Working In Contemporary Teams

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Lecture - 12

Inputs and Processes in Human-AI teams

Welcome to the third lecture in module 3. In the previous lecture, we have seen what is artificial intelligence, what are robots and how can AI or robots be integrated into the teams. We saw some common applications of AI in teams and what are the challenges these teams face. We also saw what is the level of integration that we have with AI in teams currently. Let us see what we are going to see in this lecture. The agenda for this lecture is to cover inputs and processes.

That is, what are the factors which are important for team functioning in human AI teams. To cover this, we will be using the input process output model. Now, researchers have found many factors which are important as inputs and processes. However, we will be looking only at a few factors which have been identified because they are critical for the functioning of human AI teams.

They are team design and task design and among processes, we will be looking at coordination, communication and collaboration. Before we start an in-depth look at inputs and processes, let us look at two examples where AI becomes an integrated team member. Two different industries where AI has been integrated into the teams include healthcare and space exploration. In healthcare, we can have a medical team which is devising a plan and executing a treatment plan for a patient. This medical team will consist of doctors from different specialisations, nurses, technicians and administrators from the hospital.

It will also include the patient and his family. The AI in this case is usually a virtual agent. The AI is responsible for looking through the medical history of the patient, comparing it with other patients who have had similar problems and finding out any patterns. These patterns will help raise red flags as to what the doctors have to be careful about when they are devising the treatment plan. Later, when the patient is undergoing

the treatment, the AI will monitor the parameters of the patient and again compare with other patients and will alert the doctors and the nurses to anything that is indicating an adverse reaction to the treatment.

Accordingly, the medical team has to change the treatment plan for the patient. Another example from the healthcare sector is that of a surgical team who has a robot team mate. In this case, we can have a doctor, nurses and technicians and a robot who are together performing a surgery. Another example of AI in teams is in space exploration. Consider an astronaut on a space station who along with a robot is doing routine maintenance on a machine.

The team which is doing the operation or the team which is doing the maintenance will consist of ground control team members, crew inside the space station, the astronaut who is outside the space station and the robot. In both the examples, that is in healthcare as well as space exploration, you will notice that the AI is a team member. The human team members of this team are dependent on the AI for taking the correct decisions and for this reason, we can say that the AI is an integrated team member. Having seen these two examples, let us now proceed to understand inputs and processes in human AI teams. Earlier we had discussed that inputs operate at different levels, that is the team level, the individual level and the organisation level.

The rest of the lecture is going to focus on team level factors. So before that, let us look at what are the individual and the organisation level factors which are important for team effectiveness. At the individual level, the personality and the past experiences of the team members are crucial to determine whether the AI and the human team members will be able to work together well. If the team members approach the team with a positive predisposition towards the AI, then it is very likely that they will be able to get along well. One major factor which influences this are the past experiences of the team members.

If the team members in some previous team or through some personal experience has seen that AI can contribute positively to a team task, then it is very likely that they will have a positive predisposition to the AI. On the other hand, if the team members have seen that AI is not reliable in some previous experience, then it is very likely that they will approach the AI in the current team also with some level of scepticism. Therefore, when teams are composed, organisations should be careful to look at predisposition of the team members towards working with AI. At the organisation level, factors which can input, factors which can affect team effectiveness include the training, the support and the HR policies. For example, if the organisation provides a lot of training for the team members on how to work with the AI counterparts, it is very likely that they will be able

to get along better.

Having seen the inputs at the individual level and the organisation level, let us proceed to the team level. Team design and task design are important factors because when we are in the design phase, we should programme the AI to be able to deal with any kind of changes or any kind of problems that come up either due to the team members or to the task. Let me explain. The first aspect in team design is the team composition. Two factors are important here, that is diversity and size.

Diversity refers to the ratio of human and AI components. The AI is designed to take in a certain amount of data, process that data and then give outputs to certain designated team members. In case there is a change in either the size or the ratio of human AI components, the AI team mate will find it difficult to scale. Therefore, when the team is being composed, the designers have to keep in mind whether there is a likelihood of change in either the diversity or the team size and build or programme the AI so that it is capable of dealing with this change. It is also important to keep team size in mind when we are considering the human team members.

