WEB-EM-07 Abstracts and Feedback

1. **Name:**

   Submission ID: 49319001

   Provisional Title: A guide to choosing appropriate sorting algorithms

   Abstract: This paper is inspired by a previous model demonstrating the heap-sort algorithm in Eden. There are a number of other common sorting algorithms in computer science. Each has its own advantages and disadvantages, and the most efficient can only be chosen when certain parameters of its application are known.These parameters include available space, the state of the data to be sorted, and the size of data. In addition to this, some methods have advantages and disadvantages when it comes to data manipulation, like insertion and deletion. The aim of the model is to demonstrate to a user how changing these parameters in a given situation would change the choice for the most efficient algorithm. One of the results of this is that the model could be used as a guide to selecting an algorithm given a particular situation. My proposal is to implement 3 sorting algorithms, so as to be able to make more than one comparison.

   Model description: I will use Eden instead of Cadence instead of my model. The purpose of the model is to visually display different sorting algorithms at work in parallel on the same set of data. There will be some interactive parameters which change the conditions of the data to be sorted. There will be an individual scout window for each algorithm to display the sorting animation. There will be another window which will display information about the algorithm that is currently selected, as well as data generated from the runs.

   References:

   - Previous submissions including the heapsort model that we have been shown in lectures.

   Weighting: Paper - 60 / Model - 40 (Paper not exceed 6 pages)

   Comments: See my general discussion of category D models. I'm not entirely clear to what extent you intend to implement sorting algorithms in EDEN in a way that illustrates the distinction between sorting methods effectively. For this purpose, you need relatively large data sets, and you of course cannot implement sorting of such sets in the way that the heapsortBeynon model works. (The advantages of heapsort over bubblesort aren't apparent with small data sets.) You may find the WEB-EDEN bubblesort examples developed in connection with EM paper #107 helpful.

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2. **Name:**

   Submission ID: 49295850

   Provisional Title: An Analysis of the dependencies that determine player positioning in the sport of Badminton.

   Abstract: The sport of Badminton is one of the most tactical and physically demanding competitive sports in the world today. In both Level Doubles and Mixed Doubles, the success or failure of an elite pair of players is based, without a doubt, on the positioning of the players on the court. In this work, we will analyse the complex variables that determine the ideal positioning of players with relation to each other so that they may most efficiently cover the court as a pairing. The

dependencies that will be analysed will include, for any given player on court: the flight characteristics of a badminton shuttlecock, including its three dimensional directions and speed; the current and intended position of ones partner, the current and likely intended positions of ones opponents, and the most likely next shot played within the rally. We will also consider the changes in thinking regarding doubles positioning that has occurred over recent years as the game has become more popular, and high paced due to technology advances. This analysis will be broken down from the point of view of a coaches idea of 'perfect' positioning and shot selection, and will include visual representation in the form of a graphical model to represent these ideas and show the results of experimentation on numerous variables. These additional variables may include shot speed, player/opponent aggressiveness, movement capabilities and more. The visual representation is intended not only as a platform for experimentation, but as a learning aid for coaches to help players who are learning the principles of good doubles positioning and shot selection. The work will go on finally to discuss why Empirical Modelling principles allow for an excellent environment in which people learning to play a tactically sound game of badminton can experiment and reason out exactly why the dependencies developed and discussed lead to the perfect doubles positioning. This will lead on to a discussion of how the model can be further developed in order to take into account some of the other important ideas that are yet to be modelled, including decision making before shot production and developing an environment in which players can make their own tactical choices and see the consequences.

Model description: The model that will accompany the paper will aim to demonstrate all the working dependencies discussed within the paper. The model will include a graphical representation of the playing area of a badminton court, a reasonable approximation of the flight characteristics of a shuttle in three dimensions – line, length and height, as well as the shuttle speed, and will also include the positions of the players on the court. The model is intended to be "run" so that players who are using this tool as a learning aid, can actually see the ways that they should be moving on court, including an idea of which part of the court each player is "covering" i.e. which areas of the court where, should the shuttlecock be hit from the opposing team, would result in that particular player moving to play the shot. This is to be almost "hard coded" to a certain extent, with little intended scope for experimentation. The model will "play out" as a continuous rally between modelled pairs of players. The model will also include a variety of interactive features, including shuttle speed, some influence over shot selection by way of a measure of "player aggression" – the likelihood that they will choose an aggressive shot – and selection of more advanced court coverage that are more prevalent now in professional doubles, than would be seen at a lower "club standard" of doubles that represents the way the game was played and taught professionally in previous years. For the purposes of learning, the court area represented in the model will display useful guidelines for players who are looking to understand exactly what is important about the doubles positioning, including numerical indications of distance from the outer boundaries of the playing area, the relative position to ones partner, and other variables that are important for the dependency based analysis discussed in the model.

References:

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Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: See category E feedback for general discussion. This is a well-conceived model, but very ambitious in scope for the time available. You will need to build up the model stage by stage, not trying to take on the whole agenda initially, and seeing how far you get. Bear in mind that modelling even one small feature of a badminton game (such as intercepting a shuttlecock in flight) could be a modelling study in itself!

3. **Name:**

Submission ID: 49291639

Provisional Title: Modelling Nitrogen within a sub sea diver's body tissues for diver safety and training

Abstract: This paper will describe two great scuba diving risks in great detail and include many examples. It will study existing models for these problems, including the algorithms of recreational dive computers (typically wrist mounted computers, with a simplistic user interface and hidden & closed model) and how these, and dive tables compare with a new EM based model. The problems described are due to human body's absorbing ('on-gassing') & releasing ('off-gassing') of nitrogen during compression during descent, and decompression during ascent. There are two issues with nitrogen when diving. The first effects deep divers. Too high a partial pressure (percentage of particular gas in overall mix, at particular pressure), and the body behaves unusually. This is known as Nitrogen narcosis. It is recoverable, but is dangerous at depth as it impacts on judgement, concentration and coordination. The second issue is with ascent. During ascent, the diver has a higher nitrogen partial pressure within their body, than the gas in which they are breathing. The body off-gases nitrogen due to the pressure differences. Too high a difference, and the rate in which nitrogen is leaving the tissues is too great, and bubbles form within the body. Bubbles can appear anywhere, and restrict blood flow, resulting in serious safety problems - decompression illness (DCI) - i.e. the bends. The body has many types of tissue. These can be categorised as 'fast' tissue, such as the brain, to 'slow' tissues such as bone marrow. 'Fast' tissues absorb and release gasses faster than 'slow' tissues at the same gradient factor. This complicates the model since problems can occur in any tissue. Staying at depths for longer increases the partial pressure in all tissues. High partial pressures within 'slower' tissues is of concern as the diver has to spend longer during their ascent to 'offgas' the nitrogen. Ascent is usually slowed by means of 'safety stops' - a pause in ascent for a period of time.

