# Association for Automated Reasoning Newsletter

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**From the AAR President, Larry Wos...**

The debate continues. In this issue, we include the (recently modified) proposed CADE Bylaws and David Plaisted's comments on this revised set. I encourage AAR members to read the arguments presented and keep ever-present in mind that in most cases, like entropy, sharp change is dangerous.

On a different note, G. Huang presents a solution to TopSpin. For those researchers who enjoy puzzles—as I do—Huang's article will be of immediate interest.

Finally, for the curious, I cite the results of the recent survey in the *AAR Newsletter:* the overwhelming majority voted in favor of continuing paper copy of the newsletter (I believe the tally was 3 to 1—*total*).

## Alan Robinson Receives the Herbrand Award

CADE, Inc., has announced that Alan Robinson will receive the Herbrand Award at CADE-13. The Herbrand Award is given by CADE to honor a person or a group of people for exceptional contributions to the field of automated deduction. It carries a certificate and a check for $1000. Previous awards have been made at CADE-11 to Larry Wos and at CADE-12 to Woody Bledsoe.

Alan Robinson has generously asked for the $1000 to be donated to the Woody Bledsoe Student Travel Award, which will be used to fund one or more students to attend CADE-13.

## CADE, Inc. Bylaws

*Alan Bundy, President, CADE, Inc.*

For those following the continuing saga of the CADE Inc. bylaws, another installment is now available. The CADE Trustees have produced a modified version of David Plaisted's proposed amendments. These new proposals retain the essential elements of David's proposals, namely, democratically elected Trustees, but change some of the details that the Trustees were unhappy about. You can view these proposed changes on the CADE web page on

http://www.cs.albany.edu/~nvm/

In particular, there is a page that juxaposes the original bylaws, David's amendments to them, and the trustees further amendments, together with a commentary.

There will be a vote on these proposed amendments at the CADE Business Meeting during CADE-13. This will be held during the evening of Wednesday, July 31, and not Saturday, August 3, as it says in the advance programme.

## The Trustees' Democratic Bylaws Proposal

*David A. Plaisted*

The trustees of CADE, Inc. recently proposed a democratic set of bylaws for CADE. Their proposed bylaws have some similarities to those previously proposed by myself and some others. In their proposal, the trustees made some comments about our set of proposed bylaws. I would like to respond to these comments, as well as to comment about the trustees' counterproposal.

I commend the effort of the trustees to develop such a set of bylaws, and also the fact that their proposal specifies three year terms for trustees, as does our proposal (assuming that CADE meets once a year). However, their proposal has a number of deficiencies, which the CADE community should be aware of. I expect that the trustees will modify their proposal, but this commentary is based of necessity on their initial version. In any event, these comments should be of value in bringing relevant issues to light.

There are a number of inessential differences between the proposals which I will ignore. One of the notable differences has to do with the degree of democracy. In the trustees' proposal, the secretary, treasurer, and current and forthcoming program chairs are automatic (that is, nonelected) trustees. There will in addition be six elected trustees. Therefore it is conceivable that one-third (or more) of the trustees could be nonelected. This results in only a partially democratic system.

Another very serious problem with the trustees' proposal is that motions passed at CADE business meetings are considered as only advisory. This means that the trustees can ignore them if they so choose. This results in a further weakening of the voice of the membership in the governance of CADE. I modified the wording of my proposal to be more clear in specifying that motions passed at the business meeting are binding on the trustees.

In addition, the trustees' proposal specifies that amendments to the constitution require a two-thirds majority. This could mean that the CADE community gets stuck with a set of bylaws that we find out is not suitable, but no one can get rid of them because of the two-thirds requirement. My proposal specifies a simple majority, which is more appropriate in an initial period until all the implications of the bylaws are understood and experienced.

Any of the above points is in itself sufficient reason to reject the trustees' proposal. There are also some other, less serious problems with it. The trustees propose that elections be conducted according to a complicated single transferrable vote system. This system has some advantages, but it is hard to understand, makes it hard to count the votes, and makes it hard to verify that the votes have been properly counted. I proposed a two-round system. Such systems are well-tested, in common use, easy to understand and run, and give voters a second chance to evaluate the candidates. In addition, in some ways my system is actually more sensitive to voter preferences than the single transferrable vote system.

The trustees' proposal also weakens the function of the trustees as a nominating committee in giving the members a choice. In my system, the trustees will make at least three nominations in addition to the current program chair and incumbent trustees, who are automatic nominees (and not excluded from the slate as the trustees stated). The trustees' plan removes the automatic nominations and only specifies that the trustees will nominate two individuals, who are likely to be the current program chair and an incumbent trustee.