Say a human team member is currently controlling two or more one or two AI counterparts. In case the team size increases and the number of robots which he or she has to control increases, then they will find it difficult to do so without some prior training. The next aspect of team design is the team structure. Two aspects are important here, one is the role and the other is the leadership. What is a role? A role is a group of behaviours which is important for the functioning of any social unit.

For example, take the family. For a family to function properly, someone in the family has to take the role of a caregiver, enforcer and breadwinner. In case one of these critical roles is missing from the family, it can detrimentally affect the functioning of the family. In the same way, teams also have certain roles. Bellbin, a very eminent team researcher, found that there are nine roles which are important for team functioning.

Just close your eyes for a moment and think about the last team in which you worked. Can you spot one person who was always enthusiastic in the team? This person would be constantly exploring opportunities, developing contacts and getting things done for the team. This is the person who is taking the role of the resource investigator. Can you remember a person who was holding the team together? This person would be constantly talking to the team members and identifying points of friction or conflict and lubricating the points of friction. This person would also be identifying what work is urgently required of the team and helping the other team members to get it done.

This team member is carrying out the role of the team worker. So there are nine roles like this which are important for team functioning. And in case any of these critical roles are missing, the team will find it very difficult to function properly. Now the question when it comes to our human AI teams is what are the roles which can be assigned to the AI so that it can carry out those roles properly. Research shows us that there are two roles which can be assigned to the AI counterpart which is that of a creator and that of the perfectionist.

The team member who carries out the role of a creator is responsible for gathering large amounts of data, processing that data and then giving inputs to other team members. Since AI is able to deal with large amounts of data, it makes a lot of sense to give the role of a creator to the AI. Please bear in mind that the term creator doesn't mean that the person has to be creative or inventive or innovative. It is primarily to do with the processing of information. The second role is that of a perfectionist.

A perfectionist is the one who is obsessed with the operational details. Usually the person who takes the role of a perfectionist is happy doing routine tasks repeatedly without making mistakes. Since AI does not get tired, it can be assigned the role of a perfectionist easily. So two roles have been identified which would be good to be assigned to an AI in a team. One is that of a creator and the other is that of a perfectionist.

Another way to look at roles would depend on the level of competence and autonomy of the AI. The AI can either be an executor, an assistant or a master depending on the level of autonomy and competence. If the AI is merely following orders from a human team member, the AI is taking the role of an executor. In case the AI is working along with the team member, as in for example in our space exploration, if the AI, the robot and the human team member are together repairing a machine, then the AI has the role of an assistant. However, if the AI has the task of giving instructions to the team member, then the AI is taking the role of a master.

Another important aspect which comes in team structure is leadership. We have to keep in mind that a leader of a team is one who does whatever is necessary for the team to complete its tasks. Therefore, this person is constantly on the lookout for what is happening in the team, constantly on the lookout for seeing if there are any problems or conflicts which are arising either among the team members or with the task and then giving solutions. So when we think about whether the AI is capable of carrying out a role like this, we have to make sure that it should be able to gather such kind of information, process it and make the right kind of decisions.

Now let us look at team task. Team task refers to activities which the team has to carry out when they are doing their work. Now the team can be engaged in different kinds of team tasks. Either they should be responsible for generating plans, choosing or making decisions as to which is the best plan to follow and then executing the plan which has been chosen. Take the example of our medical team which is coming up with a treatment plan for a patient. Not only do they have to devise a treatment plan based on the patient's medical history, but they also have to execute it and monitor the patient's response to the treatment.

The degree of innovation involved here is quite high because they have to keep in mind the medical histories of each individual patient and they also have to monitor the patient's response to the treatment and make changes to the plan depending on the way the patient responds to the treatment. The next aspect of team task is the complexity and structure of the task. Complexity can vary from low to high. If we consider the treatment plan which the medical team is coming up with, the level of complexity is quite high because we have to take into consideration medical history, current parameters and then devise the plan and then we have to listen to the nurses, to the technicians and to the patient to be able to execute the plan properly. Therefore the level of complexity in this situation is quite high.