Model description: Modelling this behaviour in EM makes sense to me, since it is an iterative problem, involving many dependent equations. I'd be interested to know if it has been done before. The model will model multiple types of tissue. I will study the number other models The model will monitor the partial pressure in each type of tissue over depth & time. The user will be able to create a dive profile (depth over time graph) within the model. I see this being done using a simple user interface of three directional arrows. Up & down for depth, and forwards to proceed in time. At each interval in time (a press of the forward arrow), the user will be given an estimate of the time they can remain at their current depth, to be able to return to the surface without DCI, and without making any safety stops. Additionally, during the 'dive', the user will experience an estimation of the partial pressures in each of their tissues, and the likely effects of these. A diver may wish to plan their dive using a model, to know the time they can maintain a particular depth for. This is for a reason of safety within the physical dive. Trained sensible divers will not exceed these limits, and should therefore be able to experience the wonderful real world sub sea environment - with much-reduced risks of DCI. A diver in (initial beginner diving) education may wish to use the model to understand the cause of nitrogen narcosis & the bends. This is a critical component of all diver training, and would be better educated with an interactive, graphical model. If the above proves simplistic, further work could be done to estimate air consumption, with benefit to both types of users. The former could use to predict the length of time they can stay at depth given a certain cylinder (size & pressure), or the volume of air a particular dive profile requires. The latter could benefit from infinite examples of how depth effects air consumption. Because the equations within the model will be recursive, I am of the understanding Cadence must be used for this model.

References:

- http://www.oceanwreckdivers.com/images/decompression_theory.pdf
  http://www.thedivingblog.com/decompression-theory/
- http://www.rebreatherworld.com/general-and-new-to-rebreather-articles/5037-gradient-factors-for-dummies.html

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: My general comments on categories F and G are probably the most relevant here. Your case study sounds promising, if potentially ambitious. I'm assuming that your model is based on simple approximations to the real biological processes involved, and that the "dependent equations" to which you refer are the ones that motivate the use of Cadence. If you address this case study with Cadence alone, you will have a lot of work to do to supply visual and interface elements that have yet to be developed - whatever you can do in this respect will be valuable, but it may be a good idea to use Cadence-with-EDEN in order to save time.

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4. **Name:**

   Submission ID: 49290724

   Provisional Title: Solar System Model based on Newton's laws of motion

   Abstract: The development of models using tools like tkeden or cadence, helps to represents direct relation between objects which the observer conceptualize from the world and support the development of relations that diverge from the scenario that initially was defined. In a Solar System model the interactions amongst the planets and Sun are founded in gravitational relations, however the orbit usually is represented based on the geometric behaviour established in the kepler's laws, where the relation are often defined between de Sun and the planets and in a second level between planets and its moons. Even though this types of modelling helps to scale up the model, for example later is easy to define the relation between the solar system and the galaxy, it do not allow to play with the established model and play with other scenarios. The focus of the paper will be then compare who this kind of models behave in scenarios like tkeden and if the time scope is enough will compare it with other frameworks like Microsoft F# and cadence.

   Model description: Kepler's laws were formulated based on the astronomical observations and as a result three laws that define the planetary movement. Isaac Newton based on the relation deducted by Kepler, discovered that this relations was founded in the gravitational forces and established that mainly this relations can be represented in just one formulation. The model proposed, will use Newton's laws of motion to generate a construal that represents the planetary movement amongst the sun the planets and also considering the moon. Furthermore could be also considered other existing objects like comets and scenarios what if where the observer might apply changes in the characteristics of the objects to review how the model behaves in different conditions.

   References:

   - 005 - Definitive principles for interactive graphics
   - 047 - Empirical Modelling for Educational Technology
   - 107 - Constructivist Computer Science Education Reconstructed
   - 087 - Rethinking Programming

   Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: This is a classic example of a category C model. Implementing such a model is non-trivial (you should start small with a 2-body system!) and you can gain credit for pioneering work with Cadence on this theme. It's a good idea here to consider how to add value to your model e.g. by considering a range of experimental interventions you can make and/or by carrying out some comparative studies such as you mention. You may find it useful to consult the authors of submissions 11 and 43.

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5. **Name:**

   Submission ID: 49289044

   Provisional Title: Packet Switching Computer Networks : An educational perspective

   Abstract: This paper discusses the use of Empirical Modelling to demonstrate the flow of packets in a packet switching computer network. Computer networks mainly consist of two types of networking techniques: circuit switching and packet switching. This model will be based on simpler version of Packet Switching networks. This model will demonstrate the flexibility, resource sharing, robustness and responsiveness of a packet switching network so that it can be used as an educational tool for students who are studying computer networks. The students can change various observables and see the effect of it in the model. The aim of this project is to model a computer network based on packet switching technique and develop a working model in CADENCE.

