatened.

Earlier in this section, we also exposed the example where a man is accused of having shot and wounded a jeweller, and then robbed him. One effect of «wounding» is that the wounded shopkeeper was unable to take care of his property. This is exploited by an excuse stating that, having shot the shopkeeper incidentally, the defendant actually took away property, in order to look after it and then return it. Another effect of «wounding» is that the wounded shopkeeper needed medical aid. The robber can concomitantly with the excusatory component stated above, claim that he actually ran away, in order to get such help for the shopkeeper. Kuflik, Nissan and Puni (1989: Sec. 10) pointed out the relevance of a distinct comic dimension in excuses, separate from futility, but nevertheless, the ALIBI scheme thus far incorporates this in credibility, whose evaluation fits in a special scoring phase, to be applied either to single elements of an explanation, or to concomitant elements. Scoring as implemented in ALIBI is, instead, liability scoring, in the decomposition and recomposition of action trees, and corresponds to a phase that fits upstream, in the control flow, of where we placed credibility scoring, whose need we outlined. Separating these scoring phases makes sense, as after all, certain substantiated accusations leave little space to excuses, and the defendant, if unwilling to

3 The effects of being frightened, in a real or mock robbery, may be either giving in (e.g., by handing property), or quite the opposite: a frightened person may be able and motivated to defend him- or herself beyond actual need, and thus he or she is dangerous. Some years ago, in Italy, a well-known football player, Re Cecconi, threatened, in jest, a jeweller who did not recognize him and therefore killed him.

4 The HRA expert system provides advice on whether user’s statements come within the definition of hearsay (and thus can be expected to be rejected in court), and tries to embody a story model, with criteria of narrative coherence to match «the way lawyers, judges, jurors organize story information» (MacCrimmon 1989). This is a factor in credibility.

5 Although in ALIBI we modelled a class of excuse-finding, ALIBI analyzes an accusation given as a single input chunk, and does not contain a model of questioning suspects. (Inbau and Reid 1953) is a textbook on the interrogation process. Questioning simulation would, of course, make one shot explanation inadequate: e.g., detectives tend to ask the same question over and over again. On ways to overcome this limitation of explanation, see (Moore and Swartout 1989).

In ALIBI, excuse-finding exploits degrees of freedom within the non-observable part of
plead guilty, has to do with less incriminating versions of his actions: the phase of devising a less incriminating version (a version with liability minimized) is separate from the imposition of credibility constraints.

3. Remarks on representation

In ALIBI2, the following simple generative grammar is used for parsing; we intend to refine it, by allowing, for example, recursion in sentences (and, thus, compound sentences):

\[
\begin{align*}
\text{sentence} & \rightarrow \text{noun_phrase} + \text{verb_phrase} \\
\text{noun_phrase} & \rightarrow \text{preposition} + \text{noun_phrase} \\
\text{noun_phrase} & \rightarrow \text{determiner} + \text{mod_noun} \\
\text{noun_phrase} & \rightarrow \text{mod_noun} \\
\text{verb_phrase} & \rightarrow \text{verb} + \text{noun_phrase} \\
\text{verb_phrase} & \rightarrow \text{verb} + \text{adverb} + \text{noun_phrase} \\
\text{verb_phrase} & \rightarrow \text{verb} + \text{noun_phrase} + \text{adverb} \\
\text{mod_noun} & \rightarrow \text{noun} \\
\text{mod_noun} & \rightarrow \text{noun} + \text{noun_phrase} \\
\text{mod_noun} & \rightarrow \text{mod_adjective} + \text{mod_noun} \\
\text{mod_adjective} & \rightarrow \text{adjective} \\
\text{mod_adjective} & \rightarrow \text{adverb} + \text{mod_adjective}
\end{align*}
\]

