By: John Simone, Kunal Pinto
      and Amanda Cipolla
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Physics in Cartoons

The cartoon that was analyzed by our group was the Disney movie The Emperor's New Groove. This movie is very entertaining and comical, however when a closer look is taken at the use (or lack thereof) of Physics Laws, many errors can be found. The following are four examples of situations in The Emperors New Groove where the laws of physics were over looked and ignored in the creation of the scene.

#1 (19:05-19:48)

After Emperor Kusko is turned into a lama, he is put into a cloth bag and thrown into a stream. The bag travels with the current until it falls over a waterfall. Since the bag is cloth and would therefore, absorb and fill with water, the lama and the bag should sink instead of flowing with the current. This is due to the force of gravity on the body of the lama. Because the body of Kusko is more dense than the water, the body would not float, as is shown in the film, but would rather sink. Had the bag been waterproof and filled with much air, the lama and bag would float and follow the current of the stream.

#2 (34:02)

When Kusko first realizes that he has been transformed into a lama, he goes to a nearby pond to see his reflection. He stands roughly a foot in front of the pond and looks in to see his reflection is no longer that of a human. Since the water is acting as a plane mirror, $<i = <r$, with reference to the normal (perpendicular to the surface. In this case vertical.) Because of this law, the above is impossible. If the lama were looking at the water at a certain angle, the image could only be seen by somebody at that same angle on the other side of the normal. For the lama to see his own image, he would have to look straight down at the water so that he is looking along the normal. The following would be true $<i = <r; 0 = 0$.

#3 (28:34)

In this scene, Kusko finds himself in the middle of a group of sleeping panthers. An upset chipmunk (who is several feet away from Kusko) blows up a balloon and pops it hoping to wake up the panthers that will then eat Kusko. When the chipmunk pops the balloon, it creates so much of a draft that it almost blows the lama away. This is inaccurate because the air that would be expelled from the balloon is only as much air that was contained in the balloon to begin with. The pressure in the balloon is higher than the pressure outside the balloon. Since air follows the concentration gradient, (high to low pressure) when a hole is put in the balloon, the high-pressure air inside follows the gradient and rushes out of the tiny hole. The membrane of the balloon is not strong enough to support the exiting air pressure and so, the balloon pops. When it pops, the volume of air that was still remaining in the balloon disperses. In the situation that occurs in the movie, the volume and pressure of the balloon are not great enough to cause such a large draft of air. Had the balloon been larger in volume and had the membrane of the balloon been thicker to allow a higher pressure inside, then a large draft would have been possible. The humor of the scene lies with the sound of the popping balloon that wakes the panthers; therefore with out the gust of air from the balloon, the scene would still be comical.

#4 (34:02)

There is one point in the movie where the lama and Pancho are spending the night in the forest. It is a very cold night, yet the lama sits in front of a cave wall, away from the fire. This causes the shadow of the lama to fall against the wall. The movie shows a stable shadow; no movement or change in size. Since a fire flickers (it waves, grows, shrinks, shifts, etc.), the shadow, too, should move. This is because when the fire moves, the rays of light that it emits hit the wall and the lama at different angles. The absence of light on the wall (those areas where the rays could not reach the wall because they were stopped by the lama) is the shadow. Thus, because the rays of light are constantly coming from different angles, and therefore are hitting the wall and lama at different angles, the shadow should move.