   Model description: The model will consist of a client machine, some routers and a target machine. The observables for the client machine will be packet size. The observables for router will be Maximum Transmission Unit (MTU) and a variable to keep track of the fact that whether the router is up and running or down. The packets will be reassembled in the last node (router) and sent to the target machine. Since this will be a very simplified model therefore there will be a very simple version of handshake and all the packets will follow the same path, i.e. the packets would not travel in different paths to reach the target machine. Before sending the packets the client machine calculates the shortest path to the target machine using Dijkstra's Algorithm. Therefore weights will be assigned between the routers depicting whether they are near or far. The Dijkstra's algorithm calculates the shortest path using these weights. The client machine also calculates the MTU of the path by sending a large packet size and then a router sends back a message if the packet size exceeds the MTU of the router, then the client adjusts the packet size depending upon the router's MTU. Now the client machine sends the packet with adjusted size, if the size exceeds the MTU of any other router on the way then the client machine again re-adjusts the packet size. This process goes on until the MTU of the path is calculated. The client machine then divides the data into datagrams of the size equal to MTU. This model will show the flow of the packets in an animated fashion, therefore CADENCE will be the most appropriate model development tool to develop this model.

   References:

   - Grid Computing - an empirical perspective (WEB-EM 1)
   - Neural Networks and Notations (WEB-EM 2)

   Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: See my general comments on category G modelling studies. Whilst it's a good idea to use Cadence in this application, you do need to be aware that visualisation and interfaces are not yet

developed in the forms that are most appropriate for your needs. You'd get credit for tackling this, but it might be too great a distraction from what is already quite an ambitious modelling objective. You give some details of what your model will do and the algorithms you will use to implement it, but you shold bear in mind that observables, dependencies and agency are the most appropriate focus for an EM account, and identifying these should be your primary concern in model-building.

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6. **Name:**

   Submission ID: 49282525

   Provisional Title: Mexican gulf oil spill prototype

   Abstract: I would like to create the prototype of the Mexican gulf oil well, and try to explain what was the reason for this disaster which caused tonnes of cruel oil leak to the ocean. Obviously, preventing oil leakage is currenty one of the main problems in oil industry. As an example we can take the Mexican gulf, inspite of being huge and poverful company, BP was not able to preclude this spill quick. It took very long lime and huge amount of money to mend the well and this leakage caused a wide range of problems, both for company and for the surrounding environment. It shows that, companies are not quite equipped, and they are not ready for preventing such clusters. Of course i am not going to create all these scenario in delails. (i would like i can't) But what i want to do is, to explain key points of spill problem. This module will help us to understand clearly what happened to oil well. It turns out to be more explainable case rather than soluble.

   Model description: The model will illustrate the basic constuction if the oil well and show what was the reason for leakage. There will be several dependencies showing the drain depending on mouse movement. I think i will do this by using EDEN and Cadance togather, to show the leakage as an animation. There will be the "Damage" button, which after being clicked will indicate the drain root. Also there will be "Reset" button which will reset the module's work. Probably, i will try to represent also a possible solution by blocking the well with concrete. In this case there will be also a button which will launch the concrete drain to the well.

   References:

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   Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: My comments on categories F and H are probably most relevant to this study. You may find the discussion of Interactive Situation Models particularly topical when considering how you would model the oil well structure that is central to your study. You should find useful precedents for making EM models of artefacts in the archive (e.g. digital watch models) and in previous WEB-EM submissions. It may also be useful to look at railway accident scenarios that have been a prominent theme in previous versions of CS405 - they may give you helpful ideas about how to analyse your particular scenario in terms of agents, observables and dependencies. (Giving an LSD account of the roles of agents within the oil well scenario would be an interesting exercise.) You need to look carefully at your use of English, and work on polishing your text so as to avoid grammatical errors, and to establish a good focus for your paper.

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7. **Name:**

Submission ID: 49282471

Provisional Title: Maze game

Abstract: The aim of this game is discover the correct way to get out under condition, which are: 1- In limited time. 2- Do not touch the walls (then you will have to start over at the beginning. This game will design by using Eden method.

Model description: My theme will be Software Development.

References:

- 1- Empirical Modelling as an unconventional approach to software development by Meurig Beynon.
- 2- Rethinking Programming by Meurig Beynon.

Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: My comments on model categories A and E are probably most relevant. This is a good scenario to work with, but you will need to develop your ideas very considerably in order to make a really good submission. There's a danger that you focus too much initially on an intended functionality rather than thinking about modelling the environment in which maze traversal occurs in terms of observables, dependencies and agency. Notice that by focusing on concerns 1 and 2 you are actually putting an emphasis on richer modes of observation (e.g. how near am I too a wall? how fast am I moving through the maze?) than you need to initially. In the first place, I would concentrate on the more basic combinatorial features of maze traversal. If you can get access to it, it may be of interest to find out more about the first year CS modelling exercise in the introductory Java programming module, as this is based around maze traversal, and has involved the development of interesting educational resources related to your proposal.

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8. **Name:**

Submission ID: 49281677

Provisional Title: Flight Schedule

Abstract: The data structure and algorithm is an important part in computer science as well as constructing computer applications. The computer scientists use different data structure to store their collected sample and apply algorithms to process these samples. In many cases, the computer scientists employ various algorithms to build a new algorithm. The efficiency of an application is hugely relying on the arrangement of the data structures and the design of the algorithm. The data structure is a particular way to organise data in an application or in a system. On other side, the algorithms are the way to manipulate the data. By study number of data structures and algorithms, this empirical modelling project is about building a flight scheduling, which allows user to find the shortest to their preference destination, based on an algorithm and data structure model. The users can use the model to get a flight to the select destination at quickest time. The model will able to show to the user the alternative route, if their selected one is not available. The graphical features are also applied to the model, so that user can visualise their journey. The focus of the application is to provide user a simple friendly graphical interface. The model will be built by employ number of tools that has been taught through out the course. The application from this project is a demonstration of the data organisation using the empirical modelling (EM). The implementation of

the model is an experience of applying the empirical modelling to construct the algorithm to process data. The project helps to obtain valuable skill, which is building an application using different empirical modelling tools such as Scout, Eden or Donald. Most importantly, this empirical modelling project will show the distinction between Empirical modelling and the traditional programming.

