COMMUNICATION

The workshop topic is the basics of radio communications. During the class, participants will learn about the Morse alphabet and how it can be transmitted using various mobile apps and communication methods. Participants will use it to send and read messages and passwords they have composed, while learning about the history of the invention of the radiotelegraph and its use in the 19th and 20th centuries, as well as its use in the armed forces.

Duration: 90 minutes

Age group: 14 to 18 years.

Objectives:
1) **General goals:**
   a) to learn about The Cipher Game and its wider historical context - the communication technologies present during the Polish-Bolshevik War,
   b) to learn the Morse alphabet.
2) **Specific goals:**
   a) to develop creativity,
   b) to develop analytical and critical thinking,
   c) to stimulate interest in cryptography and radio communication,
   d) to learn about the history how the radiotelegraph was constructed and used.

Materials needed:

For participants: smartphones or tablets with The Cipher Game and Morse code apps installed, Morse code support printouts, Wi-Fi connection, A4 paper and pens for groups use (and notes, if needed).

The Cipher Game https://play.google.com/store/search?q=gra%20szyfr%C3%B3w&c=apps&hl=pl&gl=US
MorseLight: https://play.google.com/store/apps/details?id=com.ranjan.malav.morselight_flashlightwithmorsecode&hl=pl&gl=US
Morse Chat: https://play.google.com/store/apps/details?id=digital.dong.morsechat&hl=pl&gl=US

Trainer preparation:

Before class, go through the process of installing and using Morse code communication applications yourself, and familiarise yourself with the tasks and

missions in The Cipher Game.

The workshop can be delivered as a single class or in a series of three workshops around The Cipher Game. Depending on the guiding method, you can choose the slogans sent to each other by the participants in the class. The phrases proposed in the following scenario will introduce participants to the history of telegraphic communication and lead to follow-up workshops. You can also create your own phrases related to the topic of your lessons or representing the most important topics that you want to integrate, e.g. before a test.

STAGES

Duration	Exercise description	Materials needed / comments
10 min.	**Introduction:** Welcome the participants, introduce yourself and tell them what today's workshop is about: *Today you will learn about an important figure in Polish history. We find ourselves in a very specific place, a specific time and in a very specific historical context. I say 'find' because you will experience the story in an interactive way - using a VR/mobile game in which you take on the role of our hero. I will therefore not tell you about it. Your task is to experience it for yourself. The beginning of the workshop will therefore be devoted to completing in-game tasks. Then we'll break away from it for a while to return to the workshop room and look at one important feature of both this game and the whole amazing story that you'll learn today. What is this feature? What is the story? Well, you will find out soon enough!* Ask about the group's experience with VR - has anyone played or watched anything in virtual reality before? Ask about experience with computer and mobile games. Establish the rules of the workshop with the participants: *- we focus on creation, creativity and not criticising others* *- we don't worry about technical issues and errors - sometimes they just happen* 😊	The Cipher Game https://play.google.com/store/search?q=gra%20szyfr%C3%B3w&c=apps&hl=pl&gl=US Note: <u>Depending on the group's experience with programming/ VR/ Games, choose the subsequent exercises and the working method.</u>

	- the "3+10" rule: *When I ask for 3 minutes for me, I want your full attention and focus. If you don't listen then (when I'm explaining VR support, coding, or a given task), then for the next 10 minutes of your work you just won't know what to do.* - the "pause" rule: *Sometimes in the course of the work we will need to move on to the next task or the next stage of the workshop. I know it's hard to move away from the work/VR/game at the time, but we have to do it to know the next task and the next element of the workshop. On the word 'Pause' we will therefore stop whatever we are doing at the moment and put the smartphones/VR aside to listen to the next sentence/part of the workshop.*	
20 min.	**Gaming experience** Explain that in a moment some people will be able to experience the game in virtual reality, each person in the group will perform one task from The Cipher Game. Choose how to familiarise yourself with the game, taking into account the number of workshop participants and the equipment at your disposal. Then, explain the basic controls in the game and launch the first mission. Emphasise that participants should get as far as the second door (which contains a second character listening for enemy transmissions) opens. Pause the game there. Also ask the participants to pay particular attention to the equipment and communication technologies present in the game. Tasks in the first mission: - Find and activate the torch. Test the option to switch the torch on and off (visual cues are then activated highlighting the items to be used) - Find the board and start the engine ("Dragon") - Control the voltage on the board (test the optimum position and show it to the group, then override and make the jams fall out) - Go to the other room and find the key to the door - Replace the plug in one antenna and switch it on - Replace the plug in the second antenna and switch it on - Switch on the power supply to the apparatus in the correct order - Determine the optimum voltage without burning out the equipment	Match the implementation of this step to the equipment at your disposal: - If you have one set of goggles and a relatively small group, you can demonstrate VR gaming by dividing the mission into small tasks and swapping participants frequently. Everyone then plays in one group. Try to connect the goggles to the screen (so that the whole group can see what is happening in the game). - If you have a larger number of goggles, get participants into groups and ask them to take turns and swap goggles. - If you don't have VR goggles, divide participants into groups/ pairs and ask them to turn on the game on their smartphones or computers.

