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RoboCup European Championship: Report of the Amsterdam 2000 event

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Abstract

The authors, as the local organizers of the RoboCup European Championship, present a brief, informal overview of this event, with the aim to archive the main results, but also as a report to support organizers of future RoboCup events in the organization and coordination of such a rather complex tournament. © 2001 Published by Elsevier Science B.V.

Keywords: RoboCup; Organization of European Championship

1. Introduction

The Robot World Cup, RoboCup [1], is an international initiative to foster AI and intelligent robotics research by providing a standard problem, a soccer game, where a wide range of technologies can be integrated and examined. The first Robot World Cup, RoboCup'97, was held in Nagoya, Japan, in August 1997, and included the participation of more than 40 teams. RoboCup'98 was held in Paris, in July 1998, where more than 60 teams participated. In 1999, the third Robot Soccer World Cup was held in Stockholm, Sweden, and in August 2000 the fourth edition of the games was held in Australia. Future scheduled RoboCup events are: RoboCup 2001 Seattle and RoboCup 2002 Japan. Sites for 2003 and after are not decided yet.

From 28 May till 2 June 2000, the first European RoboCup Championship was organized in Amsterdam. This event, initiated through a proposal at RoboCup 1999 in Stockholm by Frans Groen, was a first attempt to organize the RoboCup competition on a regional basis. As such, it served as a tool to probe the feasibility of the organization of such an event on a local scale.

From start, the objective was to organize a low-cost scientific event accessible to all interested research groups in the region. The second objective was to attract the attention of students-to-be and interest them for sciences. This objective has left its mark on the organization as such: members from the academia have been the driving force behind this event.

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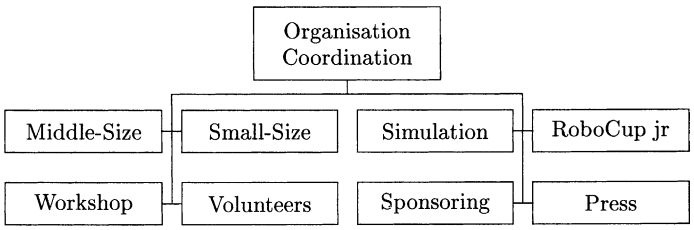

Fig. 1. Organization.

Without the active support of their respective institutions, expressed in the efforts of the faculty-boards, conference organizers, members of the system labs, volunteering students and joined task forces comprised of employees of the research groups involved, an event like this would be very hard, if not impossible, to realize.

A similar remark could be made about two sponsors: SONY and NWO. At the right time, they provided the organizing committee with the necessary financial backup to take the 'go ahead' decision. This, and much more were enabling factors for the First European RoboCup Championship. In this report, we summarize our findings and evaluate what has gone right and wrong. We hope that this evaluation will prove useful to others and stimulate them to take RoboCup in all its forms one step further. A detailed report including all the match results is available at http://www.robocup.nl.

2. Organization

Preparation for the event started almost a year in advance. Since the organization can hardly be qualified as a standard one, the need for a manual which summarizes the experience of the past is large. Although the manual of Sweden was of great help to us, it arrived somewhat late and therefore we had to reinvent the wheel again to some extent. We have translated the Sweden manual to our local situation (see [2]).

To optimize the efficiency of the organization, it was split into two parts: (i) organizational and logistic aspects and (ii) RoboCup related aspects. For the work of category (i), a professional organization was used, the University of Amsterdam (UvA) Congress Bureau, work in the second field was done by the academia. We think that, in principle, this is a good separation of activities and responsibilities though it is difficult to define a clear boundary. The organizational structure is elucidated in Fig. 1.

Most critical for the organization was the fund raising and finding of a proper place for the event. The first aspect has been a constant worry. Regarding the venue, the University Sports Center of the UvA offered us access at a substantial discount. This place was approved by Mr. Kitano during a visit.