Another issue slightly off the subject is that of verifying the vote count when our proposal is voted on at CADE 13. I requested that some of the supporters of our proposal participate in the vote count or at least be able to recount the ballots. So far there has been no response from the trustees, but I expect this to be forthcoming. I also requested that there be at most one proxy controlled by one individual at CADE 13.

In sum, the trustees' plan does have at least a partial democratic aspect, and has short (three year) terms for trustees. But it also has a number of very serious drawbacks that make it unacceptable in its current form. I encourage the trustees to modify their plan, which they may have done already by the time this issue appears. In contrast, the system proposed by myself and others is more democratic and workable, and none of the criticisms raised against it have any substance. We believe that our proposal is more worthy of your support.

## Using OTTER and Prolog to Solve TopSpin

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TopSpin consists of a circular track with 20 pieces numbered 1, 2, ..., 20 placed in the track, and a turnstile that always holds 4 consecutive pieces. There are three legal moves in TopSpin: slide all the pieces around the track one position in the clockwise or counterclockwise directions, or flip the turnstile and its 4 pieces 180°. If we picture the turnstile at the top of the circular track, then sliding the pieces one position in either direction corresponds to sliding the pieces through the turnstile one position to the right or left. Thus we refer to the moves as *sliding left, sliding right*, and *flipping*; and denote them as L, R, and F, respectively.

### 1. The Representation

Starting from the leftmost position of the turnstile, from left to right we number the positions 1, 2, ..., 19, 20 in that order. We use a 20-place relation $S$ to represent these 20 positions and 20 constants 1, 2, 3, ..., 20 to name the 20 numbered pieces. Thus a configuration of TopSpin is represented by a literal $S(c_1, c_2, c_3, .., c_{20})$, where $c_i \in \{1, 2, 3, ..., 20\}$. Corresponding to the three legal moves, we get the following three rules for TopSpin:

$S(x_1, x_2, x_3, x_4..., x_{19}, x_{20}) \Rightarrow S(x_2, x_3, x_4, x_5, ..., x_{20}, x_1)$ (move L)

$S(x_1, x_2, x_3, x_4, ...., x_{19}, x_{20}) \Rightarrow S(x_{20}, x_1, x_2, x_4, ..., x_{18}, x_{19})$ (move R)

$S(x_1, x_2, x_3, x_4, x_5, ..., x_{19}, x_{20}) \Rightarrow S(x_4, x_3, x_2, x_1, x_5, ..., x_{19}, x_{20})$ (move F).

## 2. Unscrambling the Pieces

Given any initial board with scrambled pieces on the track, the problem is to find a sequence of moves that unscrambles the pieces. Using OTTER 3.0, we can always move piece 20 to its destination first, then move piece 19 to its destination, ..., and finally we get a configuration: $S(*,*,3,4,...,18,19,20)$ where $*,*$ is either $1,2$ or $2,1$.

But OTTER could not move 2 to its destination when the $*,*$ is $2,1$. In solving the subgoal of moving 5 to its destination, OTTER found a sequence of moves

$$FLFRFLFR$$

which permutes five consecutive pieces in 0.83 seconds without moving the remaining 15 pieces. This derived rule, written formally, is

$$S(x,y,z,u,v,w_6,...,w_{20}) \Rightarrow S(y,z,u,v,x,w_6,...,w_{20}).$$

Once we add this rule as a new axiom to the set of support, OTTER swaps 1 and 2 in 24 steps and in 252 seconds while preserving the order of other pieces.

## 3. Two Hard Problems

One hard problem in TopSpin is turning the turnstile upside down without changing the order of the pieces. The brochure that came with the puzzle gave a 37-step solution.

To record the orientation of the turnstile, we add a 21st position to the relations. The orientation position is filled with the constant '0' or '1' to indicate the two distinct orientations of the turnstile. The moves R and L do not change the value of the orientation position, but move F always changes the value.

We found that the following 31-step sequence of moves accomplishes the task of inverting the turnstile with a minimal number of steps:

$$RFLFRFLFLLFRRFLFRFRFLLFRFLLFRFR.$$

Another hard problem is to find a minimal length of derivation that switches two adjacent pieces while leaving the other pieces fixed. The brochure that came with the puzzle gave a 49-step solution. We found the following 41-step sequence of moves that accomplishes this task:

$$FLFR17(FL)LFR.$$

We found both sequences and proved them to be minimal using Prolog and OTTER. The search space is too large for OTTER to accomplish the tasks alone. Working backward using OTTER, we generated all configurations that were 12 steps from the goal. Then we used Prolog to search from the initial board to these OTTER-generated configurations. To constrain Prolog's depth-first search strategy, we added another place in the relation to store the maximum search depth allowed. To show that the solutions were of minimal length, we let the Prolog exhaustively search all possible shorter sequences. The second problem took about 23 hours on a 486 PC.