Uncoordinated Collaboration Among Students*

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The true teaching occupations have the basic conditions—listening to each other and the co-operation. The students in elementary schools are often require the presence of adult guidance persons. In the high school, it is more likely to develop the uncontrolled willingness to cooperate, even without the guidance or coordinating teacher. Co-operation without external control mechanisms are in other areas with different shapes. We tested what can happen in the classroom in a series of experiments. When the model was implemented, the students did not know the purpose of the experiment or the interaction chosen. The game was made on a voluntary basis, and its experiences were reported at the next meeting. The analyses were done in mathematics lessons with GeoGebra and Excel programs in the computer. It was a good basis for introducing game theory, but the versatility of its use also serves the relationship among sciences.

Keywords: creation of models, spontaneous arrangement, educational science, decision, game theory

Introduction

Outside of nature and social sciences, we meet with appearances in many areas of life. In a given group formation, the observed objects or persons can change their behavior and state.

The change sometimes occurs due to external force, while on other occasions, it can not be observed without side synchronization. In the first step of the report, the author presents an example of the forms of ordering and mass relations in some areas, then the author present the possibilities of spontaneous rendering and the appearance of emerging organizational arrangements (Ágoston, Nagy, & Orosz, 1974). Next, it is followed by describing and analyzing an experiment in a school environment. The experiment is suitable for modeling social and school orientation.

Basic Concepts Related to Rendering—Visual Rendering of the Order

One of the basic conditions of the order description is that we can explore the medium that is considered to be the basis of organization. This medium is different in disciplines and other features, but with similar characteristics can be given.

In biology, the basis for differentiation between different animal species and the same species may differ. The order can be dominated by the maintenance, social, or a kind of traditional aspect. This external sorting can create a special order for the spontaneous group of animals that is reserved for external constraints (Boza, 2013).

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The group organized in this way will mostly stay in sync, while the external organizing force holds it together. After the external constraint ceases, the order will be overturned. The group of organization and its examination can be found in sociological research (Gazda, 2008). Sociology in this research investigates the large number of people in the group. The members of the group are in a relatively crowded space with each other in direct interaction, while the likelihood of interaction among adjacent persons is low (Csányi, 1999).

During such events, an extremely interesting phenomenon may appear, in which individuals' behavior is aligned with the others without external control. Education studies are all the student observation, the student communities, and the behavioral spontaneous groups. The research, along with individual knowledge, deals with examining the smaller groupings of students and the larger students' compartments (Néda & Káptalan, 2009). A group of students can also be considered as a group, whose team is formed without a directed external sorting principle, the behavior of such groups as a group member disorganized. While their attention is tied to by the same event, it seems and has a strong emotional charge (Néda & Káptalan, 2010).

The Emergence of the Spontaneous, and the External Organizing Principles in Educational Science

The appearance of a spontaneous arrangement in some groups can be connected to the different situations and occasions. The synchronization in this sense means, that the group works as a single object. This can be realized with external sorting effect, but also spontaneously, depending on the composition and dynamics of the group. One of the sources of synchronization phenomena in life is to be found in the willingness to cooperate. In such events, the group creates and keeps itself in sync. The realization of a spontaneous or directed sorting within each discipline can be varied. The synchronization in the field and the nature of ordering also determine the characteristics of order formation.

One of the observable phenomena in this connection is that the spontaneous arrangement has geometrical design, so that individuals can be related to their environment from several sides. If the entities in the group are in a dimension, then there will only be one array if the group consists of only a few members. This is true even in cases where the principle of organization operates under a strong external pressure. There are some one-dimensional layouts that can be found in the living environments. In these cases, the number of elements is below 10, and if a strong external arrangement is created, there is no synchronization among the elements. The basic element of teaching and education is to keep students' attention, and to develop and retain the will of thinking together, which can also be helped by forming a group structure.