The committee met on a bi-weekly base and checked progress according to the timetable. It should be stressed that the complexity of the setup and the overwhelming number of things that needed to be arranged made it difficult to keep clear track of the progress. The committee worked according to the principle that every person had integral responsible for some type of activity, e.g. the person responsible for the simulation had to take care of projectors, computer time for the simulation connectivity, etc. The congress bureau handled all logistic aspects including negotiating with firms, reservation of the hotels, handling of the registration and all money transactions.

Public relation work was done by a professional from the Technical University of Delft. Proper handling of the press requires a kind of unique person who can both answer in-depth technical question as well as have ample media experience. To facilitate this, we have set up a Question/Answer form [2]. Although we have managed to cover all the media and get ample of attention, we still feel that more could have been made of it. An aspect which one should not underestimate is the importance of the web.

3. Event

The event covered a full week. A precise planning is given in the timetable at [2]. As an evaluating remark,

Table 1
Small-sized participants

Team	Country	Web
5DPO	Portugal	http://www.fe.up.pt/∼robosoc/
CFA UPMC Paris	France	http://www.robo.jussieu.fr/rbo/Robocup/UPMC-CFA_robocup_team.htm
FU Fighter	Germany	http://www.inf.fu-berlin.de/∼robocup
Genius	Taiwan	
Rogi	Spain	http://rogiteam.udg.es/robots/rogi2team.html
VUB AI-lab	Belgium	http://www.ida.liu.se/ext/epa/cis/1999/006/14/

we mention that the testing of the setup (transition between Sunday and Monday) was maybe planned a little tight.

3.1. Small sized

Six teams entered for the competition in the small-sized league. They were all placed within one pool. The teams are given in Table 1. This competition was won by the FU Fighters, who did beat the Rogi team with 6–0 in the finals. Third was the VUB AI-lab, fourth 5DPO.

3.2. Middle sized

In the middle-sized league, 10 teams competed. The world champion of 1999, the team Sharif, was also invited to this European tournament. The arrival of the Sharif team was delayed, due to late subscription and (hence) visa problems. Consequently, up until a late state it was not certain whether there were 9 or 10 teams for the competition. Most teams brought a modest number of team members (5–10) and robots along (3–5), however both the Swedish and Italian teams brought a considerable greater amount to the tournament, which gave a higher pressure on the available space and infrastructure than was originally expected. The teams are presented in Table 2.

The competition was set up as follows: 10 teams played a half competition in two pools. The first eight entered a tournament — the quarter finals. The four winners of the quarter finals went into the semifinals. The two losers of the semifinals went for places 3 and 4, the small finals. The two winners of the semifinals went into the finals. We have tried to make the two initial pools of equal strength. We used the Stockholm rating for this.

Concerning technical issues, a miss was that some of the chairs were bright red, being cumbersome for some robots that could look over the field boardings. The illumination was 1000 Lux uniformly distributed. This was sufficient. However, in the blue goals for the Iranian team, more light had to be installed. The power for the paddock area was planned to be sufficient, however, the lighting company initially did not bring sufficient power distribution cables along, and

Table 2
Middle-sized participants

Name	Country	Web
5DPO-2000	Portugal	http://www.fe.up.pt/∼robosoc/
Art	Italy	http://www.ai.sri.com/∼iocchi/robocup99/art.html
Attempto	Germany	http://www-ra.informatik.uni-tuebingen.de/forschung/robocup/welcome.html
Dutch team	The Netherlands	http://www.robocup.nl/clockwork/index.html
GMD	Germany	http://ais.gmd.de/BE/robocup/
IsocRob	Portugal	http://socrob.isr.ist.utl.pt
Sharif	Iran	http://linux.ce.sharif.ac.ir/robocup/
U. Minho	Portugal	http://www.robotica.dei.uminho.pt/robocup/
Ulm Sparrows	Germany	http://smart.informatik.uni-ulm.de/SPARROWS/
Uppsula	Sweden	http://www.docs.uu.se/robocup/2001/

tapped in the team setup weekend all current from the (220 V) illumination net instead from the (380 V) powernet. This was solved on Monday when a (380 to 280 V) converter was brought along (as was in the planning) and more cables. All games have been taped by Einstein TV using top cameras and some goal cameras, albeit that the quality is modest. Since the end of October the tapes are in Delft, where VHS copies can be ordered (pieter@ph.tn.tudelft.nl).

