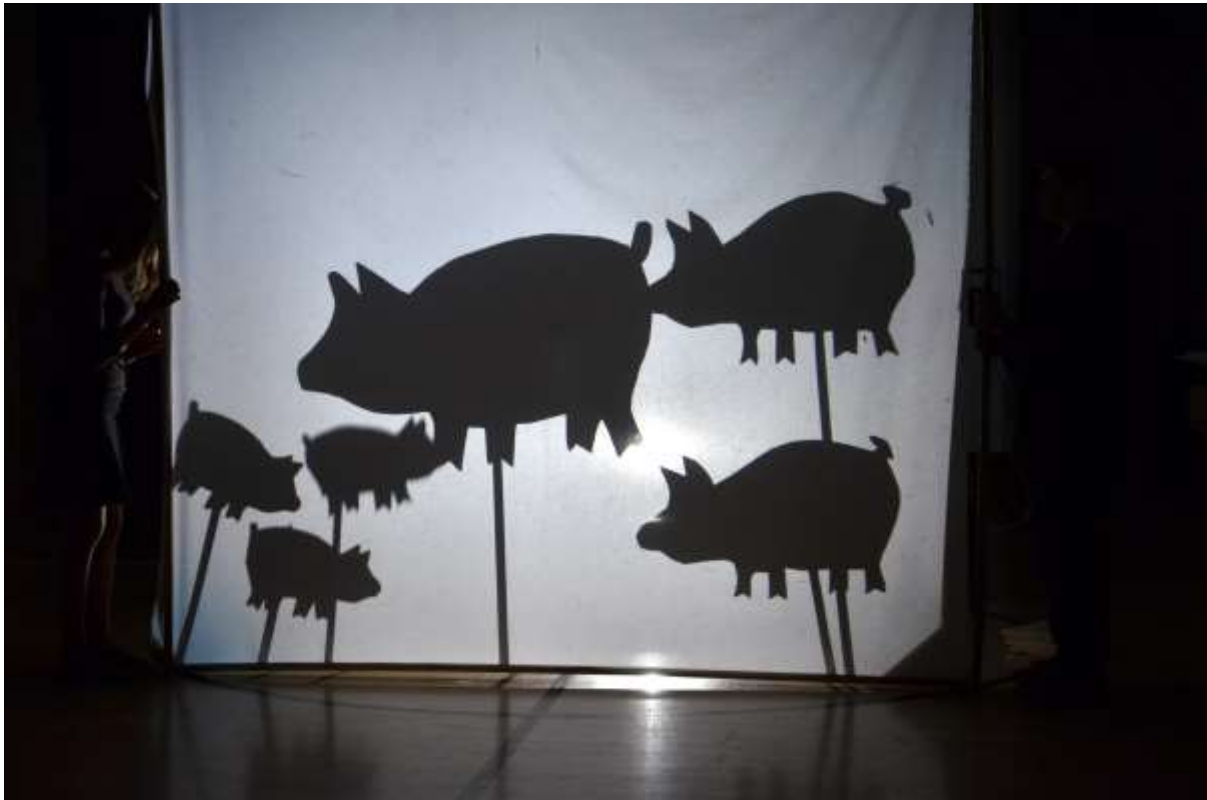


The Pig “Number Six”, or the Physics of Shadow Theater
*Research project and theater performance written, directed and produced by
the Sydan-Laukaa School’s KIKS-team from Finland*



STEAM projects can be implemented not only with the purpose of science learning, but also to create art with the help of science. Sydan-Laukaa School’s KIKS-team from Finland has written, directed and produced a theater performance, in which the physics of light has also got a special role...

1 Project Summary

The Pig “Number Six” theater play is written, directed and realized by the KIKS-team of Laukaa School. A whole class of 7th graders were participating in the KIKS-team and they all were involved in the creation of the play. To explore visual illusions and the physics of shadow theater, KIKS-team made a scientific research concerning the development of visual effects, which they have implemented in the play. University of Jyväskylä physics education PhD-student, **Antti Lehtinen** has helped the group’s scientific research. **Kristóf Fenyvesi**, University of Jyväskylä’s KIKS-coordinator has inspired the KIKS-team from cultural and artistic aspects. Theater director Kirsi Sulonen from Laukaa was also helping with making the play ready. The team’s teacher, Mirka Havinga has facilitated the whole project.