Likewise, the focus of a well-focused group may be lost due to unsuitable group arrangement. If the pupils' location in a student group is appropriate, which they are unable to coordinate with each other, to work together, or to the thinking of the teacher, the group acts disorderly. In such cases, the teacher finds the cause of the decline in the efficiency of teaching in his/her own work in the curriculum or in the discipleship of the students. Instead, it may also be the reason that the spontaneous or external sorting principle does not favor a particular classroom layout lies in it. To get to know this, the author made the following experiment (The examination of social order in classroom conditions and information exchange in a Latin prison).

Some of the selected students received the following instruction: Your friend is in jail for committing robbery. They could only talk for three minutes, during this time, you need to get three information from your friend:

1. Where did he/she hide the prey?

2. What is your plan with the common dog?
3. What should be the name of the unborn child?

Another group of students will receive the following information and instructions: You got a prison sentence because of your crime, from your partner who comes to visit you in three minutes, as long as your visit time lasts, you need to know three things:

1. Where did your grandmother buried?
2. What happened with the other partner?
3. Who married your sister?

The pairs who participating in the game can start receiving this information about three meters away from each other. However, students in the same class are only one meter away from each other. Members of the group can not predict that their partner will ask questions as well. But they know they need to get all the information in three minutes.

Results

Gameplay Analysis to Determine the Maximum Gain and Decision Probability

The game theory analysis of the situation is carried out using a strategic analysis for one partner. Since all the parties involved in the interaction receive the same information, the parties are ready for the same purpose on both sides, and both the decision and the profit are characterized by symmetry. The interaction, however, is not a complete information game, since the parties do not know about each other's intentions (Tóth, 2010). Opportunities of the parties include questioning and listening. When they received the information, they both developed their own strategy. The options for acquiring the desired information, the author was evaluated on a scale of five. The biggest gains will be achieved if we get an answer to their questions. If someone answers the questions of the party involved in the interaction, the score represents less value, but it causes the satisfaction of the other party (Szabó, 2012). However, non-observant behavior and decision are not lucrative for either party.

Table 1
Decision and Payment Matrix

Opportunities		Prisoner		
		Gives time	Persevere	The maximum value for the columns
Visitor	Gives time	0	1	0
	Persevere	5	0	0
	The maximum value for the columns	5	1	

Since the game does not have a clear saddle point, the maximum number of fingerprints is not the minimum of the column maxima, the minimax theorem can not be the solution to the game (see Table 1). In such cases, it is worthwhile to take part in the game with a mixed strategy, as this will minimize our loss. This means that it is highly probable that it is advisable to switch between the two strategies. To do this, the payment matrix helps a lot. Strategic decision is also supported by another method of analysis. By writing the co-operation-silence and the weight of the desertion-attachment matrix, we get linear functions. The intersection of the straight lines gives the optimal probability of selecting the co-desert.

Based on the above payment matrix, the probability of selecting the silence co-operation was $P(C) = 0.17$. Since players have two options before the start of the game, the probability of query desertion is $P(D) = 0.83$ (see Figure 1). This means that, for example, if a couple were standing in front of each other and waiting for

100 questions, they would be listening in 17 cases, and in the other cases, they would be stubbornly asked. If we play the game with multiple partners, each pair can assign the same probability values. Because of the constant value of the payment matrix, the change in the number of elements does not change the probability of the decision.

Figure 1. Search balance: Election probability-gain.

Figure 2. The probability of choosing a co-operation by increasing the number of participants in interaction.

Figure 2 shows that the probability of selecting a co-operation, which is constant due to the number of elements. During the preliminary analysis, the author only counted the interactions among the participants directly involved in the interaction. This situation is similar to, for example, the periods preceding the classroom when the students are already in the classroom with their own decision-making strategies for different interactions. In the process, teaching different interactions are more complex. In the game, as in the

pre-teaching period, the students' individual decisions are mostly determined by random probability (Nagy & Tasnádi, 2012). The number of represented students was 32, according to the number of students participating in the game. Figure 3 below shows the status of players in the game by column. The calculations indicate that four or five pairs of 16 pairs can exchange information based on the given criteria. In every three minutes available, each student has to change strategy several times, but if there is a sound-insulated wall between the pairs, the interaction takes place according to the likelihood of gaming theory and the amount of information exchanged does not change on average. In the game and in reality, there was a tune of sounds that was just created by the participating parties.