The colors that were used in Amsterdam were in fact the colors used in Stockholm: Pantone Process Blue for the Blue Goal, Pantone Process Yellow for the Yellow Goal, Pantone Process Cyan and Pantone Process Magenta for the team shirts. The ball is (probably) Pantone Orange 021. Pantone Process colors are the basic colors used by printers to print color prints. The green of the corners is probably Pantone 340. A few meters of fabric in magenta and cyan as shirts or skirts for all the teams were available, however, hardly used, due to a new rule that team colors were not mandatory.

On the Sunday before the games, a meeting about the rules was organized. It became clear that several team leaders were not aware of what the rules actually involved, or what the status was of the changes proposed on the web, i.e., what was ratified and what was only proposed. Moreover, it appeared that the definition of charging was unclear. The rules that we finally agreed on had to be propagated to the teams by the team leaders. Something that had not always been done or was not always digested by the team members, as we noticed later on during the games. Moreover, not all dealmakers had already arrived in that stage. Reason that the main rules were projected on the wall during the games (also as a service to the audience).

In general, the atmosphere in Amsterdam was good and the competition was fair. Three new teams, from Holland, Sweden and Portugal entered the league. Iran won the games in a severe struggle with Italy. We think that the final ranking reflected the strengths of the teams. Some progress with respect to Stockholm was made, in general better collision avoidance was seen, as well as better vision systems. Encouraging team behaviors have been spotted. We propose not to leave the walls out in future games, as the vision systems will probably not be able to handle this. We would like to enforce better color recognition and team behavior, as well as colored advertisements on the walls to start with, combined with a larger field.

3.3. Simulation

All in all 14 teams (see Table 3) entered the competition for the simulation league. The teams were grouped according to strength into two groups.

Airg Sibiu Ulbs did not show up, and PSI had troubles getting into the Netherlands and arrived too late to effectively take part in the competition. The competition scheme was based on first a pool of which the

Table 3
Simulation league participants

Name	Country	Web: http://
Airg Sibiu Ulbs	Romania	airg.verena.ro/new/projects/
AT Humboldt 2000	Germany	www.ki.informatik.hu-berlin.de/
Cyberoos 2000	Australia	www.cmis.csiro.au/
Essex Wizards	Great Britain	privatewww.essex.ac.uk/~kkosti/
FC Portugal	Portugal	www.ieeta.pt/robocup/
Karlsruhe Brainstormers	Germany	www.karlsruhe-brainstormers.de/
Mainz Rolling Brains	Germany	www.informatik.uni-mainz.de/ANGEW/
Lucky Lubeck	Germany	
No AI	Sweden	
Pizza Tower	Italy	medialab.di.unipi.it/
Polytech 100	Russia	
OULO2000	Finland	
RoboLog	Germany	www.uni-koblenz.de/~fruit/
Wroclaw	Poland	www.ict.pwr.wroc.pl/robocup/

top four qualified and then a knock out scheme. The competitors insisted on getting a full ranking of all the teams. FC Portugal was the winner in this league, Karlsruhe Brainstormers was second, and the Essex Wizards did beat Cyberoos 2000 for the third place: 2–1.

Concerning technical issues, contrary to other years competitors were given one month in advance access to the target system to compile and test their code. The simulation as such was run on a parallel system, the ASCI DAS system, a distributed supercomputer. The Vrije Universiteit part of this machine contains 128 nodes. For the matches, each player was mapped onto a processor. An extra processor was reserved for the soccerserver. To minimize the cross talk of network, traffic players of the two teams were separated by a switch. The system on which the simulation was run was connected to the standard visualization via an ISDN line. The bandwidth of this line was more than sufficient to give the updates for the visualization. Besides that, a 3D visualization was run on an ImmersaDesk that was placed on the campus. Logfiles can still be retrieved from http://www.cs.vu.nl/das/robocup.logs/.