	Then, retell the context and history together: - Who is the main character in the game? - Where does the action take place? - In what year? Or years? - In the middle of what important historical event are we? - What were its causes? - What educational technologies were present in the game? What method of communication was used in the first mission and what is the purpose of device standing on the table in the second room?	
20 min.	**Task 1 - Establishing communication** Explain that the communication system we see in the game is the radiotelegraph. In the mission, we therefore switch on the power to the radio apparatus and the antennas that send radio signals in a very specific sign system. Emphasise that military communications at the time were based on a very specific system for sending signals. This communication system consisted of several breakthroughs and inventions, which we will explore together in this workshop: The first is the idea of the <u>telegraph</u>, which we will explore by starting with the optical telegraph, which is the method and manner of sending optical (visual) signs. Get participants into smaller teams of 3-4 people and then into larger groups ('platoons') of two teams each. Explain that the first task of the participants is to establish an optical communication system in their platoon, i.e. between two teams (subgroups), and to send and read specific messages using it. Emphasise that the system is intended to be simple and quick, and that participants will not be given any supplementary materials or prompts <u>(they can use the handset and "google" the different sign systems, but they cannot use the communication on the phone)</u>. Their aim is to quickly come up with or learn a sign system, practise it and prepare to send and receive messages (each team is to send, receive and read a message). <u>Give participants 10 minutes to prepare for transmission.</u> <u>Do not suggest any solution or method to participants. Give them time to come up with or explore and test their system themselves.</u> **Signal sending**	Note: try to encourage groups to share responsibilities and activate all participants. For example, if time permits in each task two people from the group can try to send the same message, (repeating the message to be sure), the senders and readers can also change between tasks. Extra information for the trainer:https://medium.com/@mzywial/%C5%BCelazne-ramiona-w-centrum-warszawy-b2585983effd https://wynalazki.andrej.edu.pl/wynalazki/36-t/610-telegraf-op

Ask everyone to be absolutely silent (we cannot shout messages to each other). Position the teams at opposite ends of the room or corridor (left and right) and give each platoon two messages to send (one for each team):

Teams on the left: SOS, Teams on the right: Mayday

Give the teams on the left two minutes to 'send a message'. Afterwards, ask the teams on the right what message they have received. Then, give the teams on the right two minutes to transmit their messages. Afterwards, ask the teams on the right what message they have received.

Ask how many platoons managed to successfully transmit and read their messages and what type of communication did they use?

Appreciate the ideas and creativity of the participants. Pay particular attention to ideas characterised by simplicity, intuitiveness, speed and a clear (hard to misunderstand) sign system. Appreciate the group's use of familiar and standardised sign systems (gesture systems, flags or the Morse alphabet).

Emphasise that what we are trying to create, i.e. the idea of the optical telegraph, was already used in the Roman Empire. Focal points or other sources of strong light were often used to send visual signals. They were used to notify of threats or the outcome of a battle. Systems such as Chappe's Telegraph, which used the proper alignment of two beams in relation to each other to create a system of characters with associated letters, were also developed. Optical telegraphs became a system of communication used throughout Europe, including Poland. It was home to the Warsaw-Modlin-Saint Petersburg line, which was manned by 1,904 people on 149 towers and covered as many as 1,200 kilometres.

Emphasise, too, that sending signals by light, gestures or flags has been and continues to be used in the army and can be used in emergency situations (e.g. in the mountains, where we can see other people from a great distance but are unable to communicate with them).

Emphasise that optical telegraphs were in operation in the 19th century, but slowly began to be supplanted by electric telegraphs. The enables the transmission of electrical impulses via cables over long distances. However, both the emerging electric telegraph and light-based communication required

	a standardised, simple sign system - enabling easy and fast communication. It was the context of the telegraph technology that led to the development of the Morse Alphabet.	
15 min.	**Task 2 - Communication development** <u>Congratulate participants on completing the first task.</u> Emphasise that we have established communication and will now look at ways to improve it. So we will be sending and receiving messages again, but using Morse Alphabet. Ask participants to: - download the MorseLight application for visual communication (using a torch) - familiarise themselves with the Morse code signalling instructions (in particular the duration of signals and pauses). Demonstrate how to use the app (in particular the use of the torch button by holding it down). Emphasise that, as in the previous exercise, the team's task is to: - transmit and read the SOS/Mayday message (by "typing" it yourself, without using a ready-made algorithm in the application). - send and read the message assigned by the trainer. Give the platoons 5 minutes to practise transmitting (one team to the other) and then 5 minutes to do the actual transmission. As in the previous exercise, ask the platoons to split into teams, line up on opposite sides of the room/corridor and exchange and read the signals. After five minutes spent practising, allocate SOS/Mayday messages to the teams and give each group a	https://play.google.com/store/apps/details?id=com.ranjan.malav.morselight_flashlightwithmorsecode&hl=pl&gl=US