Model description: The flight schedule will be built using the combination of Scout, Donal and Eden language. The model includes a main widow contains a world map with number of buttons. The world map occupied most of the window and the destinations on the map are represented by the squares or circle figures. The buttons are allowed user to start finding route, reset the model or close the model. The user selects the destination by clicking on the figures on the map and the user is only select three places on the map. The first clicked figure is where the user starts, the second clicked point is where user wants to interchange, and the last clicked point is the final destination. The selected points are turned into different colour from other points, the use can deselect the location by click on the point again. Once the user hit the button to find route, the model will perform to find the shortest route according to the user requirements. The retrieved flight information is displayed in table format on the side of the map as the result of the model performance. The information table holds the details such as the journey duration, shortest route and other possible route. The reset button enable user to start new route finding, while the exit button cancels all process and close the application.The model use the data are held by a database, which stores all the information about the locations, to process the request from user. In the model, the Dijkstra's Algorithm might be employed to work out the shortest path to the destination. The Dijkstra’s Algorithm is an efficient and well-known algorithm for shortest path finding, it is also used to compute the spanning tree for the graph. The implementation of the Dijkstra's Algorithm will be the core of the project to satisfy the requirement of the scenario.

References:

- Discrete Mathematics and Its Applications - Kenneth Rosen (Author) - ISBN 0073229725
- http://www-b2.is.tokushima-u.ac.jp/~ikeda/suuri/dijkstra/Dijkstra.shtml

Weighting: Paper - 30 / Model - 70 (Paper not exceed 7 pages)

Comments: Both categories D and H might be applicable to this modelling study. It seems from what you write as if you have in mind using EM to frame data structures and algorithms particularly well-suited to handling the flight scheduling problem. I am somewhat concerned that your emphasis is inappropriate for EM - in your abstract, you mentioning conventional programming concerns (getting to a destination in the quickest time, having a user-friendly interface) and proceed to spell out the functionality of your model in the spirit of a conventional application. Remember that the primary focus for EM is on the observables, depencdencies and agents (ODA) relevant to your application - it is not an easy matter to talk about efficicency, user-friendly interfaces, the most appropriate data structures and algorithms etc from an EM perspective since these are meaningless without reference to a precoceived functional goal. Though EM can be applied when you want to explore the potential for different implementations, this can only be done effectively on top of an EM model that addresses the more basic "ODA" issues (cf. heapsort).

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9. **Name:**

Submission ID: 49278178

Provisional Title: A Model of Snake Using Empirical Modeling

Abstract: This paper will be exploring Empirical Modeling in the context of a snake program. Snake is a classic game first releases during the 1970s. In the game the user plays the role of a snake whose task is to eat food, grow longer and avoid hitting its own tail or the wall. The aim of the game is to eat as much food as possible which will then be converted to a score. The primary aim of this project is to "explore" the snake's world using Empirical Modeling. There are many construals which need to be made by the user, such things as the location of food and obstacles. Some AI or automation will be involved putting into practice the lessons learned during the exploration stage of the project. Of course all this can only be done once the snake program and test bed is implemented in "Cadence" which is a challenge in itself. There is a possibility of going into a multiplayer version of up to 4 snakes each with its own keyboard input. This allows a competition environment and allows more of a comparison of AI construal with human construal. The project will hopefully be done in "Cadence" with association with "Eden", "Scout" and "Donald", among other programs. An exploration of construal making will be done, eventually leading up to an artificial imitation of construal making which we humans do. This will be tested by varying the environment and comparing the efficiency and accuracy of construal making both by the AI and a non-informed human (A human which is expecting the change will invalidate the comparison). There will also be exploration on how "Cadence" and other pre-existing, well-established EM tools like "Eden", "Donald" and "Scout" can be interfaced together. A look at efficiency will be in order, especially when there are multiple methods which can be used to implement the model.

Model description: The model will be mainly done in "Cadence" with potentially some "Eden", "Scout" and "Donald" as well. The model will consist of an arena (100 by 100 blocks initially but can be varied to any size) where the snakes will live. The model will show a top down view of the snake world, i.e in 3rd person from a bird's eye view. There will initially be 1 snake with possibilities of a multiplayer version of up to 4 snakes. The number of food blocks will vary as will the number of obstacle blocks. The snake will move in dependence to the input keys of left, down, right and up as well as time. The snake's body length will increase once the snake eats a food block. A new food block will be generated in dependence to a food block been eaten by the snake. And the snake dies if it collides with a snake block or a wall block. The Observables is the arena of 100 by 100. At first the user may not even realise that he is playing a snake game. But after a few seconds of observation together with the user's construal gained elsewhere, he should be able to work out that the game closely resembles the game snake. Still there is nothing to distinguish the colourings of food or obstacle blocks, and perhaps only with dying multiple times can the user come to a reliable construal. An AI will eventually be developed to simulate the construal makings which we humans can do. Tested by changing some of the key in game dynamics and seeing if the AI can adapt and form a new construal as well as how long this would take compared to a human. One of the problems to be encountered will be the update of the graphic in accordance to time. Of course the more changes that happen and the bigger the area that needs to be updated the more of a problem this may be. A variety of approaches may be examined, from drawing lines using "Donald" to making and deleting windows in "Scout".

References:

- "The Interpretation of States: a New Foundation for Computing?" by W M Beyon, S B Russ "http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/papers/027/"
- "antnaviagationKeer2010" by Daniel Keer, (Extends Model by) Kok Cheng Tan "http://empublic.dcs.warwick.ac.uk/projects/antnavigationKeer2010/"

Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: My general comments on A and E are probably most relevant to this topic. You should bear in mind that the Ant Navigation model involved input from two students over a considerable period of time, and it will be difficult to make anything as sophisticated in a short period of time. Re-

use may be a possibility, but you will otherwise need to be careful not to devote too much time to the technical aspects of creating a suitable environment. There is definitely scope for interesting technical studies of the kind you've outlined where the implementation of the environment is concerned. Starting with the basic modelling challenge you identify and seeing how far you can get towards the more ambitious AI goals is definitely a good strategy. It may be that a feasibility report would be the best overall target for your submission.