The parallel system proved to be very stable. Only in two cases was a restart of the match necessary. The fact that the simulation is run on a remote system with proven stability adds much to decrease the runtime problems. During all the matches, traces of the network traffic induced have been taken. These will be analyzed soon. Based on this analysis, we will try to see if suggestion for an optimal configuration can be made. It is clear already that the simulation is dominated by the network. Almost all competitors appreciated the possibility to test their code in advance very much. During the matches, almost no software problems occurred.

3.4. Workshop

The workshop was scheduled in one full-day program on Wednesday 31 May, located at the Free University. During this day, 14 papers were presented, giving rise to lively discussions. The titles of the papers, together with the authors, are given below. Ranked to the first author, they were from the following countries: Germany (4), Italy (4), Portugal (2), Romania (1), Spain (1), United Kingdom (1) and Yugoslavia (1). A CD-ROM containing the papers was distributed at the workshop. Apart from the accepted papers, this CD also contained 16 team descriptions: one for the small-sized league, 10 for the middle-sized, and five for the simulation league. Copies of this CD are still available via wiebe@cs.uu.nl.

Here is the list of accepted papers: [1]

1. Simulation league
   - 1.1. Mihal Badjonski, Kay Schröter, Jan Wendler and Hans-Dieter Burkhard, *Learning of Kick in Artificial Soccer*.
   - 1.2. Ciprian Candea, Marius Staicu and Boldur Barbat, *Holon-like Approach for Robotic Soccer*.
   - 1.3. M. Riedmiller, A. Merke, D. Meier, A. Hofmann, A. Sinner, O. Thate and Ch. Kill, *Karlsruhe Brainstormers 2000 — Design Principles*.
2. Vision-based methods
   - 2.1. Stefan Enderle, Marcus Ritter, Dieter Fox, Stefan Sablatnög, Gerhard Kraetzschmar and Günther Palm, *Vision-Based Localization in RoboCup Environments*.
   - 2.2. Carlos Machado, Sergio Sampaio and Fernando Ribeiro, *Image Processing Applied to a Robotic Football Team*.
   - 2.3. Fabio Marchese and Domenico Sorrenti, *Omni-Directional Vision with a Multi-Part Mirror*.
   - 2.4. Carlos Marques and Pedro Lima, *A Localization Method for a Soccer Robot Using a Vision-Based Omni-Directional Sensor*.
   - 2.5. Michael Plagge and Andreas Zell, *Vision-Based Goal Keeper Localization*.
3. (Team) behavior
   - 3.1. Claudio Castelpietra, Luca Iocchi, Daniele Nardi and Maurizio Piaggio, *Coordination among Heterogenous Robotic Football Players: ART in the F-2000 League*.
   - 3.2. Matthew Hunter, Kostas Kostiadis and Huosheng Hu, *A Behavior-Based Approach to Position Selection for Simulated Soccer Agents*.
   - 3.3. Hans-Ulrich Kobialka, Peter Schöll and Ansgar Bredenfeld, *Tools for Assessing RoboCup Behavior*.

[1] The final program of the workshop as well as a copy of the papers can be found at [4].

3.4. Maurizion Piaggio and Antonio Sgorbissa, *Exploiting ETHNOS for Communication and Coordination of Heterogenous Soccer Robots in the ART Team*.

4. Miscellaneous
   4.1. G. Adorni, S. Cagnoni and M. Mordonini, *Design Issues for the ART F-2000 RoboCup Goal-Keeper*.
   4.2. Josep de la Rosa, Bianca Innocenti, Albert Oller and Albert Figuerras, *An Example of Dynamical Physical Agents*.

