Truckin

A teaching game for expert systems

by the Loops Design Team
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Abstract. *Truckin* is a knowledge system used for teaching knowledge representation techniques in Loops. *Truckin* provides an environment for creating, testing, and evaluating small bodies of knowledge interactively. Much of the knowledge in *Truckin* is represented as rules for controlling an automated truck in a simulation. The rules enable a truck to plan its journey along a road as it buys and sells commodities. A *Truckin* knowledge base can be evaluated in terms of the ability it gives an automated truck to make a profit while avoiding hazards of the highway. *Truckin* knowledge bases can be extended incrementally, so that a new Loops user can begin by extending existing sets of rules. *Truckin* contains illustrative examples and idioms for access-oriented, object-oriented, and rule-oriented programming.

Introduction

Loops is a knowledge representation system designed for use in building expert systems. It augments the Interlisp-D environment with object-oriented programming, access-oriented programming, and rule-oriented programming. Loops was developed by members of the Knowledge Systems Area at Xerox PARC.

In January 1983, the Loops system was ready for *beta*-testing outside of Xerox PARC. To help beta-test users to learn and evaluate Loops, the Loops Group decided to offer a short intensive course. This course was intended to provide hands-on experience in using Loops. Because Loops was designed for expert systems applications, it was believed that *the best way to teach Loops would be to organize the course around a mini-expert system.*

It was important that the mini-expert system for the course not be too technically specialized, because people taking the Loops course would come with a variety of different backgrounds. The mini-expert system should be based on knowledge from common experience. The expert system needed to be engaging enough and open-ended enough to draw people into developing fairly elaborate knowledge bases. This led to the idea of a simulation game around which we could have "knowledge competitions".

This document describes the *Truckin* world as a teaching and simulation game around which the Loops course is organized.

The *Trucker's Handbook*

A "player" in *Truckin* is qualitatively different from a player of computer and video games, such as those that are popular in arcades and on home computers. In most computer games, a player is a person. In *Truckin*, a player is a knowledge base. In this way, personal competition in *Truckin* is one level removed from the game. The objective is to create a knowledge base that can effectively guide a truck in the situations it encounters in the simulation environment.

Truckin provides a set of commodities, producers, consumers, hazards, road stops, and trucks. The *Truckin* world is intended to be complex enough to be interesting in the Loops course, but too complex for a simple mathematical model. The online data base of facts about this world is, metaphorically, called the *Trucker's HandBook*. A wise *Truckin* player will consider the facts in the *Trucker's Handbook* in planning its route.

The simulation in *Truckin* is controlled by a program called the *GameMaster*. In different contexts, the term "Game Master" refers to different combinations of programs, knowledge bases, processes, and computers. For simplicity, we refer to the whole thing as "the" *GameMaster*. The *GameMaster* chooses the initial configuration of the highway, sometimes called the game board, decides on the legality of the requests made by the players, updates the GameWorld and maintains the display.

The players talk to the *GameMaster*, who also decides which player gets the next turn. Currently, players get their turn on a time-robin basis, i.e., the player who has used the least amount of time gets the next turn. During a turn a player can buy or sell commodities at any *RoadStop* at which it is parked. These transactions are governed by practical considerations of how much money is in the truck's *cashBox*, whether there is cargo room in the truck for the goods, and whether the *RoadStop* advertises an interest in buying or selling the particular commodities. During a single move a truck can also drive to one other *RoadStop*. The distance that the truck can travel in a move is governed by a variable reflecting traffic conditions, as well as the maximum speed of the truck and the amount of gasoline remaining in the fuel tank.

Profits and Risks

The goal of a player in *Truckin* is to maximize profit during the game. The game ends after a predetermined number of turns. At the end of a game, the winning player is the one with the most cash. *AlicesRestaurant* is a special roadstop because any player who is parked there when the game ends, gets a hefty bonus.

Players compete for a fixed supply of goods and parking places. Just as with real trucks, there are a number of things that are important to know about the world. For the details of this, a player should consult the *Truckin Handbook* (database of relevant Loops classes). Here is a summary of the elements of the *Truckin* world:

Kinds of Trucks. Players start the game at *UnionHall* with an empty *truck* and an allotment of fuel and cash. Trucks come in different varieties, with different speeds, different fuel efficiencies, and different capacities for carrying merchandise. During each turn, the speed of the truck is measured as the ratio of the number of roadstops actually moved and the maximum allowed for that class of truck.