To inspire other “kids” in their school, Sydan-Laukaa KIKS-team has also written an article in Finnish to explain the physics of shadow theater by introducing very interesting examples, such as the physics of producing colorful shadows.

Antti Lehtinen's video on physics of light and shadows: <https://youtu.be/Lw83oKUzxW4>

Video on colorful shadows: <https://www.youtube.com/watch?v=eKj1EwJ7THU>

PhET simulation on color: https://phet.colorado.edu/sims/html/color-vision/latest/color-vision_fi.html



The play was performed in the Christmas celebration of the Sydan-Laukaa school on 21.12.2016. The play got very enthusiastic feedback from the other students, teachers and parents. This film is made in the last dress rehearsal the day before the celebration.

2 Content of the Play



Father Christmas ("Joulupukki" in Finnish) is coming back home to his village, Korvatunturi from one of his busy journeys before Christmas. On the way, he meets with his caretaker, who is responsible for all the buildings and animals in Korvatunturi.



The caretaker tries again to ask for higher payment, but Father Christmas is too busy to listen. When Father Christmas arrives at home, he checks everything with his telescope. He sees that his elves are helping him to pack the billions of gifts to all children of the world.



Then he turns his telescope towards his piggery and dreaming about of eating "The Pig Number Six", as his favorite traditional Finnish Christmas-ham for Christmas dinner.

The caretaker is frustrated, because she has too much snow-work and other things to do in Korvatunturi. She also has a big family of her own, 16 children, and they don't have money to buy food. She is also dreaming about the big swine, the Pig Number Six in Father Christmas piggery. While Father Christmas is sleeping, she steals the swine.



Father Christmas hears something, wakes up and checks with his telescope if everything is in order. He finds out that his biggest swine is missing. He calls the police. Policemen come to arrest the Caretaker and put her in a prison.





When Father Christmas sees with his telescope that the Caretaker is in prison, he changes his mind. He finds it is not right that the poor Caretaker is in the prison and her big family cannot have Christmas. He goes and gets the Caretaker out of prison and gives her job back.



He asks if the Caretaker would like to join Father Christmas on the Christmas dinner. He also asks if she would like to have a pay rise. Father Christmas and Caretaker think together that this will be a best Christmas ever and they start a party.





3 Physics of the Shadow Theater Research Report, created by the Research Team of the Sydän-Laukaa KIKS group

Report in English

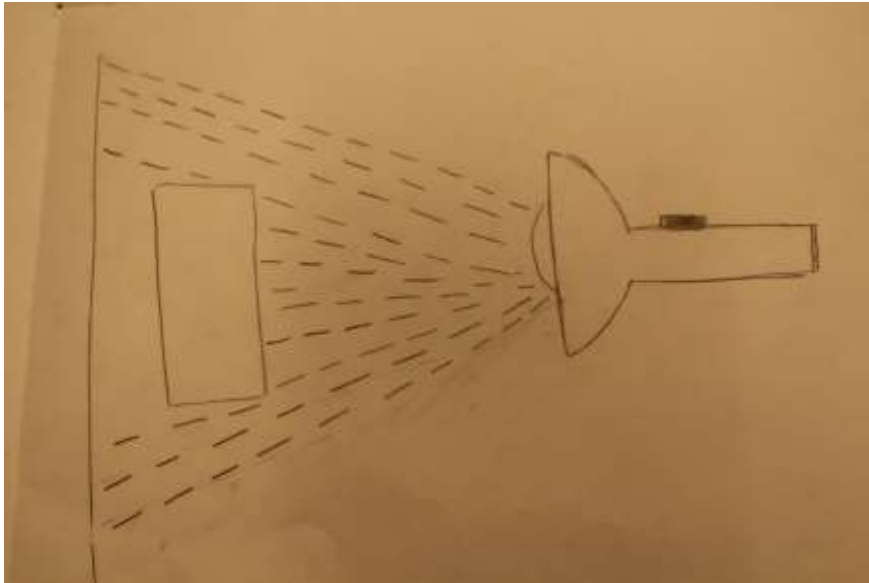
SCIENCE AND ART IN THE CHRISTMAS THEATRE

The class 7B in Sydän-Laukaa school is doing a theatre show to the Christmas party of the school. Shadow theatre is a big part of the theatre show. The show uses a big wall to which shadows are projected. The wall has wooden frames and a white sheet. Overhead projector together with big green, red and blue lights is used too.