	prepared card with a word to be transmitted (e.g. Encryption, Division, Propaganda, Key, Enigma, etc.). Then ask each group what word they picked up? Recognise the groups that have successfully completed the task and encourage those groups that have failed to send or read the message to continue. Emphasise that Morse communication that used light sources was used in the army, e.g. on ships. A torch or light can be seen from a great distance, so this is another way to send an SOS message in a potential emergency. Emphasise that the international emergency signal (SOS) has its origin precisely in Morse code - it is a simple and easily distinguishable message that we can transmit by the simplest means in an emergency.	
15 min.	**Task 3 - Radiotelegraphers** <u>Congratulate participants on completing the second task.</u> Emphasise that we have improved our communication - we already have a simple code mapping the alphabet and enabling communication. We move on to the third and final mode of communication and task. Explain that with the development of communication technology, the real revolution turned out to be the invention of the electric telegraph - sending signals by electrical impulses and using just the Morse alphabet. To send signals using the Morse alphabet, the so-called 'key' was used which was a simple electrical device as seen in the game (on the table in the other room): *The key was connected to power and ground cables. Pressing the key brought the metal plates into contact and closed the electrical circuit, generating an electrical impulse. By using the key, it was possible to operate an electrical pulse of different lengths and time intervals between specific signals (an ideal device for use with Morse code). Such an impulse was sent via telegraph cables, which began to spread across all of Europe and beyond in the 19th century. The most famous such cable was the transatlantic telegraph cable connecting Europe with the United States and allowing telegrams to be sent across the ocean. The laying of this cable and the establishment of communications was a major event in 1858, although it took*	https://play.google.com/store/apps/details?id=digital.dong.morsechat&hl=pl&gl=US

| | *more than 17 hours to send the first message via this cable. When telegraph communication was changing the whole world (development of media, banking, international communication, etc.), another invention was linked to the telegram. It was radio and the airwaves.*

Emphasise that in this task, the group's aim is to send a Morse code message in audio form and using radio waves.

Ask participants to:
- download the Morse Chat application for audio communication using the Morse alphabet

Demonstrate how to use the application (in particular creation of aliases, private conversations, and message transmission)

Emphasise that, as in the previous exercise, the team's task is to:

- transmit and read the SOS/Mayday message (by "typing" it yourself, without using a ready-made algorithm in the application).
- send and read the message assigned by the trainer.

Give the platoons 5 minutes to practise transmitting (one team to the other) and then 5 minutes to do the actual transmission. As in the previous exercise, ask the platoons to split into teams, line up on opposite sides of the room/corridor and exchange and read the signals.

After five minutes spent practising, allocate SOS/Mayday messages to the teams and give each group a prepared card with a word to be transmitted (e.g. Encryption, Division, Propaganda, Key, Enigma, etc.).

Then ask each group what word they picked up? Recognise the groups that have successfully completed the task and encourage subsequent self-work in the case of those groups that have failed to send or read the message.

Emphasise *that the Morse alphabet was the ideal sign system at the beginning of the development of radio communication, as it was based on signal (of different lengths) and no signal (breaks). This was important because, at the beginning of the development of radio, no one had yet been able to transmit voice over it.* | |

	The earliest prototypes of radio (created by, among others, Marconi) therefore mainly used Morse code and the generation of radio waves (without "superimposing" voice on them). This alone, however, was enough for radiotelegraphs to start coming into use, first on ships. Marconi, who for many years was regarded as the creator of radio (the first radio creator being Nikola Tesla) wisely assumed that one of the largest navies in the world, the British Royal Navy, for example, might be interested in the new invention. Radiotelegraphs then appeared on both military and civilian ships (a radiotelegraph of Marconi's design found its way aboard the Titanic, among others, where it saved the lives of hundreds of passengers by transmitting a rescue signal to other ships). From ships and the navy, the radiotelegraph was later distributed to other branches of the armed forces and to the radio station in the Warsaw citadel, where the action of the game takes place. Emphasise that, although we did not use the traditional key and radio waves normally used for this type of communication, we operated with a button and used slightly different radio waves (allowing for Internet reception on our phone) to send the message. This was the job of radio operators, even during wartime, to transmit and receive messages of strategic importance.	
10 min.	**Summary** Congratulate all the groups and ask if the groups now have a better understanding of the work of radio operators during the Polish-Bolshevik War? Also ask if any group has managed (intentionally or accidentally) to bug on someone else's message (e.g. by going on the same channel/seeing what another group is transmitting)? Explain that radio communication has a way of being intercepted - if we send something in the form of radio waves, after all, not only our addressee can receive it. Ask what then should we do with our message so that only the recipient is able to read it? Listen to the answer and point out that such a message must be encrypted, i.e. it must be deliberately distorted using a specific method and then restored to its original state only by the person who knows the method. Emphasise that this is what the work of The Cipher Game main character was also about.	

| | While receiving coded messages, he was simultaneously looking for a way to decode them, i.e. to discover the method by which they had been distorted.

What's more, Jan Kowalewski did it in a way that is reminiscent of your work today - because analytical thinking, creativity and looking for patterns and repetition were key.

Emphasise that those participants who want to find out how Kowalewski did it are invited to come to workshop no. 2 or to complete The Cipher Game.

Summarise the workshop, thank all participants and teachers, and invite them to the next workshop as well as to learn more about other IPN educational materials. | |