The preliminary syntactic analysis yields predicates that are used during the following phase, that, in turn, is meant to produce a formal description of the process whose ascertained part is interpreted in the given accusation: as an early phase of performing its task, ALIBI identifies mischievous elements ascribed in this accusation. Classificatory reasoning concerning this phase was the issue in a system developed by Meldman (1975; Gardner 1987: Sec. 4.4.1), which tries to identify, in an input set of facts, intentional torts in cases of assault and battery; examples match exactly, or by replacement in an abstraction hierarchy of objects or kinds of events. ALIBI does not try to figure out whether there is going to be disagreement in court on judicial grounds. Instead, more preliminarily (as it can be expected of a suspect) it tries to deny the broader, non-observed context implied by accusers, and it is that way that torts are denied or diminished. In the properly legal domain, instead, a program developed by Gardner (1987) – explicitly, not a work in problem-solving psychology – tries to distinguish easy from hard cases. (There is a debate, in jurisprudence, as to whether a demarcation can be found between clear cases, i.e., cases as to which agreement between competent lawyers can be expected, and hard cases, that lead to expert disagreement.) «The overall objective is not a program that 'solves' legal problems by producing a single 'correct' analysis. Instead, the objective is to enable the program to recognize the issues a problem raises and to distinguish between those it has enough information to resolve and those on which competent human judgements might differ» (ibid).
of actions, to be used by the process of action decomposition. The second phase of parsing involves semantics, and a representation based, more or less, on deep case grammars (cf. Harris 1985). We are aware of the fact that separating syntax and semantics in cascaded phases is not the best choice. Not only: semantic analysis should be enabled to exploit common-sense knowledge stored in the knowledge-base that ALIBI already exploits when looking for excuses; knowledge other than linguistic semantic knowledge, is episodic memory, and knowledge of usual (or likely) patterns of episodic knowledge. In the prototype, we deal with syntax separately, as we have been trying to modularize as much as possible in the first instance, so we could spot more clearly elements needed in the architecture at the technically specific level: heuristics of justification. In due process, it should be possible, for us, to realize better what modules should be closely integrated.

We allow specific attributes that are particular kinds of deep cases; this way, target is a particular case of location. For the action of throwing a stone on the glass, as stated in the input accusation, analysis yields the following, as an element in episodic memory:

- **action:** throw
- **actor:** defendant
- **object:** stone
- **source:** defendant (’s hand: by default)
- **target:** glass.

The structure of the representation, for this given instance, is a nested list:

```
[ [ throw,  action ],
 [ defendant, actor ],
 [ object,  stone ],
 [ target,  glass ] ]
```

As to the source of the motion of the stone thrown, this is, plausibly, the actor, and there is no need to include this as data in episodic memory, as it belongs in semantic memory on the act of throwing.

Please observe, that in subtle ways, common sense tend to confound facts and indictment. For the same action just discussed, it would have been possible to derive the following representation, according to knowledge on the usual pragmatics of throwing: focus is on the presumed target (it is already a conjecture), while the stone would be considered as merely an
instrument, instead of the object, as the case is literally, at the surface level of verbal description:

\[
[ \text{PROPEL}, \text{action} ], \\
[ \text{defendant}, \text{actor} ], \\
[ \text{objective}, \text{glass} ], \\
[ \text{instrument}, \text{stone} ]
\]

\textit{ALIBI} should avoid being tricked into such a representation, as it embeds a hidden assumption that is detrimental to the interests of the defendants: it predefines his intentions.

Values of attributes should not be restricted to names or nominal compounds: they may be internally defined symbols, that point to instances individuated (\textit{stone} is the first instance of stone met), or to the internal representation of phrases or sentences. This is necessary in order to account for semantic compositionality. For example, to indicate the relative temporal order between actions, the temporal case could have as value a pointer to another elementary episode.

The semantic knowledge stored in \textit{ALIBI} includes a representation of the structure of objects. Let us consider, for example, an accusation that has the defendant hitting the glass with a stone, thus causing the display window to be broken, which in turn allowed the defendant to get in.

\textit{ALIBI} knows that in a display window, there is a glass, and it relates the two concepts, when they occur in the accusation. The defendant may have been stated to have hit a part (the glass), and \textit{ALIBI} would understand that the whole (the display window) was broken, and vice versa\(^6\). \textit{ALIBI} under-

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\(^6\) The following predicate employs \textit{PROPEL}, one of the primitive acts of Schank’s \textit{conceptual dependency theory}, as a general concept, and, according to the specific action imputed or claimed, select a suitable verb, and construct appropriate phrases – with \textit{deep-case} arguments inserted – to accompany it:

\[
\text{select\_\textit{PROPEL\_act}(hit, What) :- done(hit, \_ \_ \_ \_ What).} \\
\text{select\_\textit{PROPEL\_act}(threw, Upon\_what) :- done(throw, \_ \_ \_ \_ Upon\_what).}
\]

that is «Select verb hit or threw according to the accusation stressing one action or the other».