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10. **Name:**

    Submission ID: 49277621

    Provisional Title: Emperical Modelling - a new approach to teaching mathematics through problem solving

    Abstract: In education there has been a marked emphasis shift from problem solving via teaching to teaching through problem solving. Students are taught a deeper understanding of mathematical ideas through interaction with the problem environment. The merits of using Empirical Modelling approach to model the problem's environment through agency and dependency are discussed; and the disadvantages of using traditional IT solutions. The towers of Hanoi problem is modelled using Eden. This problem has traditionally been used in psychological research into problem solving, and more specifically by teachers to teach problem solving and recursive algorithms to students. The simple dependencies and restrictions given to each artefact make it an ideal problem to examine Empirical Modelling's use in modelling mathematical problems. Limitations with using Eden are examined and compared to an idealised definition of EM. The solution as a valid tool to teach problem solving is discussed.

    Model description: The model is an implementation of the Towers of Hanoi problem in Eden. The game consists of three rods and a number of discs of different sizes which can slide onto any of the rod. The game starts with all the discs stacked in order of ascending size on one rod; so that the smallest disc is on top. The player must then move the entire stack to another rod but: can only move one disc at a time, each move must take the top disc on one rod and move it to the top of another rod. No disc can be put on top of a smaller disc. The model aims to encourage the student not only to complete the game, but also to discover the quickest way to complete it; then the quickest way to complete the puzzle when there are n discs. The model displays the three rods in a simple visual representation. The user has the option to specify the number of discs at the start of the game and once the game is in progress to move a disc from one rod to another. A more generalised problem is also available to the user where the discs are placed in a random order and the user can examine the shortest path to a final position. The model is also expanded to allow to user to expand the standard Towers of Hanoi problem to incorporate extra rods.

    References:

    - Carpenter, T. P. (1989), Teaching as problem solving. EM Project Archive.

    Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: The most relevant categories for this proposal are I and A. The reference you mention isn't familiar to me (!), and the theme of "teaching as problem-solving" doesn't altogether map to the standard discussion of educational technology from an EM perspective. I'm not totally convinced about the assertion "The simple dependencies and restrictions given to each artefact make it an ideal problem to examine Empirical Modelling's use in modelling mathematical problems". In general,

restrictions are not the sort of things that are conveniently expressed in EM - it's the openness to alternative construals and potential "solutions" that I associate with topics suited to EM. Good to see that you acknowledge the need to generalise and extend the problem context - I'm just concerned that this cannot overcome the rather circumscribed nature of the Towers of Hanoi problem. Perhaps a more radical extension would be one in which the sizes of the disks was changing dynamically. Be careful with spelling: your title uses the non-word "Emperical".

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11. **Name:**

    Submission ID: 49275611

    Provisional Title: A Asteroid Impact Detection Tool based on a graphically interactive model.

    Abstract: In this paper the applicability of using of using an empirical model to obtain properties and interpret data of a moving asteroid object construal based on the knowledge of incomplete data about the asteroid's properties. From the point of view of the person studying the asteroid, his or her focus is not on the getting the most accurate data yet but an estimation given the data already input into the program. The model relies on the users observations to build and modify the construal. The purpose of this study is to evaluate the suitability empirical modelling languages for building a model which could alternatively be built using object orientated programming. The scenario is that the user finds some initial details about the asteroid object and as new and more complete data is observed the construal is progressively built. Compared to the code compile cycles of object orientated programming empirical modelling may have the advantage. The model of the asteroid will hold certain physical characteristics like a size, mass, density and a velocity and acceleration. The paper will evaluate the suitability of methods in applying mathematical equations which would act as gravitation force on the asteroid object. Being an empirical model the forces acting on the asteroid object can be modified if the user feels the asteroid trajectory needs to change. At times the user can find interdependencies of certain properties of the asteroid object such as its temperature and rotation. These should be able to be linked during the development of the model.

    Model description: In this model, it is proposed to produce a program which models a scenario were a number of objects including planet, asteroid and sun all interact with one another. The purpose of the program is to discover whether the asteroid is on a collision course with the planet based on the current parameters. The purpose of using empirical modelling is to build the model with some accepted unknowns which can be updated on the fly to produce a progressively more accurate model. The model is to be created using a combination of Eden and Cadence environments. It is hoped the model features a highly interactive graphical presentation where the components' variables are modifiable from the GUI by the user. The sun has a size, mass, orbit and an associated luminance. The size and mass are linked such that as they increase the luminance increases also. It is hoped the size of the sun can be changed directly from the GUI. The size of the sun also effects the acceleration of the asteroid. The planet shares the same properties from the sun accept luminance. Its properties too can be varied. The Asteroid's has a mass, composition (density), velocity and a trajectory or path. The Asteroid's trajectory is dependent on its own properties as well as the sun and the planets. Therefore as you change various properties in the model, the asteroids path changes and there will be an exaggerated set of conditions whereby the asteroids path matches that of the earth's. It may be possible to model the impact based on a simple calculation of the kinetic energy of the asteroid. Graphically the model will be presented using various shapes, lines and points that are represented by variables making use of definitive notations. The variables will be dependent on expressions some of which are based on mathematical formulae. The model will attempt to use the superior graphical capabilities of Cadence over tkeden.

    References:

- Definitive Notations for Interaction – Dr Meurig Beynon – Univesity of Warwick, Coventry, England
- Definitive principles for Interactive Graphics – Dr Meurig Beynon – Univesity of Warwick, Coventry, England
- Evaluating Definitive Principles for Interaction in Graphics – Dr Meurig Beynon – Univesity of Warwick, Coventry, England
- Deflection of near-Earth asteroids by kinetic energy impacts from retrograde oribits. - Colin R. McInnes - Planetary and Space Science- Volume 52 – Issue 7 – Pgs 587-590

Weighting: Paper - 40 / Model - 60 (Paper not exceed 7 pages)

Comments: This model is well matched to category C. I like the fact that you have focused on features that should be well-suited to EM - the emphasis on a specific kind of body that has properties only partially known, and about which information will be discovered in an incremental fashion by an individual observer (as opposed to planets about which the important data is already known). It is a good thing that you intend to use Cadence, as this adds novelty to your approach, but you will need to be careful not to be over-ambitious. You can perhaps use the WGD for instance, but you may still need to build interface components if you don't intend to use EDEN. A 2-dimensional model would be quite enough to highlight many of the interesting features of your scenario. It may be worth consulting the authors of projects 4 and 43. Note that 'empirical modelling' has an independent meaning from 'Empirical Modelling'. In your title, you should have "An asteroid ...".

