A non-judgmental reconstruction of drunken logic

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We investigate the extension of previous work by Krishnaswami et al. in [6] on Handwaving Logic, a logic that can be effectively modeled by Fairtlough and Mendler's Lax Logic [4], towards trying to achieve a reasonable formalization of "drunken logic." More advanced formalizations of drunken logic fail to be modeled effectively by lax logic, and we argue that much more study deserves to be paid to this and other concerns which we group together under the umbrella of Chemically Assisted Reasoning (CAR - but don't drink and drive). However, unlike various "judgmental" reconstructions, for instance of modal and lax logic [8], this will *not* be a judgmental reconstruction. We're not here to judge, man.

Section 1 briefly re-presents handwaving logic. Section 2 discusses a simplistic representation of drunken logic that can be modeled by Lax Logic, whereas Section 3 shows how this modeling behavior breaks down for a more precise formulation. Section 4 concludes after arguing (drunkenly!) for more investigation into this and other concerns of Chemically Assisted Reasoning.

1 Introduction to handwaving logic

Handwaving logic grew out of a concern to create better models of the way people actually use logic in the real world. Current logical systems effectively model logic in a manner acceptable to most logicians and type theorists; furthermore, the introduction of substructural logics such as linear

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$$\frac{\Gamma \vdash A\ true}{\Gamma \vdash A\ handwave}\ \text{INTRO} \qquad \frac{\Gamma \vdash A\ handwave}{\Gamma \vdash \text{✋}A\ true}\ \text{MODAL}$$

$$\frac{\Gamma \vdash A\ handwave}{\Gamma \vdash A \wedge B\ handwave}\ \text{EXERCISE-FOR-READER-1}$$

$$\frac{\Gamma \vdash B\ handwave}{\Gamma \vdash A \wedge B\ handwave}\ \text{EXERCISE-FOR-READER-2}$$

$$\frac{\Gamma \vdash A \vee B\ handwave \quad \Gamma, A\ true \vdash C\ handwave}{\Gamma \vdash C\ handwave}\ \text{OTHER-CASE-SIMILAR-1}$$

$$\frac{\Gamma \vdash A \vee B\ handwave \quad \Gamma, B\ true \vdash C\ handwave}{\Gamma \vdash C\ handwave}\ \text{OTHER-CASE-SIMILAR-2}$$

Figure 1: Some of the rules of handwaving logic (elimination rules are the standard ones)

logic shows promise in applying methods from proof theory to the work of robotics, A.I. and security researchers. However, current proof theoretic approaches are entirely inadequate for half of the statements made by an introductory mathematics textbook, and for even the most basic statements made by your average politician.

Handwaving logic addresses these concerns by conservatively extending standard intuitionistic logic with a *handwaving judgment* described by "*A handwave*", which is internalized in the *handwave modality* ✋. The monad admits much more powerful non-standard reasoning techniques than are generally accepted in the uptight, narrow-minded intuitionistic logic. The power and convenience of the handwave modality is evidenced by the following judgment.

$$\dfrac{\dfrac{\dfrac{\dfrac{\Gamma \vdash B\ true}{\Gamma \vdash B\ handwave}\ \text{INTRO}}{\Gamma \vdash A \wedge B\ handwave}\ \text{EXERCISE-FOR-READER-2}}{\Gamma \vdash A\ handwave}\ \text{HW-AND-E1}}{\Gamma \vdash \text{✋}A\ true}\ \text{MODAL}$$

As described in [6], logic as it is used in the real world can be modeled by equating ✋A with A. Alternatively, standard techniques described in [10] can be utilized to reverse-engineer the *handwoven proof obligation* as the implicit constraint on the lax monad.

2 A brief discussion of drunken logic

As Bovik has famously noted in [2], nowhere outside of undergraduate lectures are scholars are more prone to sweeping generalizations than at the bar. Furthermore, judgments which cannot be evidenced outside of the presence of alcohol, such as the notion "I find A attractive," obviously may (in some circumstances) be proven under the constraint of drinking. Drunken logic can simple be expressed, more or less, by reinterpreting the handwave modality 👋 as the shotglass modality $\square$. In this reinterpretation, *A true* maps onto *A attractive*, while the modal judgment *A handwave* maps to *A beergoggles*. Our extensive investigations have shown that this model along with other, similar ones (such as the related game-theoretic judgement *A i'lldoitifyou'lldoit* that is vastly amplified under the $\square$ modality) are sufficient to model the vast majority of lapses in judgment under the influence of the $\square$ monad.

3 The challenge of durnken logic

Per Per Martin-Löf [7], something is true when witnessed by an *object of knowledge*, which lends itself to an obvious question of whether the truth of a proposition can be obviated by the presence of alcohol, seeing as alcohol has an clearly negative impact on one's knowledge [1]. The possibility of the analytical truth of a proposition becoming questionable under the influence is also evidenced by discussion as to whether conference submissions that can be understood while drunk are novel enough to be worth accepting.[1]

Indeed, in the above presentation of drunken logic the things that are "potentially true" are in a sense monotonically increasing; there is no provision for things that are *true and provable* while clean and sober to be revoked under the influence of alcohol. Put another way, while *A attractive* may be true under sufficient "monadic influence," it is necessarily negated if one has drunk themselves to sleep, blindness, or need of medical attention. Speaking of medical attention, Girard approaches a similar problem in his discussion of his glossary discussion MEDICINE as a problem of only being able to work with *positive information*: "the typical technique in medecine is to work only with positive information 'As far as we know, one cannot get `AIDS` by blood transfusion'" (fixed-width font in the original) [5].

[1] John Renyolds, personal communication on the Wean elevators.

We call models that must deal with models that must handle the nonmonotonic changes present in extreme modal situations *durnken logic*; in fact, drunken logic should be considered merely a special case of this more general situation. One could imagine that a constraint-based system might be able to handle blood-alcohol information such that a sequent is only considered in relation to an external constraint $\mathcal{C}$, represented as $\mathcal{C} \mid \Gamma \vdash A$. A classically-based system might be able to handle the nonconstructive truth of certain drunken judgments. Chaudhuri also demonstrates a notion of contradiction in intuitionistic linear logic such that certain contradictions can arise without being catastrophic to the overall consistency of the system [3]. A connection to linear logic would also allow us to investigate connections between the consumption of resources and the consumption of alcohol, perhaps giving a satisfactory logical justification for the truth of the "Three Tequila Proposition":

$$\mathsf{tequila} \otimes \mathsf{tequila} \otimes \mathsf{tequila} \multimap \bot$$

Most promising, perhaps, an approach based on modal or hybrid logic could internalize states of drunkenness within a Kripke model - this would potentially generalize to other chemical modalities, such as the observation of certain researches in this area that application of their particular modal operator was akin to transportation "out of this world."[2]

4 Conclusion: Chemically Assisted Reasoning

It is not our intention in this paper to solve all (or any) of the problems we present; rather, it is to propose various approaches to this rich research area that has previously been explored only in the most ad-hoc manner. In general, we think that the opportunities for generalization presented in the previous section point to rich opportunities awaiting researchers in the field of *Chemically Assisted Reasoning* (or "CAR" - but don't drink and drive). Reasearch areas far afield from proof theory, such as work on *regret minimization algorithms*, also have obvious applications to the logic of drinking, and to chemically assisted reasoning in general [9].

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