\[
\text{select\_\textit{PROPEL\_act}(threw, Target\_of\_\textit{PROPEL}):- done(throw, \_ \_ \_ \_ Upon\_what),} \\
( \text{is\_part\_of(Upon\_what, Target\_of\_\textit{PROPEL});} \\
\text{is\_part\_of(Target\_of\_\textit{PROPEL}, Upon\_what)}.}
\]

that is «A broader or a narrower concept may have been stated as being the target of the \textit{PROPEL act}: a part of the whole may be hit implying that the whole was hit, or, vice versa, the whole may have been stated as being the target, while it is a particular component that was actually hit». 
stands also the chain of enablements: removing an obstacle that guarded property, allows access to the property. Both the de/composition of actions, and the set of effects of actions, constitute an AND/OR tree, in our representation. Predicates that, in semantic memory, state the constitution of compound actions, invoke effects as well. The architecture of modules is

7 Here is an example – drawn from (Kuflik, Nissan and Puni 1989: Sec. 4) – of a Prolog rule that describes the compound action of threatening by means of a gun:

\[
\text{compound\_action}\left(\text{threaten}, \left[\text{aim, hold}\right]\right) :- \text{done}\left(\text{threaten}, X, \text{Threatened\_Victim}\right), \text{is\_a}\left(X, \text{gun}\right), \text{asserta}\left(\text{has\_as\_effect}\left(\text{frightened}\right)\right), \text{etc.}
\]

that is rendered, in English, by the statement:

«threaten is a compound action that has to be assumed as constituted by the sequence of actions aim and hold, if the accusation imputes, among actions performed by the defendant, having threatened the victim by using a gun as instrument; if this is the case indeed, then define, as being an effect, a predicate has\_as\_effect(frightened), where frightened is assumed to refer to the victim. (etc.)»

Then, the predicate has\_as\_effect will appear among the conditions belonging to the antecedent of at least one rule whose left part is the predicate explain with a suitable value as argument.

For example, stemming from an ascertained or claimed situation where threatening led to the victim being frightened, one possible heuristic for devising excuses in such a situation is expressed by:

\[
\text{asserta}\left(\text{goal}\left(\text{gave\_in\_panic, } _, \text{Threatened\_Victim}\right)\right).
\]

that means

«Define, as a goal to be currently pursued, the generation of an excuse claiming that the victim, in panic, gave the defendant property he is accused of having obtained unlawfully (robbed, as the situation requires the presence of the possessor)».

and is invoked in the antecedent of a rule, after the condition has\_as\_effect(frightened), included in the same antecedent. Please observe that in Prolog, an underline character (that is, _) stands for an unspecified argument.

Besides, an effect predicate states the effects – help\_needed (for the victim) and guard\_needed (for property) – that follow the effect frightened:

\[
\text{effect}\left(\text{frightened, [help\_needed, guard\_needed]}\right).
\]

The antecedent of explain predicates includes especially predicates of three kinds: done (a condition requiring that a certain kind of action be included in the accusation),
shown in Figure 6. Explanations are developed separately for the various actions imputed, but, if this is relevant, with knowledge of other actions having occurred, or having to be assumed⁸. Whereas we provide alternative

**Figure 6. The architecture of modules in ALIBI**

```
parser

how: decomposes the accusation, by visiting, in semantic memory, the composition tree of actions.

collect_effects: takes care of the effects of actions.

Excuse finding:

<table>
<thead>
<tr>
<th>why</th>
<th>recursively: explain</th>
</tr>
</thead>
</table>
| has_an_effect | (that selects one of the effects of such an action), and goal (that invokes the generation of an excuse according to a given heuristic that is suited for the particular situation). For example, the following invokes, for predicate explain(aim), the generation of two alternative excuses, claiming that the defendant aimed at the victim accidentally, because he had fallen through the way of access (say, a broken display-window), or denying that the defendant ever aimed at the victim:

explain(aim):- done(threaten,X,Y),
  has_as_effect(fall_through),
  goal(accidentally_aim,X,Y).

explain(aim):- done(threaten,X,Y),
  goal(not_aim,X,Y).
```

In case shooting, not just aiming, is imputed, a modified heuristic is invoked for predicate explain(shoot).