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12. **Name:**

Submission ID: 49275334

Provisional Title: Empirical Modelling: A Model of Traffic Simulating to Aid Traffic Signal Control

Abstract: Urban traffic jam has always been a bothersome issue in which traffic signal control plays a critical role. Testing a traffic signal scheduling in a real-world environment is very expensive and also impractical, as well as applying a untested deductive scheduling may cause unnecessary real-world traffic jam. A mathematical approach may accurately calculate a effective scheduling solution, whereas it is complex and abstract. This paper introduce an approach which aims to use potential of Empirical Modelling to simulate a model for network traffic signal and variational traffic condition. The model will help people to experiment different traffic signal scheduling on many traffic conditions in urban traffic settings to seek out an optimal solution for each kind of state. Users observe experiment result in the model directly and intuitively whether these different schedulings reduce average traffic delay and congestion or increase them. Perhaps it will also help people intuitively understand how a noneffective traffic signal scheduling or increased traffic flow produces congestion and traffic delay while observing the process, and how to relief this situation by traffic signal control. It can be also used to simulate traffic base on real-world traffic data, therefore testing and observing efficiency of a particular traffic signal scheduling for real-world issue are provided here. Additionally, many research groups have been working on finding out the optimal traffic signal control solution, such as a multi-agent system for network traffic signal control in which each agent intelligently and dynamically control signal for each intersection through observing ambient conditions and exchanging information with other agent. This model is perfectly capable of constructing a fundamental environment to aid researchers to experiment and observing validity of their research findings before applying them in the real world.

Model description: In Empirical Modelling, construals are built rather than programs, the model consists of 3 main construals of urban setting(maps), vehicles and traffic signal lights. Interacting with these contruals in the model allows modelers or users to control traffic signal lights or set a scheduling, set route of vehicles and their amount on a road and construct an urban setting(one single intersection, two adjacency intersection or a junction of three roads etc). During the experiment, users manipulate traffic conditions to directly experience and observe dependency between them, therefore it can be used to collect simulated real-world data and adjusting signal scheduling to seek out an efficient signal control solution for real-world traffic issues in a virtual environment. In a experiment, urban setting is set in advance and it is not changeable, but it can be reset for another experiment, but user is allowed to increase or decrease the amount of vehicles on a road, change their route settings and control signal lights at any time without violating traffic regulations. Signal control scheduling also can be made in advance by using related algorithm, then they will be applied and experimented as needed. Each of vehicle is marked by a number and defined by a route with an initial direction, users can input definition of a route for a vehicle by inputting its mark. The actions taken by vehicles when pass an intersection are defined by turning right or left or going forward, and action stop is taken when red light up at an intersection or forward vehicles remain stop state. Intersection is also marked by letters so that user can define vehicle's action at a specific intersection. Vehicles is assumed to run at a regular urban speed limitation and in the case of no traffic accident occurring. In conclusion, the model simulates real-world traffic which help people to observe traffic jam producing, experiment traffic signal scheduling in different traffic conditions and obtain an efficient signal control policy in such condidtions.

References:

- Beynon, W. M., Cartwright, R. I., Rungrattanaubol, J., Sun, P. H. (1998, September). Interactive Situation Models for Systems Development, Research Report CS-RR-353, Department of Computer Science, University of Warwick.
- W.M.Beynon, J. Rungrattanaubol and J.Sinclair Formal specification from and observation-oriented perspective. pp. 1-14.
- Arel, C. Liu, T. Urbanik, A.G. Kohls (2009 July). Reinforcement learning-based multi-agent system for network traffic signal control. IET Intelligent Transport Systems. 4(2) pp.128-135.
- Srinivasan, D., Min Chee Choy, Cheu, R.L. (2006, Sep) Neural Networks for Real-Time Traffic Signal Control. Intelligent Transportation Systems, IEEE Transactions on. 7(3), pp. 261–272.
- Quan; Liu Jin-guang, Liu Pei-hua, Rong Jian, Liu Xiao-ming. (2009, April) Dynamic Optimization Project Study between the Traffic Organization and the Traffic Signal Control of Urban Traffic. Computer Science and Information Engineering, 2009 WRI World Congress on. 3, pp. 182–186.

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: My comments on models in category B apply here. This submission is quite similar in theme to others that have been undertaken previously - in particular, one of the WEB-EM-6 submissions by James McHugh, using Cadence. Until suitable interface mechanisms are developed in Cadence itself, it will probably be easier to make use of EDEN for that aspect - this would enable the kind of extension of McHugh's model that he himself envisaged. One of the issues to bear in mind is that there is a clear role for simulations that incorporate no visualisation at all, but simply involve calculations based e.g. on probabilistic models of traffic volume and mathematical models of network flow. It is important to think of ways in which visualisation can play a more essential role - a focus on observables, dependencies and agents is helpful here,

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13. **Name:**

    Submission ID: 49275034

    Provisional Title: iCar Park

    Abstract: Car parks are found everywhere and their use is part of our daily lives. There are in excess of 31,035,791 cars on British roads and when travelling, the need of car parks is in high demand. It is a huge business and there are many big companies e.g. NCP, that operate car parks throughout the country. The paper will discuss how car park owners can improve their earnings by understanding customers' behaviour and habits of parking. It'll also brief how the implementation of fines can discourage users from abusing the facility as well as legally increasing the revenue in compression with the car parks that take no measures against drivers that do not stick to regulations. It'll also describe how the modern car parks are these days dependent on technology for access control and monitoring. It is often said that security is never enough. Taking this into account, this paper will also look at ways of how car parks could be made even more secure than car parks of today, in order to prevent vehicle theft.