↑ 32	↑ 76	↑ 68	↑ 83	↑ 87	↑ 27	↑ 92	↑ 52	↑ 91	↑ 33	↑ 100	↑ 59
↑ 95	↑ 81	↑ 75	↑ 83	↑ 100	↑ 90	↑ 27	↑ 92	↑ 32	↑ 72	↑ 55	↓ 14
↑ 38	↑ 29	↑ 25	↑ 29	↑ 95	↓ 7	↑ 62	↑ 62	↑ 97	↑ 24	↓ 15	↑ 89
↓ 9	↑ 71	↑ 42	↑ 69	↑ 36	↑ 38	↑ 83	↑ 51	↑ 98	↑ 23	↑ 20	↑ 90
↑ 33	↑ 91	↑ 100	↑ 22	↑ 44	↑ 79	↑ 78	↓ 12	↓ 1	↑ 29	↓ 8	↓ 3
↑ 50	↑ 89	↑ 42	↑ 56	↑ 97	↑ 66	↑ 71	↑ 42	↑ 43	↑ 77	↑ 34	↑ 51
↑ 73	↑ 55	↑ 89	↑ 51	↑ 91	↓ 18	↑ 72	↓ 11	↑ 20	↑ 68	↓ 1	↑ 70
↓ 18	↑ 47	↑ 84	↑ 61	↑ 58	↑ 56	↓ 11	↑ 66	↑ 31	↓ 3	↑ 32	↑ 59
↑ 53	↑ 94	↑ 37	↑ 98	↓ 5	↑ 31	↑ 87	↓ 1	↑ 91	↓ 13	↑ 34	↑ 41
↑ 98	↑ 74	↑ 87	↑ 32	↓ 21	↑ 94	↓ 13	↑ 19	↑ 77	↑ 49	↓ 8	↑ 65
↑ 45	↑ 55	↑ 26	↑ 100	↑ 76	↑ 86	↑ 58	↓ 8	↓ 8	↑ 52	↑ 81	↓ 13
↑ 89	↑ 33	↑ 58	↑ 27	↑ 88	↓ 15	↑ 30	↑ 23	↑ 30	↑ 93	↑ 48	↑ 23
↑ 85	↑ 57	↓ 2	↑ 56	↓ 12	↓ 9	↑ 24	↓ 7	↑ 69	↑ 84	↑ 97	↑ 83
↑ 33	↑ 39	↑ 43	↑ 100	↓ 18	↑ 22	↓ 5	↓ 10	↑ 19	↑ 54	↓ 3	↑ 84
↑ 40	↑ 97	↑ 96	↑ 82	↑ 72	↑ 50	↑ 41	↑ 20	↑ 75	↑ 37	↑ 22	↑ 50
↑ 53	↓ 9	↑ 91	↑ 61	↑ 22	↓ 13	↑ 97	↑ 52	↑ 62	↑ 93	↑ 67	↑ 39
↑ 64	↑ 37	↑ 47	↑ 39	↑ 57	↑ 85	↓ 17	↑ 91	↑ 30	↑ 88	↑ 80	↑ 32

Figure 3. Strategies chosen during the visit: ↑ (asking) and ↓ (give an answer).

Statistical Analysis and Network Description

After the first perception of the tone, each participant changed its originally designed strategy. The questioners were either questioning or silent, the cooperating students were either listened to their partner or started questioning themselves. At the end of the game, the students answered the following question:

During the game, how did you decide after you heard the sound and you realized that you were answering your question:

1. Did you give your partner time?
2. Did you insist on successfully completing your own job?
3. Are you cautious and at the same time incapacitated?