RoadStops. *RoadStops* are the positions along the highway. In the standard version of the game board, there are sixty six RoadStops along the highway. Neighboring *RoadStops* are separated by one mile. Up to two trucks can be parked at a *RoadStop.*

Producers. *Producers* are *RoadStops* at which players can purchase goods. A given producer will sell only a fixed kind of item, for example televisions, shirts, or apples. A *Producer* has only a fixed inventory of items for sale, and this inventory is used up as the simulation runs. The game board display shows the quantity of items for sale, and a price ratio which can be multiplied times the *averagePrice* of a *Commodity* to determine the purchase price. An icon is displayed on the game board to show the kind of *Commodity.* There are usually about 30 *Producers* distributed along the highway.

Consumers. *Consumers* are *RoadStops* at which players can sell goods. In general, *Consumers* are interested in generic kinds of goods, such as sporting goods, office supplies, or groceries. The capacity for a *Consumer* to buy goods decreases as items are purchased. The game board display shows the quantity of items that will be purchased, and a price ratio. The name of the generic class of *Commodities* to be purchased is displayed on the game board. There are usually about *23 Consumers* distributed along the highway.

Commodities. *Commodities* are the things that are bought and sold along the highway. The kinds of Commodities that are available are shown in the *Trucker's Handbook.* Some Commodities have special features, such as being fragile or perishable. *PerishableCommodities* have a *lifetime* (expressed in turns) which determines how long the *Commodities* remain salable. *Fragile Commodities* have a *fragility* which determines how likely they are to break when you go past *RoughRoads.* *Commodities* also have a volume and a weight which means that a truck can carry commodities limited by the available volume and weight on the truck.

Gasoline. Driving a truck uses up gasoline. Gasoline can be purchased at *GasolineStations* along the highway. Running out of gasoline results in a towing and a fine. There are usually about 5 *GasolineStations* along the highway.

WeighStations. *WeighStations* represent the arm of the government in *Truckin.* If a player goes by a *WeighStation* without stopping, he risks some chance of receiving a stiff fine and a towing back to the *WeighStation.* If he stops, he must pay a small toll (and use up a turn).

Rough Roads. Some *RoadStops* correspond to rough places on the road. Driving past a *RoughRoad* entails some risk to any *FragileCommodities* that are on board. If a player stops at a *RoughRoad,* no damage will result.

Bandits. *Bandits* in *Truckin* do not sit still. They can park at various *RoadStops* as controlled by the *GameMaster* and can intercept trucks. If a bandit intercepts a truck, or is parked at the same roadstop as a truck, it will take all of the *LuxuryGoods* that it has room for and one fifth of the money in the *cashBox.*

The CityDump. In general, an attempt to sell perished or damaged goods results in a stiff fine.

However, such goods can be unloaded for a fee at the *CityDump*. (In the simulation, these goods are sold for a modest "negative price".)

The Union Hall. If a player runs out of gas, he will be towed to *Union Hall*. There he will be given a new allotment of cash, but his truck will be emptied. This happens to a player whether he goes to *UnionHall* on his own request, or whether he is towed there for violating some rule.

Alice's Restaurant. At the end of the game, all of the trucks try to make it to *Alice's Restaurant*. Players ending the game at any of the Alice's get their cash doubled. There may be more than one *Alice's Restaurant* on the highway, and any one of them will do. If there are more trucks in a game than parking places at the restaurant, then there will be competition for the places. To preclude the strategy of just going to *Alice's Restaurant* and parking, any player who parks there for more than some specified time will be towed away to Union Hall.

Advice for Independent *Truckers*

To succeed at *Truckin*, a player must be responsive to the configuration of the highway and to changing conditions. To make a profit, a player must consider the spread between price ratios and the convenience of the relative locations for buying and selling commodities. A player must not exceed the capacity of his truck in either weight or volume.

We have a few final suggestions for players. Don't buy goods that you can't sell at a profit. Don't buy *PerishableCommodities* if you can't deliver them on time. If your goods spoil or are damaged, take them to the *CityDump*. Keep an eye on your fuel gauge. Don't drive too quickly with *FragileCommodities* over *RoughRoads*. Don't spend all of your cash on *Commodities*; you may need some for incidentals along the way. Watch out for bandits, rough roads, and weigh stations. And try to be at *Alice's Restaurant* when the game ends.