Using Rodin and BMotionStudio for Public Engagement

Dana Dghaym, Asieh Salehi and Colin Snook
University of Southampton, Southampton, United Kingdom

As part of its public engagement activities the University of Southampton's Faculty of Physical Science and Engineering holds an annual 'Science Day' when the campus is open to the public and researchers demonstrate aspects of science related to their research. Many aspects of science are demonstrated and the event is very popular and well attended. For Science Day 2016 we used Rodin and Event-B to demonstrate how mathematics can help to analyse problems. The Science Day is primarily targeted at children up to year 11 but many older siblings also attend and we also wish to engage with parents. The day is advertised within local schools and naturally appeals to teachers. The event is therefore a good opportunity to initiate on-going engagement with children via their schools. Therefore, the demonstration must be designed to appeal to, and be accessible to, people of many ages and mathematical abilities from young children through to professional scientists and mathematicians. We used BMotion Studio to provide two simultaneous visualisations. The first visualisation was a cartoon style representation of the real-world problem designed to appeal to young children and not requiring any mathematical abstraction skills. The other visualisation was a simple Venn diagram representation of the sets and counters involved in the mathematical model which older children and adults could easily follow. For the younger children we would point out the mathematical representation to make them aware of it but not attempt to explain it unless they were interested. For those that appeared to be particularly adept and interested in the underlying mathematical system we gave a brief overview of the Event-B model and verification by proof.

We designed a simple safety related problem based on parking two cars in two parking bays with an unprotected crossing and bays protected by signal. The children were given a scenario for a particular car to park in a bay and asked to select from a list of conditions that needed to be satisfied for that scenario to be safe. They were then asked to configure an Event-B context to reflect their selected conditions using a purpose built editor. The configuration used boolean constants to enable guards in the corresponding machine. If the correct guards were selected the scenario could be performed safely. That is, any attempt to crash the two cars by moving them to the same location would be prevented by the model. If important conditions were not selected cars could be crashed and if superfluous guards were enabled the scenario could, in some cases, not be completed. We gave a toy car to any child that completed the exercise.

The exercise was very popular throughout the day and at times children queued to try their selections. In all, two hundred children performed the exercise. Several teachers commented on how useful they thought the exercise was for the children. Parents enthusiastically encouraged their children and chatted to us about the underlying research.

It was interesting to note that children often interpreted the problem in different ways to us. For example selecting that the unused parking bay should have a red light. Their reasoning was that the car might otherwise enter the wrong bay. While recognising that we had not completely specified the

requirements (in terms of behaviour of cars), we pointed out that, according to our intended requirements, they had designed a safe system but not a very useful one. Another interesting interpretation was that, in the case where several scenarios were attempted, the previous scenario may result in a bay being already occupied, so some children automatically changed the scenario and set the lights to send the car to the other parking bay. We had not intended the scenarios to be interpreted sequentially.

The children seemed to take the exercise too seriously, perhaps seeing it as a test and believing that they would not get a prize car if they allowed the cars to crash. For example in some cases they were reluctant to test their selection by trying to crash the cars. Possibly we should avoid associating success with the system being safe and emphasize exploration and understanding of the problem.

In conclusion the demonstration was a huge success at engaging public interaction with Event-B modelling and we hope to build on this in future by developing other model-based problems and interacting with local schools.

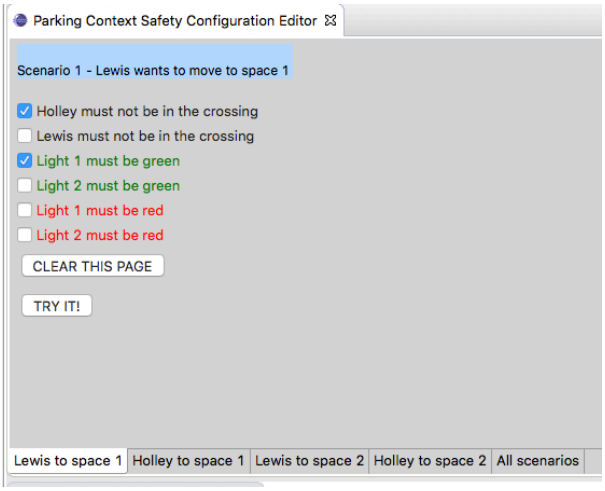

Figure 1 - Purpose built context editor for entering selections

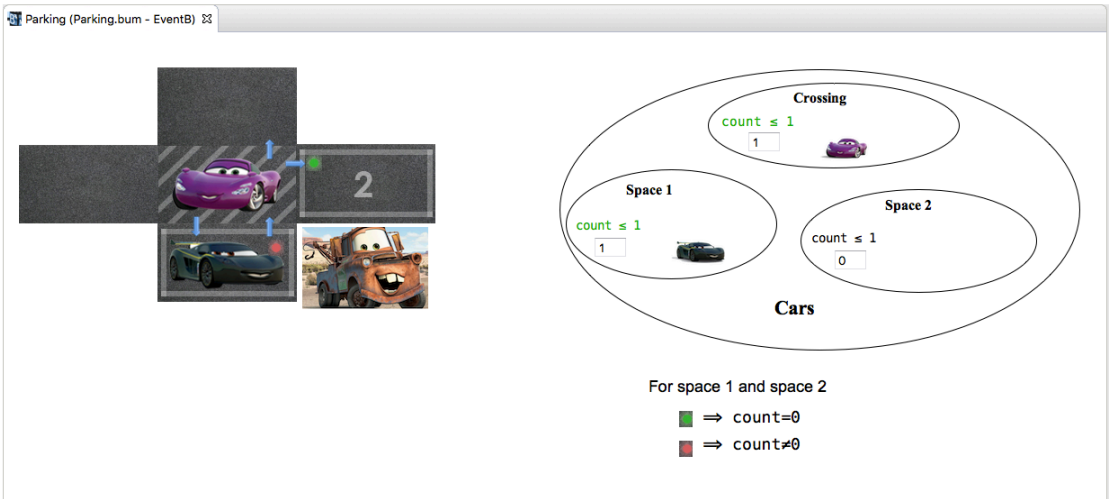

Figure 2 - BMotion Studio visualisations
(cars are moved by clicking the blue arrows)