Structure refers to the extent to which tasks can be defined and is predictable. In the case of our medical team, the task which the team is doing is actually not that structured because the predictability is low. Now why are we concerned about complexity and structure of the task when we are talking about team design? The main factor which comes into play here is the brittleness of AI. That is, AI is capable of doing things well if it has been pre-programmed to do so. In case there are any changes in the tasks and in case there are any changes in the plan, then the AI will not be able to scale up to be able to deliver what is expected.

The next important aspect of team task is interdependence. Interdependence is said to be high when the level of dependence among team members is high and when they have to take decisions taking into consideration the feedback of other people. If you look at our medical team, the level of interdependence is very high because say for example, the doctors are dependent on the nurses, the technicians and the patients to see if the patients are responding positively to the treatment. The nurses are dependent on the doctors to make sure that they administer the drugs properly and all the team members are dependent on the AI to scan through the medical history of the patient and also the current parameters of the patient and raise any red flags as to what the doctors and the nurses need to be careful about when they are taking care of the patient. Therefore, when you have dynamic working conditions, we will have to program the AI beforehand so

that it is capable of dealing with any kinds of changes.

We also have to train the human team members suitably so that they know what are the limitations of their AI counterparts and do not expect anything beyond what the AI was programmed for. Now, let us look at team processes. Next, we are going to look at team processes. There are many team processes. However, we are going to look at three team processes, coordination, communication and collaboration.

They are highlighted because they are very different from the way they happen in human-human teams. The first process that we are going to look at is coordination. Coordination is the process of bringing together and integrating the actions of team members so that they can work towards common goals. Two factors which affect coordination are the complexity and the scale of work and the level of interdependence. When complexity and scale of work increases and when the level of interdependence increases, the team members have to coordinate among each other to ensure that their energies converge at the team goal.

Now, the types of coordination become very important in AI-human teams. Let us see why. There are two different types of coordination, explicit coordination and implicit coordination. Explicit coordination is usually expressed in some verbal format and uses different processes that will help team members manage their interdependencies. Planning, adjusting the plan through different kinds of communication is a form of explicit coordination.

It relies heavily on written or oral communication such as mails, process maps and shared documents. Now, it is possible to program the AI so that the team members can communicate with each other either by written or oral command. But when we come to the next form of coordination, we will have some roadblocks. The second kind of coordination is implicit coordination. It refers to the ability of team members to act together by predicting the needs of either the task or the team member without the need for active communication.

Think about the time when you and your team members were carrying out some tasks together. Team members would have been constantly looking at each other and assessing how the other people are in carrying out the work. If you had sensed that any of the other team members were struggling with their work or they needed your help, you would have stepped in to help them. If you felt that the other team member is not having some information or may require some information from your end for carrying out the other person's work, you would have provided it before it was requested of you. So, these are some examples for implicit coordination.

It relies on the ability of the team member to observe the task and the team member and the other team members and then predict what kind of help or information or resources they would need and provide that without the other team members asking. Now, is it possible for the AI to be cognizant of this? Well, we try to program AI, taking into consideration how human-human interactions happen and we are trying to build interfaces so that the AI is also capable of providing help before the other team members ask for it. Let us look at how we can improve explicit coordination in human AI teams. By defining roles and by defining policies, we can improve explicit coordination in human AI teams. When we talk about defining roles, each team member in the human AI team should be aware of what their roles are and what is expected of them from the other team members.

Take, for example, a team which consists of robots, human rescue workers and a technician which is approaching a building on fire. The technician will be controlling the robot and the robot and the rescue workers are going to enter the building together. What should be the level of coordination between all these three roles and how should they be sharing information so that the team members are all safe and are able to carry out their work properly? At any point in time, can there be a role reversal? That is, can the technician, for example, be in a position so as to give instructions to the lead rescue workers? Can the robot be in a position to give instructions to the lead rescue workers? Under what circumstances can there be a role reversal? So, these are some of the questions which have to be examined and pre-programmed before the team actually goes to the building on fire. Another way in which we can improve explicit coordination is by defining the policies. What are the permitted tasks and what are the expected tasks from the different team members? If you look at the AI who is a part of the medical team which is coming out and executing a medical treatment plan for the patient, what would be expected from the AI? So, if the AI actually detects that there is a red flag in one of the parameters of the patient, should the AI immediately alert the nurse and the doctor or does it have any kind of autonomy in changing the medical treatment plan itself? So, this is where permitted tasks and expected tasks come.