    Model description: iCar Park Model Car parks are found everywhere we go and their sizes vary from multi-story to small pay & display parking. Prices are often charged on hourly basis that may depend on time of the day in very high demand areas. iCar Park model intends to revolve around a small car park that charges hourly rate with a "maximum stay" policy. Fee will be calculated using time stayed in hour(s), multiplied by the price charged per hour. The minimum charged fee will be for an hour, however, there will be no fee charged if a customer leaves within the first two minutes of entering into the car park. The size of the car park would be amendable if desired, providing an option to park more cars when the car park is very busy times or at special events. The hourly charging price would also be changeable in the model. If a customer breaks the rules and stays over the maximum allowed time, he/she will be fined; an amount that would also be changeable when required.

    References:

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    Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: This proposal fits best in category H, though it may have points of contact with B also. I like the rich scope for observation of various sorts that car-parking affords - it is possible to model a car park in a combinatorial way for instance - just keeping records of which spaces are occupied etc, but equally possible to consider more analogue concerns, such as the space taken up by different kinds of vehicles and the physical constraints on access to spaces etc. There is also a spectrum of applications ranging from car parks without any electronic interface to those with sophisticated equipment for handling payment and for giving advice on where to park. The important thing in building your model will be to begin by modelling observables, dependencies and agency in a car park configuration and build towards more complex interactions.

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14. **Name:**

    Submission ID: 49274888

    Provisional Title: Removing barriers to learn Empirical Modelling

Abstract: One of the primary motivations behind choosing this assignment is my own thinking (confused at present!). I find that someone who comes from a background in traditional programming development (like me) may get confused understanding EM at the first instance, with traditional concept occupying major part of the mind and thought process. I also felt that using wrong “metaphors” or Examples may act as an added confusion many a times in the understanding of EM. This assignment may not put forward any original work as such, but it considers previous works and thoroughly study them. In a sense its like “joining the dots” in the understanding of Empirical Modelling (EM). Digital development has given flexibility and speed for information processing but on the other hand we are formulising nearly everything that we intend to process or compute. It seems that we are heading towards losing out our free thought process to rule based thinking, usually pre-defined by people in order to digitalise the system. This calls for immediate need of introducing “Empiricism” to our traditional approach. This assignment intends to “Generalise” the basic concepts and implementation phases involved in Empirical Modelling (EM). In other words, it will try to draw a line between what we mean by Empirical Modelling and the practiced traditional programming. Furthermore, it tries to justify the need of “Empiricism” over our traditional approach. Finally the assignment also intends to examine whether it is possible to introduce EM in our traditional approach. In order to achieve this, the assignment will take a very simple real world example into consideration (Bubble sort development on EDEN in this case) as well as previous published papers. In order to do so, this assignment will sequentially traverse through following three phases: 1. At first "Steve’s picture" will be studied thoroughly. (Reason yet to be decided) 2. At the second stage “Famous” picture will be considered. (Reason yet to be decided) 3. At the last stage “EFL” will be considered. (Reason yet to be decided) At last, this assignment intends to present a clear picture of what is Empirical Modelling.

Model description:

References:

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Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: I have put some general comments relevant to your proposal under category J. The danger in this proposal is that getting a good understanding of EM as a whole is rather premature until you have had more experience of the practice and seen the topic from many different aspects. The fact that you have invested so much effort in reading, thinking and discussion is good, as this is essential to writing a good paper on your chosen theme, but real understanding does depend on appreciating the experience of modelling. From this point of view, coming up with a suitable modelling study is a priority. The idea of organising your paper around key diagrams is a good one: for the paper, you will need to find better ways to refer to these (not "Steve's diagram" etc), and if you can find good ways to characterise these diagrams this itself will be a contribution.

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15. **Name:**

Submission ID: 49273344

Provisional Title: Learning Mathematical Derivative

Abstract: In a calculus, a branch of mathematics, the derivative is a measure of how a function changes as its input changes. Loosely speaking, a derivative can be thought of as how much one quantity is changing in response to changes in some other quantity; for example, the derivative of the

position of a moving object with respect to time is the object's instantaneous velocity. Basic idea of the project is NOT only to build software, which will solve problems and graph functions, but which will teach students basics of derivative. As well, the project is to construct a useful program for both: people, who has already have some knowledge about derivative, and who are a very beginners in this area. But, the main point is to make an environment for students, who will study it without any knowledge about derivative. Practical application of derivative is so wide, which shows its importance. Physics: The heat capacity of the substance at a given temperature, Material point velocity; Geometry: Tangent plane to the surface, Tangent curve; Economics: Approximate calculations, Marginal analysis, Tailor's formula, Interpolation, Demand elasticity - are only some of branches of science, where it's widely used. As it's written in a short definition, "Empirical Modelling is a kind of (computer) modelling based on empirical observations rather than on mathematically describable relationships of the system modeled". The principal concept is to teach students about derivative and how to solve related problems based on previous knowledge and study it step by step, explaining each step. Gauss called mathematics "Queen and Servant to Science". I am very interested in mathematics. In a high school, I was a participator in a various mathematic Olympiads. As well, my work experience in educational centre gave me some knowledge in teaching students. All my previous knowledge and experience are become motivators to choose such topic.

Model description: The model 'Learning Derivative' will be implemented with the help of programming languages like eden and cadence. Project's interface will consist from several parts. The main will contain most important information: general definition and detailed explanation about derivative. Also, there will be explanation of a formula $m = \Delta y / \Delta x$, where m is a derivative; Δy is a difference of $y(x+h)$ and $y(x)$; Δx is a difference of $(x+h)$ and x. Besides, there will be presented a Cartesian coordinate system to display given function's graphic. To see and learn the difference of original function and its derivative, function's derivative will be graphed in the same coordinate system. Moreover, the explanation of dependencies n finding derivative of a given function also will be provided. All of these will give ability for learner to change variables and functions, and also to understand what derivative is.