⁸From the viewpoint of systems and control (a discipline that is often applied, e.g., to economics, manufacturing, ecology, etc.), the «objective» piece of evidence included in the
interpretations for the ascertained facts underlying the imputation, we don’t tackle the subjectiveness of perception or imperfect recollection on the part of witnesses. Moreover, complications such as complicity are not accounted for, by the versions of ALIBI developed thus far. We have been envisaging a new version, ALIBI4 – whose implementation we did not start yet, the project currently being unmanned – that should incorporate a module to account for complicity. For this purpose, scripts and MOPs – structures adopted by the Yale approach to natural-language processing (Schank 1982; Dyer 1983) – are matched against roles imputed or claimed.

4. THE APPROACH IN ALIBI3

Usually, legal misdemeanors or felony charges correspond to compound actions. This is the case of stealing. Sometimes, however, the charge (and

input accusation, belongs to the observability space, and constitutes the basis of both the interpretation in the accusation, and of possible excuses, which all exploit degrees of freedom in state estimation, that is, in the reconstruction of the state of the system (considered to be a black box, metaphorically) according to knowledge directly obtained by accessing and «measuring» its input and output.

The subjectiveness of perception in eyewitness reports has been dealt with, for example, by Cesare Musatti (1931) in Italy. Elisabeth Loftus (1975, 1979) has observed that leading questions cause eyewitnesses to unwittingly complete their recollections by reconstruction; in a question-answering program for the analysis of narratives, BORIS – developed by Michael Dyer (1983) – a phenomenon that was first considered to be a bug, was then recognized to simulate the Loftus effect on recollections: episodic memory modifications occur during question answering (ibid.: Chs. 1.5, 5.5, 12.1, 12.2).

Awareness of the inherent imperfection of testimony is not just modern. During the 1st and 2nd century of the Common Era, a current of opinion within Pharisaic Judaism felt the need to make capital punishment inoperative; this stance was reflected, in the Gospel, concerning adultery (but, on the other hand, an emotional passage calls for the application of an unprescribed kind of execution – drowning – for paedophilia). Beside the accepted, general approach, to limit the categories of admissible testimony, and to adapt procedures to enhance the weight of lenient opinions in court, «abolitionists» among the Pharisees took one more step: a juridic strategy was devised by Ben Zakkay, to be applied case by case, in order to avoid capital punishment; it exploited the implicitly recognized fact that recall is always incomplete. This is mentioned in Ch. V, § 2 of Tractate Sanhedrin of the Mishna (the Hebrew core of the Talmud, which is formally an Aramaic commentary). Then, in Ch. I, § 10 of Tractate Makkot, two scholars, Aqiva and Tarfon, about two generations later, generalized, by stating that were the indigenous legal system still in force, and were they among the judges in court (they had to be at least 23), then capital punishment could never have been applied. (By the way, Aqiva was martyrazied by means of iron combs.) This stance against the death penalty had its opponents, whose arguments – typically, concerning public order – are similar to the arguments of anti-abolitionists (or re-introductionists) of the present day.
then, its cost, in terms of liability) correspond to a leaf in the tree of actions. What is a leaf, an atomic action, for the latter, is clearly dictated by a choice obeying criteria of relevance. In ALIBI as developed thus far, decomposition is appropriate as far as it is relevant in legal terms (though we did not concoct yet complex situations where nuances make a difference, and stir public-opinion debates). We have been developing ALIBI step by step, and it would be harmful to try to attack several refinement problems at once, as it would blur the vision we get of the separate elements in the conceptual architecture, then embodied in the implemented architecture. In ALIBI3, liability scoring, defined intuitively, by introspection, for a given semantic memory describing the composition of actions, can be faulted with naive scoring methodology, with a not very clear correspondence with legal relevant notions pertaining to penalties, and with assuming a decomposition of actions that, for other purposes, is not very flexible. Moreover, differences between legal systems are not addressed (for this aspect, however, see our approach in the next section). Yet, at our eyes, the nature of scoring as in ALIBI3 has the merit of pinpointing the edge of detailed analysis in the direction we have been developing of commonsense modeling of human behavior.