If the AI has been programmed to alert the doctors, then the doctors and the nurses should be immediately alerted when a red flag in the patient parameters is detected. However, it should not be given the permission to change the medical plan unless the doctors prescribe so. So, these are some of the policies which have to be defined when the AI is being programmed. Another way in which we can improve explicit coordination in human AI teams is by defining the sequences and the contribution of the different team members to the team task.

Team task can either be sequential or simultaneous. And the contribution of team members to the task can be complementary or replacing one another. Say for example, we are thinking about the team which has gone into the building to search and rescue survivors. The role of the AI, the role of the robot might be to enter a room, might be to enter the different rooms of the building which is on fire and scout for survivors. And then if they detect any survivors, relay that information back to the human rescue workers. This is when you have a sequential task and where the robot is replacing the human team member in the search function.

However, if the survivor is in a very critical position and there might be any damage to the structure, then a robot may not be a feasible person to go and do the search even. The humans may have to replace the robots to do the search, identify the survivors and help them out of the building. So we have to understand what sequence the tasks have to be carried out and what is the contribution of each team member to the team task. When it comes to implicit coordination, we rely heavily on duplicating how human-human interactions happen in human-AI teams. We are trying to program AI so that it can anticipate future needs of tasks and team members by constantly surveilling the environment and also by looking at the sequence of tasks which need to be carried out to finish a work.

The main thing here is that we should be able to adjust our actions based on the predictions. Say for example, the task has to be carried out in a sequential order. If it is a human-human team, you would expect your human counterpart to be looking at how much of the work has been done and then waiting for you to complete the work so that the next task can be initiated. We will have to program the AI so that it can also scan the environment, look at the task and the team members and then we program to wait instead of probably badgering the human team members for the next task to begin. Another important aspect when it comes to implicit coordination is team coordination i.

e. the knowledge of the task and the knowledge of the other team members which is important for carrying out team task. We will be seeing this when we examine team dynamics in the next lecture. The next team process that we will be looking at is communication. Close your eyes and remember the last team meeting you attended. A wealth of information would have been passed among the team members in non-verbal communication.

A shake of the head, a nod of the head would have conveyed agreement or disagreement to some statements. The tone of the voice would have indicated whether the people were happy or not happy with what was being discussed. So communication refers to the exchange of information both verbally and non-verbally between two or more team

members. Now things will happen a little differently in human-AI teams primarily because it is not possible to program AI to interpret non-verbal information like humans do. Communication in human-AI teams takes into consideration two important aspects.

 First is the relevance, representation and sharing of content and the second is the verbal and the non-verbal communication. Team members are expected to collect and assess information which is important and relevant for the team task which is being done. Once they have processed the information they are supposed to share it in a format which is easy to understand with other team members. Say for example, two team members enter a building which is burning. When one team member communicates with the other saying that hey watch out there is a threat or look out there is some problem in front of you, he is conveying that information in a format which is easily understood and acted upon by the other team member.

 When you have robots as a team mate then the team, then the AI has to be explicitly programmed to convey this kind of information with the other team member as the reference point. That is what I mean when I say sharing the information in formats which are useful to other team members. If you go back to the medical team where the AI who is a virtual agent has understood that there is some kind of an anomaly in the patient's response to a treatment then it should not be just spitting out analytics and reports but it should immediately pinpoint to the doctors and the nurses what kind of reactions they should be looking out for. And this should be specific so that both the doctors and the nurses can immediately understand what the AI is communicating. Another important aspect which comes into communication is unidirectional and bidirectional way of communication.

 Bidirectional communication is more important when the situation is dynamic and when the other team member has to take action based upon what is being conveyed. It makes more sense for the communication to be bidirectional if the person who is listening to you can clarify what he or she has heard by asking new questions back. Another important aspect of communication is verbal and non-verbal communication. One very simple example is back channeling.

