Title of paper: Intention is Choice with Commitment, Philip R. Cohen, and Hector J. Levesque

1. Author(s)' problem statement:
AI research has ignored the issue of rational balance and the authors believe that there is a need to describe how intentions effect an agent’s web of belief, commitment to future actions and other independent intentions, which would address the issue of rational balance.

2. Building on:
The authors draw reference to the functional roles of intention defined by Bratman, and prove how his formal specification of persistent goal intention satisfies the functional roles of intention defined by Bratman.

3. Assumptions
Beliefs can be wrong and revised; goal can be achieved and dropped but not to an overwhelming extent.
Agents will not attempt to achieve something forever, or procrastinate forever.

4. Key ideas:
- The authors believe that there should be a rational balance between agent’s beliefs, action and intentions and the principles associated to this rational balance provide specification for artificial agents and approximate a theory of human action. The authors propose a logic with four primary modal operators – Belief, Goal, Happens and Done. With these operators they characterize what agents need to know to perform actions that are intended to achieve their goals.
- A planning system’s intentions are no more than content of his plans. However, an agent may form plans that they never adopt and the notion of plan lacks the characteristic commitment to action.
- Intention is different from other propositional attitude, in the sense that belief can be analyzed in isolation, however intention is intimately connected to other attitudes.
- Agents are resource bounded. They cannot continually weigh desires and beliefs in deciding what to do next. They have to establish one state of affairs and establish a limited form of commitment.
- Thinking of intention as a kind of persistent goal, the authors present two defining forms of intention, depending on whether the argument is an action or a proposition. In the former case, the agent must be committed to believing that he is about to do the intended action, and then doing it. However, the action form may have disjunction and conditionals in it. In the latter case, the agent has no idea how to achieve the state of affairs for example an agent may intend to become rich, or become happy. In this case, the agent is committed to believing that he will do something (an event sequence e) to bring about the state of affairs. There may be uncertainty in the agent’s mind about which action will ultimately bring about the state of affairs, but the outcome should be consistent with the agent’s goal. (Consider the example of intending to kill uncle, but instead losing control and hits pedestrian, who is his uncle. The outcome is inconsistent with the agent’s goal of reaching his uncle’s house).
- The formal analysis of the P-Goal (persistent goal – one which an agent will not give up until he thinks it has been satisfied , or until he thinks it will never be true) captures the following functional roles of intentions:

  Intentions normally pose a problem for the agent; the agent needs to determine a way to achieve them.
5. **Arguments/Points agreed with**

I agree with the author that intention cannot be analyzed in isolation. It is closely related to goals, desire, and belief and it is important to determine a rational balance between them.

Characterizing intentions with plans is a weak notion, and does not capture the notion of commitment, which goes along with intention.

6. **Arguments/Points Disagreed with/ Uncertain about**

I am not certain what the authors meant when they say in the paper that Agents usually do not know precisely which world they are in. However, they also state that at a given point in a course of events agents choose the world they would like to be in-one in which their goals are true. Seems like two contradictory statements.

Some of the worlds are consistent with the agent’s beliefs and some with his goals. Are the authors saying there are some worlds, which are consistent with their goals but not with their beliefs?

7. **Directions for future research/open issues**

The authors have described the relationship between goal, belief and intention but they have been unable to specify the casually self-referential connection between these mental states and the production of action. This is a direction of future research.

**Idea Log Section**

**Idea/Question:**
How can the formal specification given in this paper be verified during the design of a system?

**Follow up:** Model checking is a method of formal verification. The design is verified for all possible input sequences. It allows verification of specifications very early in the design process by using an abstract model of the system. The SMV model checker is a research tool for verification of formal specifications. This can be used for model checking the artificial agent’s specifications.