One reason to use shadow theatre is that, if the audience does not see the actor, it makes acting easier.

How shadows are made?

A shadow is formed behind an object which does not pass light.



A figure of making a shadow

What affects the size of a shadow?

The closer the object is to the light source, the bigger the shadow is. The farther the object is, the smaller the shadow is.

The show used different sizes of shadows, for example, in the scene where the elves were painting dolls and when the police puts the janitor to jail.



Testing how different sizes of shadows are done.

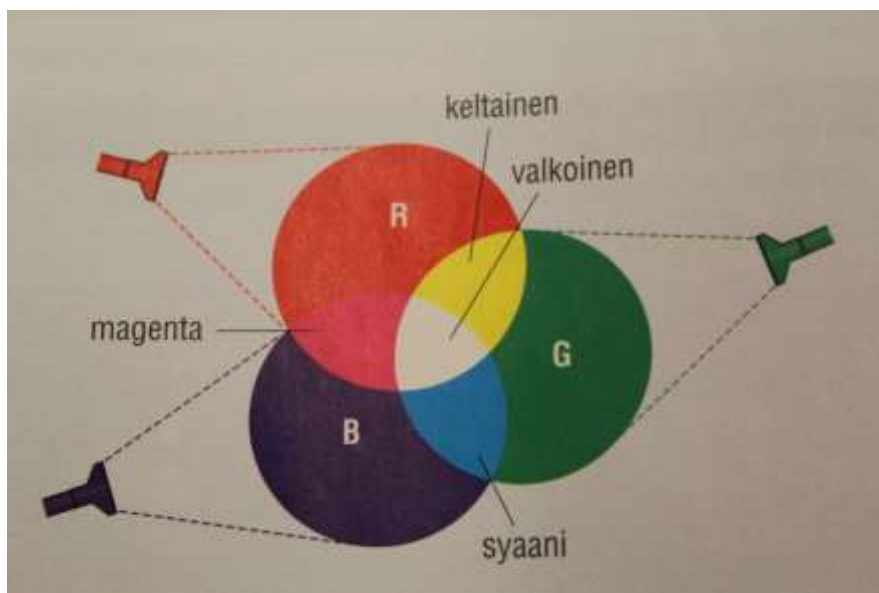
The colour of the shadow

First we used the overhead projector. The light is white and the shadows black. Then we tested different colours of light and looked for the colours of the shadows. The coloured light gives coloured shadows.



Testing coloured shadows.

In the final scene of the theatre coloured lights and shadows were used. When the light comes from three different directions, it looks like there are many people behind the wall, although there really is only one.



Combining different main colours produces shadows in different colours.