In the semantic database as given, the deontic liability cost — also as given — for stealing, is higher than the sum of the costs of its sub-actions (children, in the tree). Finding excuses exploits the relative innocence of the single sub-actions. But from the viewpoint of the liability scoring — a process that has to be independent from trials to find excuses, else it could not serve the latter purpose — we must account for such a non-linearity in costs as associated with nodes in the hierarchy: whenever a compound action appears as a concept in semantic memory, and there is a penalty specifically associated with that kind of action, we associate a cost, C, with the node considered, N, albeit at least part of the nodes of the subtree

10 As, among others, Mary Dee Harris points out (1985: p. 246), flexibility in the level of decomposition of semantic concepts is an advantage, subserving appropriateness: in the sentence John stubbed his toe while walking down the sidewalk, it is appropriate to consider «walking» as being a sequence of states that involves moving one foot forward while being supported by the other leg, and so on, as this way, it is possible to relate, analytically, «walking» to «stubbing a toe», the latter being a concurrent event that involves «bringing the toe of the foot being moved forward into contact with an unmovable object with a force great enough to cause pain» (ibid.). Instead, there is no point in breaking «walking» down to states that explicitly involve actions with feet, as far as the sentence Terry and Susan watched the sunset as they walked along the beach is concerned, while such decomposition would no longer be out of place if then Susan stepped on a shell and cut her foot. (ibid.).
rooted in $N$ may already have costs associated. By default, we interpret the

cost of an action as zero, whenever: (i) that action is a leaf in the tree and

has no cost explicitly associated, or (ii) that action is an intermediate node

with no cost explicitly associated and none of whose descendants has a
cost associated.

What we have described is the static aspect of accounting for the severity

of penalties. As to the dynamic aspect, it consists in the program calculating
the severity of the accusation as decomposed, and the severity of the alter­
native interpretations generated in order to be proposed as an excuse. The

program, in evaluating costs of excuses (i.e., of plans ascribed by ALIBI to
the defendant), embodies a basic mechanism, that recursively computes the

cost of compound actions from the cost of immediately inferior-level sub­
actions. For the time being, for simplicity sake, costs of sub-actions are

summed (at AND-edges in the AND/OR tree), and the sum is the cost as­

sociated with the compound action. A departure from this procedure

occurs whenever — while the tree is composed bottom up — we reach, at
an upper level, a node that has a predefined cost associated in semantic
memory. Whenever this happens, we substitute this predefined cost instead

of the cost as calculated by recursive sum from the subtree rooted in that

node.

For the jeweller’s example discussed in Sec. 2, ALIBI3 gives different

scores (based on the severity of the imprudence involved in the claimed

incident) to the alternative excuses: «I did not mean to do it, the SUB_MA­
CHINE_GUN fired accidentally and the JEWELLER was injured» and «I thought
the SUB_MACHINE_GUN was just a toy, so, not on purpose, I wounded the

JEWELLER with the SUB_MACHINE_GUN».

In the Lisp-based representation adopted in ALIBI3, we represent the

aggregated elements of a node as a list, storing a simple frame with the

following pattern:

```
( ( COMPOUND a ); Name of the compound action.
  ( ANALYSIS b ); List of sub-actions.
  ( EFFECT c ); If any.
  ( COST d ); If any. The value is an integer. )
```

In the case of armed threat, the relevant instance of this pattern is:

```
( ( COMPOUND threaten )
  ( ANALYSIS ( aim hold ) )
  ( EFFECT frighten )
  ( COST 45 ) )
```
Through this level of representation\(^1\), detailed descriptions of actions are accessed, in terms of predicates which, in \textit{Lisp} in \textit{ALIBI3}, are coded as lists.

5. **THE COMPARATIVE JURISPRUDENCE ASPECT**

In \textit{ALIBI3}, we defined scores intuitively, by introspection. Thus far, the versions of \textit{ALIBI} do not account for different legal systems (let alone for questionable theories on the plurality of justice, such as Lyotard's; cf. Beardsworth 1987). Legal pluralism is sometimes admitted within the same society, e.g., of customary and Western law in former colonies (Hooker 1975), or in societies recognizing the authority of religious jurisdiction(s) in marriage matters. Paliwala (1989) argues that legal pluralism should be accounted for by legal expert systems. However, typically, comparative jurisprudence studies systems of jurisdictions (countries, regions) that do not overlap. Realistically, in all modern legal systems theft and murder are considered to be crimes; different penalties for the same crimes, and some difference in the delimitation of applicability, do not change these basic, though rough, facts. However, one of the authors has developed, in the framework of another recent project, a representation for comparative jurisprudence (Nissan 1990): a unified schema for representing, for the purposes of symbolic manipulation, several parallel legal corpora. The specificalities of each single corpus are represented as details deviating from the shared core. That project resorts to passive frames embodied in deeply nested relations, and to a meta-level augmented ruleset that specifies the structure of the nested relations. (On nested relations, see, e.g., Ozsoyoğlu 1988.) The collection of frames is associated with legal notions, whereas at a lower level, further representation is logic-based. Textual fragments given as value, in frames, can be parsed. The architecture of the schema is conceived as follows:

- a \textit{low-level} representation, that is \textit{logic-based}, and interpreted by \texttt{Prolog};
- an \textit{intermediate}, nested-relation based representation, suitable for knowledge-engineering and acquisition;
- the syntax of the natural-language \textit{user-interface}.