The workshop was attended by almost all the participants discussing aspects of their tactics. In the current edition, it is almost limited to the mid-sized league.

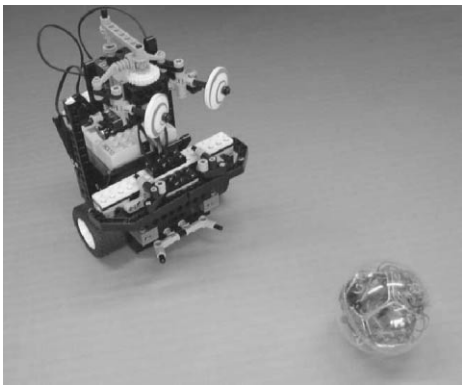

Fig. 2. Robot with ball.

3.5. RoboCup Junior

During RoboCup'99 in Stockholm the first RoboCup Jr. was arranged by Henrik Lund and Luigi Pagliarini. The aim was to allow children get experience with the programming of robots. A setup using LEGO robots and a simple and clear programming environment was made. During the preparation of the championship in Amsterdam, we noticed that there was a large interest of children for robot soccer. Therefore, we decided to organize RoboCup Jr. in Amsterdam, using a setup similar to the RoboCup Jr. 1999 using LEGO robots and the software of Lund's group. We had 12 teams (from the Netherlands and two from Germany) playing a real tournament.

The robot is based on a design by Lund of Lego-Lab Denmark. The basis is a standard LEGO Mindstorms set. The soccer robot is programmed using the 'ILF'-software developed by Lund and Pagliarini which provides children an easy to use programming environment. For a more detailed description of the hardware and software, we refer to [3]. The robots play in a one against one fashion. The field for the soccer game is a gray scale field printed on an oversize A0 ($119 \times 87\,\mathrm{cm}^2$), surrounded by a wooden frame of about 13 cm high. The intensity level of the field forms a gradient from white to black, and using a light sensor underneath the robot, one can navigate around the field. Before starting, the system has to be calibrated.

In contrast with the middle-sized league in RoboCup, the LEGO robots do not have a camera on-board. This would require too much processing time and would result in a too expensive system. Instead, the system uses LEGO light sensors, implying that an 'active' ball is needed. In RoboCup Jr. 2000, we used the balls which were designed in the LEGO-lab of the University of Aarhus (see Fig. 2). These balls contain LEDs which emit infrared light of a wavelength which is optimal for the LEGO sensors. The ball was made of transparent plastic in which 20 infrared emitters were positioned in a hexagonal grid, so that coverage of all angles is assured. These balls were hand made, but a commercial version will be available soon from a Japanese company Elekit.

There were 12 teams from eight schools participating in this tournament, in total about 50 children varying from 13 to 16 years old. In the morning, the whole group of participants was given a short general introduction after which every team was assigned to a computer and a robot. We had one supervisor per three groups, which is really needed. The younger children used the 'beginners' mode of the ILF program, while the older ones were encouraged to try the intermediate level, in which they could also use conditionals in their program. Despite the initial fear of programming, after 15 minutes everybody was very enthusiastic. The first tests were carried out to investigate the effect of the parameters of the program on the behavior of the robot. After one hour, we started playing the qualification rounds: from the 12 teams only 8 could be admitted in the quarter finals. After these qualification games, we still had teams of young children as well as older ones in the tournament.

