

I.) Seminar on Go and Game Theory - Summary Report. (1975)

The Seminar has been held, as planned, on the European Go / Kongress 1975 at Krems-Austria. On each of 5 sessions 10 to 30 interested people attended.

1. Aug. 17.00 Problems of Go-Theory (K.Heine)

1. With theory of games Go should be considered as 2-person zero-sum game with complete information. These aspects of game theory should always be kept in mind.
2. Go should be considered as a cybernetik model that gives a clue to many generalisations. Therefor mathematical and logical analysis should be considered with high interest.
3. The system of classifications gives already a lot of practical information.
4. An estimation of information-content may specially with Go lead to positive results.
5. The practical programming of computer to play Go gives proof to theoretical concepts.
6. Therefor a lot of important topics must be considered for research:
 - ◆ The rules of Go to be axiomatic
 - ◆ Is Go really a game with complete information?
 - ◆ Informationunits in Go.
 - ◆ The rate of information of special positions.
 - ◆ Computerprogramming for playing Go
 - ◆ Statistic analysis of games by copmputer.
 - ◆ The scale of rating systems.
 - ◆ Problems of logic.
 - ◆ Principles of coding in recognizing Positions.
 - ◆ Programmed learning for Go-lessons.
 - ◆ Go may be an intelligence-test.
 - ◆ Go may be a means for research in teaching theory.

1. Aug. 19.45 – 20.30 Informationcontent of Go. (K.Heine)

Go should be considered as a game with „complete information“ (i.e. the rules define, strictly obeyed, the result of the game.) As information theory to-day is a useful tool in many branches of scientific research, a study of the information-content of Go seems to be useful. Modifications of the well-known estimation

of: $361! = 10^{765}$ different possibilities were discussed. By looking at the use of the rules it is estimated that the most primitive way of playing covers around only 10^{400} possibilities or $= 2^{1330}$ corresponding to a content of information of 1330 bit. As there already exists a well-defined scale of classification according to strength, this might be correlated to informationreduction in understanding of the game by the participants. Thereby, it is hoped, more general theorems of cybernetics and a deeper understanding of the game may be the result. The value of moves and special positions may be looked at by statistical definitions.

The fact, that stronger players show less statistical fluctuations with their results that beginners is one of the observations that can be explained.

3. Aug. 17.00 -17.45 Principles of computer programming. (B.Wilcox)

- a) Specially with Go it is apparent that more look-ahead technique on a decision tree cannot perform much intelligent game playing. For goal oriented performance a computer has to be programmed with complex meanings as: territory, attack, defence, forms and influence.
- b) From small units starting, these meanings are structured as: stone; string; link; group; real territory; potential territory; sectorlines and walls. They are analyzed by micropatternrecognizer to largefield ,pattern-analysation, well balanced. The technique may be described as „web-structure“.

- c) Decisions are in general performed due to analysis. If conflicts between decision factors cannot be settled „rule of thumb“ is used as mere guessing. To some degree look-ahead procedures will be still used, but only to a very restricted amount of about 30 moves only.
- d) There is large material of experience stored for use in the machine. Learning is to some degree possible by self-adjusting of operational factors. But due to programming effort a more sophisticated learning will not yet be installed.

3. Aug.19.30 – 21.00 Report and Discussion on literature and related problems (C.Hutchinson)

- I) Development of computer programs on Go, Lit : 1960 Lefkowitz, D
 1962 Remus, H 1970 Diamont, J. 1973 Mann, B.
 1964 Thorp, E. Walden, W. 1970 Goddard. 1974 Reitmann; W. Wilcox.
 1968 TsumeGo, in Japan. 1971 Ryder, J.L. 1974 Nilson.
 1970 Wimmer, Mf. 1972 Hutchinson, C. 1975 Guenther, J. Black, T.
- II) The library system of the AGA has been organized within Princeton University Libr in the Great Oriental Collection. By this the books are open to interlibrary loan. The main part of it originates from a donation by the late Karl Davis Robinson.
- III) Logical Problems, (Tsume-Go) etc. Are worked on by the guidance of Mr. Ted Drange. Publications are to find in „Nostalgia“. They also have a postal Go-organisation. Another topic is to play on minibboards $M \times n$.
- IV) The rules of Go are now with the AGA to be considered selfconsistent from a logic point of view. They originate from the works of Olmstead and Robinson 1941; 40p. 1945; 170p. A summary is in GoMR.4(1964); 9;p:87-ff.
- V) The rating System of the AGA is organized very much alike to the Elo-system of the Chess-players. That is, a std.-deviation of winning probability is attributed 200 points. As it still rather new with the AGA it has still some time to be elaborated.

4. Aug. 17.00 -19.00 Go in Schools and Teaching Theory. (K.Heine)

- 1) Practice at school: Go may be taught to children down to 10-years of age. Much practical play should prevail to lectures. Small boards: 9x9!; 11x11; and 13x13 should be used. An adult should look after organisation, material and literature etc.
- 2) Teaching Theory. Even to-day learning appears to be a complex procedure not completely understood by teaching-theory. Considering the excellent means to measure success by the game of Go it should be pointed out to be a good tool for scientific research with teaching theory. As a game of sufficiently complex structure, -however easy to control. its advantages consist of only little interference by civilisatory factors and other educational conditions. Theory of games will give to results a solid mathematical background. A list of teaching and learning characteristics of Go is presented as a first start for research.
- 3) Experiences by teaching and course results have thoroughly been undertaken by K. Seyfert in Berlin.

Comments by Dr. K. Heine

The interest for international talk about Go and its background has proven to be unexpectedly high. The European Go-Kongress seems to be a good, successful place for this.

Discussion was vivid. The ultimate goal however has been to create an understanding for cooperation to give better background to far-reaching projects. This has not yet been achieved.

Another meeting may be held if possible about: Rules; programming techniques computer programs; teaching theory; logical analysis; etc.