\(^1\) The description given as an example is modified in the case of a mock-threat identified as such because, soon after the sub-actions listed above, the mock-robber laughs and no longer aims, which subsequence has a good chance of causing a correct interpretation on the part of the victim, who, after having been frightened, is likely to be either irate or, as pranksters claim, amused.
The original application developed as an example is based on a small subset of Italy's Statuti Regionali: Italy has 20 regions; each region has its own statute, that has the role of a constitution for that particular region. These statutes are rather similar, but because of local situations and choices, of differences in structure and compilation of the «parallel» corpora, and of historical reasons (five regions acquired an autonomous status and a statute several years earlier than the remaining regions), the issue is interesting both for comparative jurisprudence, and as a challenge to knowledge-representation economy criteria (Nissan 1990).

6. **Justifying Poor Skill An Analysis**

**SKILL**, like **ALIBI**, analyzes actions and tries to provide justifications. However, whereas **ALIBI** justifies from the deontic viewpoint, **SKILL** tries to evaluate skill at certain activities, and justification (or condemn) is for poor skill. In a sense, from the **ALIBI** viewpoint of risking punishment, crimes and incompetence are at two extremes of the same dimension: felony is worse than misdemeanor, and legal reprehensibility for one’s actions is likely to be considered, by a defendant in court, as being more disadvantageous than just moral reprehensibility, that in turn is worse than incompetence. However, from other viewpoints, for example, somebody boasting in an underworld milieu, given certain conditions, would, perhaps, rather boast of shrewd criminal intentions for an event actually due to incompetence; even during questioning, detectives sometimes get the suspect’s pride to overwhelm his or her prudence (cf. Steinross and Kleinman 1989: p. 439). According to different constellations of social factors, finding excuses for incompetence at certain tasks, or ascertaining incompetence, may bear differently on a person whose skill is questioned, and common-sense modelling of the evaluation process is interesting for AI. Skill is but one of those causal dimensions of success or failure that can be controlled by the performer, and there may be measurable differences in perceiving them, in different cultures; cf. (Schuster, Försterling and Weiner 1989).

Already (Kuflik, Nissan and Puni 1989: Sec. 11) attempted a preliminary, partial discussion of the themes that we then developed in **SKILL**, by considering the following situation: *In a provincial cinema hall, a placard announces the new program: ‘A great color documentary film, The Last Cannibals. There is no trick. When the image is shaky, it is because the cameraman was afraid’*. In Milan, Italy, there is a proverb that states: «If you suspect the worst, you commit a sin, but you guess it right» **SKILL**
incorporates knowledge of the kind that allows to commit that sin, concerning the quality of the film and the skill of the cameraman. Let us analyze possible interpretations. The setting of the story, a provincial cinema hall, is qualified as provincial, and some likely while not necessary properties of the latter are: (technical) incompetence, low standards (of a certain class of services, and of shows in particular), gullibility (of the public), charlatanism (in shows). Against such a background, certain lines of reasoning are plausible: blasé observers will tend to find that «blatant» evidence of incompetence has been unconvincingly masked, the odds being

12 Before we implemented skill, we had outlined the cameraman example in Sec. 11 of (Kuflik, Nissan and Puni 1989); for the reader’s convenience, we are quoting, here, the steps (1a to 1f) of the line of reasoning that leads to dismissing the film as incompetently made:

1a) – image is shaky, in a film, if the camera was unsteady while filming; – the camera is unsteady if the hand of the cameraman is unsteady; – if the hand of the cameraman is unsteady, then the cameraman is professionally incompetent; – an incompetent cameraman is unlikely to get a job requiring much competence as a cameraman (because it is easy to notice incompetence, by testing: see 1b). Therefore, – the image is shaky, in film F, because – the hand of the cameraman, C, of F, was unsteady, because – cameraman C is an incompetent in his profession; therefore – it is very unlikely that C would be hired as a cameraman for shooting a film requiring much competence.