Made by: Ella Jäntti, Taru Heinänen and Amanda Hovilainen 7B

Report in Finnish

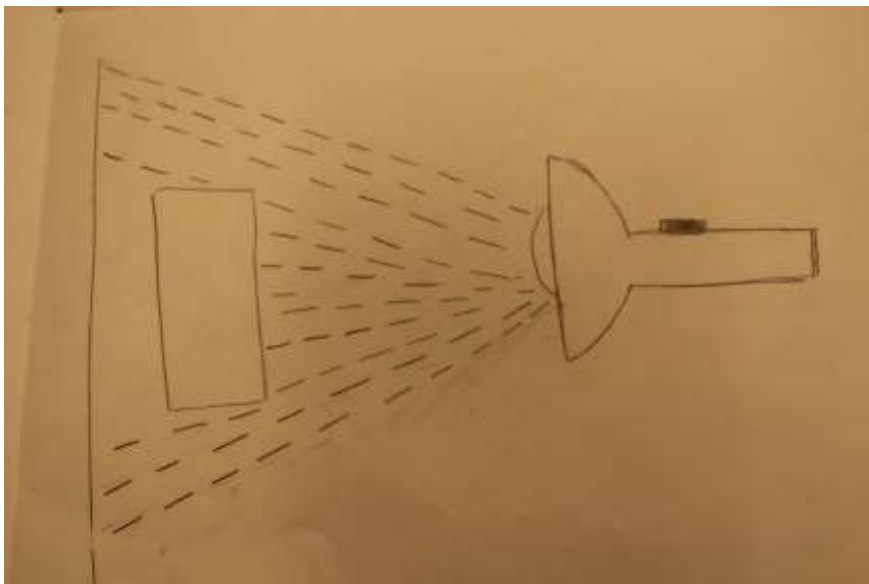
TIEDETTÄ JA TAIDETTA JOULUNÄYTELMÄSSÄ

Sydän-Laukaan koulun luokka 7B tekee joulujuhlaan näytelmän, jossa varjoteatteri on suurena osana. Esityksessä käytetään suurta sermiä, johon varjot heijastetaan. Sermissä on puiset reunat, joiden keskellä on valkoinen lakana. Siinä käytetään myös piirtoheitintä ja isoja värivaloja: vihreää, punaista ja sinistä.

Yksi syy varjoteatterin käyttämiseen näytelmässä on se, että esiintyjän on helpompi näytellä, jos katsojat eivät näe esiintyjää suoraan esiintymistilanteessa.

Miten varjo muodostuu?

Varjo muodostuu valoa läpäisemättömän esineen taakse, johon valo ei pääse.



Kuva varjon muodostumisesta.

Mikä vaikuttaa varjon kokoon?

Mitä lähempänä kappale on valonlähdeä, sitä suurempi varjo on, ja mitä kauempana se on, sitä pienempi varjo on.

Varjon kokoeroja on hyödynnetty esityksessä esim. kohtauksessa, missä tontut maalaavat nukkeja sekä silloin, kun poliisit heittävät talonmiehen vankilaan.



Harjoituksissa testattiin, miten erikokoisia varjoja syntyy.

Varjon väri

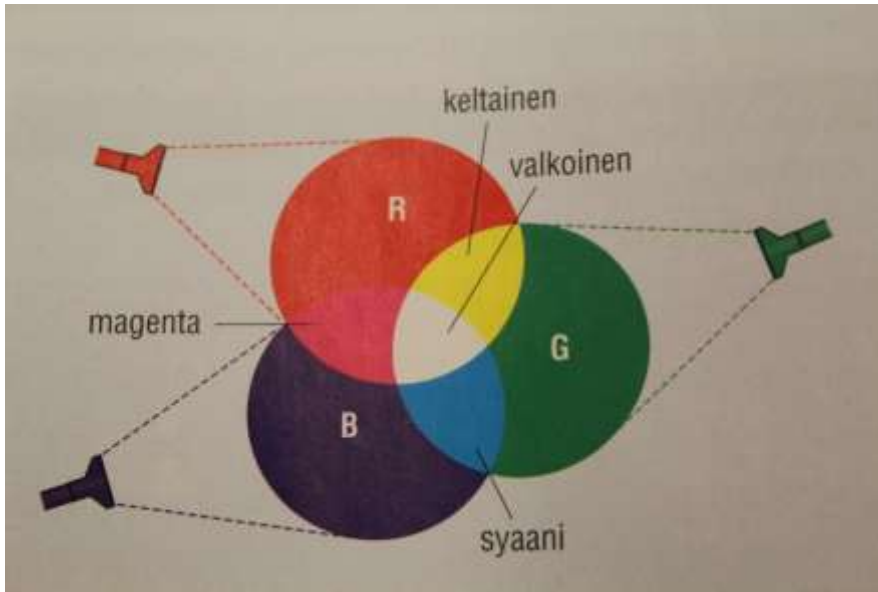
Ensiksi käytettiin piirtoheitintä. Piirtoheittimen valo on valkoinen ja varjot mustia. Sitten testattiin värillisiä valoja ja katsottiin

millaisia varjoja syntyy. Värillisistä valoista syntyy värillisiä varjoja.



Värillisten varjojen testausta.

Esityksen loppukohtauksessa käytettiin värillisiä valoja ja varjoja. Kun kolmesta erisuunnasta tulee valo, näyttää siltä, että sermin takana on paljon ihmisiä, vaikka todellisuudessa on vain yksi.



Päävärejä yhdistelemällä saadaan aikaan valkoista valoa ja erivärisiä varjoja.

Tekijät: Ella Jäntti, Taru Heinänen ja Amanda Hovilainen 7B

Press about the project:

<https://sydari.laukaa.fi/?p=184>