Table 4
Winning team's code

```
Der Manschaft
31 mei 2000 14:58u
a.ilf

SCORE IN WHITE
Robot reacts to Bumpers Activity
Robot Eyes Look at the Ball
–

Beh:1 Find the ball
Beh:2 Make a sound: BEEP BEEP
Beh:3 Search and go to the ball: 5 sec.
Beh:4 If robot sees the Ball Close
Beh:5 Go lighter: 6 sec.
Beh:6 END If robot sees the Ball Close
Beh:7 If Robot is on White Side
Beh:8 Go darker: 5 sec.
Beh:9 END If White Side
```

After the qualification games, there was a lunch break and a demonstration of the 'real' RoboCup games. We noted that some children wanted to continue programming to improve their chances on winning. However, to have a fair tournament (and to have time to recharge the balls), we imposed a strict one hour break. After lunch, we played the quarter finals, semifinals and finals on a single field in front of the supporters. A LEGO Mindstorms set was given as a first prize to the winners (Montessori Lyceum Amsterdam). To our surprise, the second prize winner was a group with a very simple program. The strength of this program is the speed it loops such that it is always faster near the ball than complex programs. The winning team had a program which was developed in the intermediate level mode, in which it was possible to use IF-statements (in Table 4, Dutch commands are translated into English).

The RoboCup Jr. games with the LEGO robots provide a very good platform for the AI education of children in the age between 8 and 15. The fact that a program has to be designed which controls a real system, and that this system has to compete with other systems (of which at the moment the physical capabilities are identical) motivates the students enormously. At the moment, we are making an inventory of other systems which have the same objectives. There is an increasing interest in this field of edutainment, both from industry as well as from academia. We believe that the AI community will benefit from a good explanation of the problems and education in secondary schools.

4. Conclusion

Organizing RoboCup, even on the scale at which we did it, and given the limited objective that we had, is a difficult task. It would have been impossible without the help of the local and international sponsors. That casts a shadow of a doubt on the feasibility of RoboCup as such since also the participants have to invest substantial amounts of money.

The simulation league is easy to organize and can even be done in a virtual way: competitors submit their code and watch remotely what is happening. In our opinion, this possibility should be explored more explicitly. The mid-sized league is very capital intensive both for the organizers as well as for the participants. We think that in the long run this cost effectiveness will be a critical success factor for the competition. Similar arguments apply, albeit somewhat less, to the small-sized league.

We have tried to organize the first RoboCup European Championships on a low budget basis. Realization of this is critical in our opinion for the survival of RoboCup as an initiative. In retrospect, one can say that we have succeeded in doing so, however, that the net result is still mixed. It is doubtful whether organizing RoboCup separate events — and attending them as participant — is a sustainable activity. One should stress that these conclusions do not hold for the simulation: they are probably the most feasible activity.

Public attention focuses on the mid-sized league. To some extent, this is understandable because intuitively these robots are the most appealing. Having said that, one should also point out that a number of the 'non-scientific' visitors were somewhat disappointed in the state of the art of robotics. The simulation league gets little attention. This is surprising since the play is of exceptional high level in this league. Limiting factor here is probably the restricted nature of the interface: people used to play with Fifa 99 are less impressed by a two-dimensional UI.

All in all, RoboCup is an investment in the future but a risky one: the return on investment in the short term is limited.

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[2] http://www.robocup.nl/robocup2000/.
[3] carol.wins.uva.nl/~krose/robocup_jr/.
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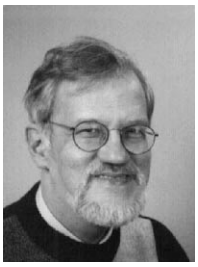

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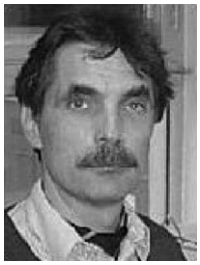
Wiebe van der Hoek is a senior researcher at the Computer Science Department of the University of Utrecht and Professor at the University of Liverpool. His current interests are logics for AI, belief revision and agent programming languages.

Pieter Jonker is an Associate Professor in the Pattern Recognition Group of the Department of Applied Physics, Delft University. His current interest is in a project on ubiquitous communications and nano computing.

Ben Kröse is an Associate Professor at the Computer Science Institute of the University of Amsterdam. His research interests are learning systems which perceive and act and computational intelligence methodologies for these systems. He is member of the IEEE.



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