1b) – It is easy to test the incompetence (that is, to obtain a negative evaluation of competence) of a cameraman as due to his hand being unsteady, because – testing can be done on a very short and inexpensive trial film, and – one easily notices a shaky image even in a very short and inexpensive film.

On the other hand,

1c) – F is claimed to be a film involving true cannibals; – cannibals belong in an exotic setting; – a film with true cannibals has to be filmed in their exotic setting; – shooting an exotic film in place is expensive; – producing an expensive film is justified only if the final product (the film) is of the highest quality; – a product of the highest quality has to be manufactured only by competent personnel; therefore – the competence of prospective personnel has to be checked; for which see (1b).

1d) – Filming X requires being near X (enough for X to be visible, as other than very small: for humans, within few meters); – in F, X is claimed to be true cannibals; – being located near cannibals is dangerous; therefore – filming cannibals is dangerous. Therefore – the above claim about F implies a claim to the effect that filming F was dangerous. – It implies also a claim to the effect that C is professionally competent; indeed, – shooting a film in dangerous conditions requires competent personnel, and, as we know from (1a), – C is – by definition – the cameraman that filmed F.

1e) However, because of (1a) and (1c), as C was found to be professionally incompetent, we conclude that – F is not of the highest quality; therefore, – F is not an exotic film taken in place; therefore, – actors in F are not true cannibals; which is contrary to claims on F (see 1d). Therefore, – F, the way it is claimed to be, is a cheat.

1f) Besides, because of (1a) and (1d), as C was found to be professionally incompetent, we conclude that – F was not filmed in dangerous conditions. Therefore, – F, the way it is claimed to be, is a cheat.
against the line of reasoning proposed by the placard\(^\text{13}\). There is a social prejudice embedded in the example of reasoning about the cameraman's skills: talent is related to wealthy working environments, and just rural distribution of a film is taken to testify of a lack of both. This pattern is shared with the following: new graduates or doctors of the leading university in a country (or, all the more so, in a leading country) have better perspectives of employment, albeit it is not necessarily true that the less brilliant products of such environments are more skilled than everybody whose degree has another provenance. However, there is some wisdom in the prejudice, to the extent that the assumption it is based upon is true: those with more talent strive for a better environment where to continue their formation, or where to display their achievements. The same assumption bears also on the evaluation of a researcher that tends to publish in little-known forums, though awareness of these varies\(^\text{14}\) with the (sub)discipline or the region, and is conditioned by the institutional and associational subdivision into discrete compartments (and departments) of a «continuous» space of topics of research\(^\text{15}\).

There are gender prejudices: a cake baked (or half-baked) is praised if prepared by a small girl, instead of an adult woman, who usually is assumed

\(^{13}\) The line of reasoning of the explanation of image shakiness, as proposed by the placard advertising the film, consists of the following steps (2a to 2c):

2a) – image is shaky, in film F, because – the camera that filmed F was shaking, because – the hand of the cameraman, C, was shaking, because – C was afraid, because – C was filming cannibals, and – as already seen in (1d) – C had to be located near those cannibals, and – being located near cannibals is dangerous. On the other hand, as we know from (1d), – shooting a film in dangerous conditions requires competent personnel.

2b) Beside reasons (1d), also reasons (1c) are resorted to, here.

2c) Therefore, – F was filmed by professionally competent people (including C), and – F is of the highest quality.

There is an important point to be observe about the use of afraid, in the story considered. In a way, it testifies of the courage of the cameraman, that has – knowingly, it can be presumed – put himself in danger; for the sake of his profession, or as a test of courage for its own sake.

\(^{14}\) See Nissan (1987), on knowledge-representation as suited to account for different degrees of awareness of phenomena – semantic or encyclopedic assertions or definitional traits – according to the environment; the latter may be characterized by national, geographical, religious, linguistic, professional, or class cultures, or even the age of the person concerned: a child or an adult. This topic is important for «intelligent» programs devised to tailor explanations (knowledge- presentation) for the user, by categories s/he belongs to, as well by constructing an individualized model of the user.