The three options came into effect after the eruptions of sound, and the group's self-assessment were transformed the opportunities and the outcome as well. Based on the answers, the author analyzed the game with descriptive statistics. The results were showed by the presence of the huge noise. The author has also completed the networking arrangements for the students who have participated in the interaction. On the basis of the absolute criterion, in the same way of action, the author grouped each participant into a new group (see Figure 4).

As a result of the mass, the tendency to attach to the information was significantly reduced from $P(D) = 0.83$ to $P(D') = 0.24$. About a quarter of the students changed their decision due to the external impact that appeared. The reason for this was that the participants were not prepared for the appearing tune, so they did not

have any information in advance. According to the players' announcement, the intent of co-operation has increased from $P(C) = 0.17$ to $P(C') = 0.24$ compared to strategic planning. Incomplete information has induced extraordinary change of strategy. For example, a person with an intent to listen, because of the noise, he/she started shouting himself/herself. This signal may be the appearance of synchronization, but the rate of change is small. Due to the disturbance situation, the following condition may have occurred (see Figure 5):

Figure 4. Show interaction in network format.

Figure 5. The behavioral intentions as a result of loud speech. → (helpless), → (asking), and → (give an answer).

Figure 6. Depicting the six random orderings in the columns.

The display of the reaction in several steps in the original layout shows the decisive presence of the number of sensations. The average of the co-ordinating and true-to-exchange speakers is approximately two pairs of interaction based on this model. The crowd's turmoil makes the efficiency co-operation worse, because the effect does not seem to have the effect of synchronization.

During the experiment, maintaining the layout given in the introduction does not result in the formation of pairs. Due to the simultaneity of the game and the lack of communication, none of the questioners or co-operators can be in the majority. The order was formed after the time elapsed (see Figure 6). At that time, when the external decision-making principle came into being, pupils gave up their own shifted strategy, and they acted obedient to the external constraint. Such a situation arises, when the ringing tone of the teaching unit starts to sound or the teacher enters the classroom. However, in order to be a mass of people who are ready to cooperate and think together, other conditions are required. Among other things, this may include a strong sorting principle—strict learning conditions. But the options include a classroom, spatially arranged classroom layout other than linear or fewer elements—that is, small staff numbers in a group (Vicsek, 2000). With the column layout and the number of elements in the experiment, the order, ie., spontaneous synchronization, can not be formed.

Conclusion

By modeling the experiment with the students, the author tried to show spontaneous or lacking order in the classroom environment. The distribution in the model reading is fully consistent with the experience. With the highly simplified model, we can get an approximate answer to what could be the maximum number of critical students, which is an overlapping and columnar classroom arrangement, spontaneously capable of creating a desert-cooperative phase transition. With the method of game theory, the importance of pupils' self-discipline has also been highlighted. Participants in the game were faced with the importance of watching each other from the absence with the adverse consequences. It is expectations of the age that school education should not give us the knowledge of the science, but the knowledge that we can use. Meeting this expectation is a great challenge for teachers. However, the students also encounter difficulties, if the task is not to learn and uplift a designated lesson. The first step in interdisciplinary applications is that students are still interested and active. However, the deepening of employability is already testing the students with the weakest skills. In their case, the experiment and the processing of the analogy of the thinking can be important. If the goal is to educate people who are complex and responsible for society and the values of nature, we look for opportunities for the relationship among sciences. An example of this is the research described above.

Recommendations

Based on the experience of the experiment, the author recommends the application in the following areas:

1. To prepare a model for social problems and situations in education;
2. When organizing the teaching and the extra-curricular activities, the model gives a conclusion to improve the quality of attention and collaboration;
3. To describe co-operation in live populations, such as ants and bees;
4. Be able to teach mathematics as a motivating task, for example, in the field of statistical and game theory;
5. It is useful to take the conclusions into choruses and teamwork by spatial arrangement;
6. In physics education, it is also a good help in the teaching of magnetic arrangements and reciprocal exchanges of energy when referring to the experience of the model;
7. With the description of a game that supports responsible social behavior, it adds the potential of educational tools.

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