  Back channeling happens when two people are involved in a conversation. One person is talking and the other person is listening. The person who is listening does back channeling when he or she indicates that he is actively listening by doing different kinds of verbal reactions. The person who is talking will feel that the listener is more involved in the communication if there is back channeling happening. If we can program the AI to mimic aspects of back channeling then the human team member who is involved in the communication with the robot or with the AI are more likely to feel that the AI is an

active component in the communication. Improving communication in human AI teams can happen through interface design where we build interfaces which are easy to use and understand.

 Think about the robot who is going to be a team member in the rescue mission. This robot should be able to process the information and convey it in a manner that is easy to understand to the team members. If the team members are going to get confused listening to the instructions coming from the robot, it's not only just going to increase the workload for those human team members but it could also jeopardize the safety of the entire team. Same thing happens when we have the AI in our medical team or when we have the AI in our aerospace programs.

 The interface should be easy to use, easy to access and easy to understand. We are often comparing human AI communication with human communication and most importantly when it comes to informal communication. We try to mimic the standards of human human communication in our human AI communication. The last process that we are going to see in human AI teams is collaboration. A team is said to be collaborative when a group of agents share a common belief and work towards common goals. Something very simple and fundamental here will be an agreement on the team's and the individual's goals.

 Consider our rescue workers along with the robot entering a building on fire. Are these robots and the humans having the same priority? Well, for the humans the priority might be to enter the building, survey it, identify rescuers and extract the rescuers with minimum harm to all the parties concerned. But for the robot, the top priority might be to identify the rescuer and move identify the survivor and move to the survivor as soon as possible.   So we have to make sure that the goals of the individuals, humans and the AI are in alignment. We will also expect the AI and the human team members to have varying expertise and use these varying expertise to share tasks, resources and responsibility for the work. It's also very important for collaborative teams for team members to encourage each other and work towards solving problems.

 Think about the last time you worked in a team and your team came against a major challenge. If the team members do not support each other and encourage each other when they come up against challenges, it will be very difficult for the team to function and meet the challenges properly. When we talk about collaboration in human AI teams, we have to design the AI and instruct the human team members on different aspects. For example, autonomy. What should be the level of autonomy of the different team members? Is the AI in a position to be able to take decisions and implement it without asking the human team members? What kind of information exchange should happen

between the team members? The information should be relevant to the task that is being carried out and it should be shared with the other team members in a format that is easy for them to implement immediately.

Tasks have to be allocated to the AI and human team members, taking into consideration the expertise of the team members. Another important aspect which comes in collaboration in human AI teams is safety. Considering that the AI has access to a lot of information, most of that live information, it is very important that it be secured against any unwitting leak to people who are not supposed to be having access to that information. The last factor which comes here is the workload which falls upon team members when one of the team members is an AI. Say for example, when there is information which is being exchanged among team members, if the information is not relevant to the task or if it is exchanged in a format that is not easy for the other team members to understand, this can drastically increase the workload of the human team members and it can severely disrupt the functioning of the team.

Therefore, factors like autonomy, information exchange, task allocation and safety have to be kept in mind when we are designing teams where humans have to collaborate with their AI counterparts. How can we improve collaboration in human AI teams? Research from different institutes show that collaboration in human-human teams improves when there is training in skills which are required for collaboration. That is, if team members are taught how to collaborate, it can really help them collaborate when they actually start working together. This is because most of us have the intention to collaborate when we enter teams, but often we do not know where to start and this can therefore hamper collaboration. Another way in which we can improve collaboration is by giving people a lot of opportunity to work along with the AI.

That also increases the extent of informal bonding between the team members. Finally, we need to build in different kinds of tools which will help the team members interface with each other. That is, they should be in a position to actively collaborate and co-create when they work together. To summarize, in this lecture, we have looked at team design and task design and we have looked at three important processes, coordination, communication and collaboration. As usual, I leave you with some interesting topics that you may want to look up. There has been a lot of research in how teams should be composed when designing human AI teams.

However, there is very little research which looks at how teams should be structured. That is, what should be the roles which should be assigned to AI, what should be the way in which leadership is defined in the team and so on. Another important topic which comes in human AI teams is nonverbal communication. We often look at mimicking

how human-human interactions happen and carry out the same in human-human AI teams as well. This can go a long way in improving team worker satisfaction and team viability in the long term. With these interesting topics, I leave you. Till we see again, bye.