\(^{15}\) This plurality of meters can be loosely related to the topic of Sec. 5. Meta-criteriology (the term is ours), i.e., devising criteria about criteria, can be much more complex, to evaluate achievement: see, e.g., Benjamin (1988).
to have to have cooking skills. More generally, age is assumed to be related
to experience. Society is ambivalent, in the best case, about late-bloomers.
Ambivalence stems from conflicting criteria: this way, class prejudices
dulcorate gender prejudice, when attitudes are forgiving towards a woman
professional that cannot cook but has somebody to help her. If a woman
yuppie boasts of being unable to cook, she depreciates the importance of
skill at an activity traditionally associated with women. Esteem for menial
work is often low, regardless of skill, albeit that kind of activity is socially
important, whereas skill at idle plays resents of a reputation of futility,
except in certain social situations.

The very process, and timing, of examining performance, may affect
results. A young man who has dated a girl, may look unshaved, and his
flowers are spoiled, if she is very late. A cake is spoiled after a few days
(depending on the method of conservation). The tape of a film may be
ruined after decades, and the film itself is, if no good copies are available.
Filming technology has evolved, and this, too, has to be taken into
account. Environmental factors affecting evaluation are evident in the
following example: adult immigrants from the Soviet Union are unlikely
to make for Hebrew teachers at Israeli schools, notwithstanding the fact
some of them taught (often broken) Hebrew to other people while back
in their locality of origin. Proficiency at the local language is given a
different weight at universities in different countries (Israel being more
lenient than the U.S., that is more lenient than, e.g., Italy). In advanced
Western societies, youngsters, being accustomed to digital watches, are more
easily forgiven than their elders were, for finding it difficult to read an
analog timepiece.

7. The skill system

Examples in skill are based on four predicates: one of them describes
an event la case-grammars (on which, see e.g. Harris 1985). Another
predicate focuses on the circumstances of the performance; the third predi-
cate focuses on the performer; and then there is a predicate on the quality
of the performance (e.g., on the taste of the cake, or on image being
shaky).

The program runs through the following phases: (i) The kind of activity
is checked against social norms; e.g., how important card-playing is deemed,
or whether robbing a bank skillfully is laudable. (ii) Environment is
considered; e.g., the publication forum for an article, or the kind of theater
where the film considered is to be found. Also, context is considered: whether the performance is for profit, etc. (iii) A tree of causes is searched, to explain out a defect. It may be that a film looks bad because of the old technology available when it was done. Another kind of cause checked, is whether time affected a perishable product (or shape: such as looking unshaved after waiting). There is a general level of cause-finding, and another level, that resorts to domain-knowledge: for example, understanding why image shakes, we need some knowledge about cameras and rigid physical objects. Semantic memory elements are matched against what is known from the input example. (iv) A judgement is passed on the performer, considering the category s/he is classified in. What is needed in order to give the performance is taken into account. (v) Conclusions are displayed. Reasons are given in favor and against the performer. For example, the cameraman’s hand may have been shaky because of old age (but, then, this is reflected upon the quality of the film), or because he had malaria in the jungle (but this has to be matched against what is known from the input, and, again, employing an ill cameraman testifies against the film), or because – as the ad claimed he was afraid of the cannibals he was shooting. Under certain conditions, an image is made to shake on purpose. Rural distribution of the film testifies about its presumed resources and its quality. The cake may have tasted bad because available ingredients were poor. A child having baked it, is to be praised anyway.

8. CONCLUSIONS

We have exposed two programs: ALIBI (through its various versions), and SKILL. Both are devoted to evaluating, explaining, and possibly justifying human actions: ALIBI at a pre-legal level, from a deontic viewpoint, and SKILL in terms of competence at some human task. Whereas architectures are open, and much can be added (e.g., complicity belongs in a future version of ALIBI), the systems we have exposed already embody models of action that contribute to common-sense modelling from a new perspective. Whereas ALIBI does not take issue with the subtleties of some legal system, it nevertheless models cognitive processes that belongs in the common sense fundamentals of excuse finding: a skill that it takes children years to learn, and whose very existence is the motive that makes it sensible, this time among adults, for both innocent defendants and actual offenders to have a competent professional to argument in their defense.
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The first version of ALIBI was implemented during the summer of 1987, by Kuflik and Punì under the direction of Nissan. The work was originally carried out in the framework of Expert Systems and Prolog courses taught by Nissan. Extensions were then specified and partly designed by him and by Kuflik in 1988. ALIBI2 was developed by Salfati and Shaul during the summer and fall of 1989, under the direction of Nissan, in the framework of Introduction to Natural Language Processing and Prolog courses. 1990 saw the development of ALIBI3, by Spanioli, and of SKILL, by Fakher-Elddeen, as undergraduate projects directed by Nissan.

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