References:

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Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: See my general comments on category I models. This is an interesting topic, particularly because it relates to a concept that naturally lends itself to some appeal to agency (cf. the way in which continuity is defined formally with reference to a "given an epsilon there exists a delta" style formulation). The derivate likewise requires some kind of appeal to the infinitessimal, and ideally this needs a form of animation to convey to the novice. There was software based around the principle of making an interactive geometric model that could be adapted to ever smaller intervals that was written by David Tall, a well-known professor in maths education, now retired. You should find useful references to his work at http://www.warwick.ac.uk/staff/David.Tall/pdfs/dot2010a-sensible-calculus.pdf, but I'm not sure if there is any associated software (his original programs were written for the BBC micro). Eden is not well-suited to dealing with the unbounded number of points / mini-lines that are needed to represent functions graphically and I think that Cadence may be a better bet.

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16. **Name:**

Submission ID: 49267628

Provisional Title: Road Model With A Zebra Crossing and A Bus Stop

Abstract: The project is a model of zebra crossing on a street and a bus stop nearby. The street expects a certain amount of traffic in the time slot of morning and evening when the street is the busiest. Apart from this, there are city buses which are expected at a particular time interval during the day. The city bus stops at the bus stop if there are passengers waiting for the bus at the stop to pick them up and if passengers in the bus want to get off. The zebra crossing has a switch for the pedestrians to help them cross the road during the traffic. It takes a fixed amount of time once the zebra crossing switch is on to stop the cars and to help the pedestrians to cross the road, once the signal is green for the vehicles they again start moving. Also the pedestrians can cross the road without even using the switch if they think the car approaching are far away or if there is no vehicle coming on the road. The user of the model has option to change the time of the day which will then affect the traffic on the street. Also the user has the option to make the pedestrian appear at the stop and to cross the road without pressing the switch provided at the zebra crossing. There is also an option for the user to make passengers stand at the bus stop so that the bus can stop there and pick them up. The model also describes that every car or the city bus maintains a distance from each other so that there are no collisions. The other thing which is of an importance is that the car which is behind a city bus stopping at the bus stop has to stop behind the city bus and can start moving when the bus does so.

Model description: This model helps the users to understand the working of the zebra crossing in the given environment by using empirical modelling concepts. It shows how different time of the day affects the traffic flow at a given time and how the zebra crossing helps pedestrians to cross the road during this time. Apart from this, it also shows a bus stop which is used by passengers frequently and how this stopping of the bus causes all the vehicles behind it to stop in a line. Other than those, if there are no passengers at the bus stop and if there are no passengers who want to get off at this stop then the bus will not make a stop there and it will just go away. The real time interaction of the user helps in understanding how certain activities affect the traffic flow and what the results of these interactions can be. The user of the model has the control of time through which he can change it, also he can create passengers at the bus stop and at the zebra crossing, too. Also, he has the freedom to make the pedestrian at the zebra crossing cross the road with a click and turn on the switch to stop the traffic to help him cross the road during heavy traffic. The number of passengers waiting at the bus stop does effect the traffic flow in a way that if there are more passengers at the bus stop it will take more time for the bus to start moving again and the vehicles behind it to follow, on the other hand if there are only a few of them, it will be a less time consuming for the bus to start its journey. To sum up, the model represents a real time environment of a given situation and helps users understand the basics of the environment.

References:

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Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: This is a category B model of an interesting variety. I think it's a good idea to aim at a specialised scenario, where there are a fixed and small number of vehicles. I don't know what level of visualisation you expect to support, not what you are proposing by way of tool support. Whilst I think you have identified some helpful scenarios that can be used to exercise your model, you should bear in mind that EM begins with observables, dependenceis and agents in a particular situation without initial commitment to any particular behavioural scenario. In making this model of the situation, it may be worth working first from a relatively simple 2D model in which lines of sight are represented using depnedencies for instance. NB: empirical modelling --> Empirical Modelling

17. **Name:**

Submission ID: 49267486

Provisional Title: A Golf Simulation

Abstract: The model is basically a golf simulation developed using empirical modelling concepts. Given a map which is shown from a bird-eye view, users will have a chance to try the simulation by simply hitting golf balls and observe the balls' landing points. There will be several dependencies which will affect the ball's motion. First of all, users will be provided a selection of several golf clubs with different shooting properties. Depending on the users' golf club choice, the ball will go to different spots if it is hit by different clubs although it is hit in the exact same way. Also, the users of the model will be able to change the wind in the simulated environment. Since the ball's motion is a simulation of real physical world, effect of the wind will also be considered. Moreover, the angle of the hit will be adjusted by the users. However, since the model is expected to simulate the real world, there will be some realistic limitations on dependincies. For example, the user will not be allowed to hit the ball in an impossible angle like 120 degrees, or even 90 degrees. As a final dependency, the users will have a chance to change the power of their shots, which is supposed to affect the initial velocity of the ball. When a user hits a ball, all these dependencies are expected to be gathered in a mathematical equation which will return the exact place of the ball at a given time. The model, using the provided equations, will calculate where the ball is supposed to be at some different certain times, so it will define the exact path of the ball from the beginning point until the final landing point. Then this path will be displayed by a simple visualization so the users will be able to observe the ball's motion very clearly.

Model description: One of the most important things about this model is that it is to be developed in terms of empirical modelling, which will make things different than it would be in traditional programming. In traditional programming, there would be some certain tasks to be accomplished in order to create a modeling environment. However, since empirical modelling concepts are to be used for this model, it is going to be much more dynamic than a traditional programming one. There are going to be several dependency variables to cause certain changes in the modelling environment. Since a person would be able to observe the result of a change in any dependency variable instantly and the golf simulation developed in empirical modelling will represent the real world, the model itself has to be running very dynamically. Additionally, the model is useful in the sense that it helps users understand some basic physical concepts about the real world. They are going to be able to observe the effects of all the dependencies implemented on a real object's motion, which is the golf ball in this case. Also, the model will display the ball's exact locations in given times, so the users will have a chance to see the changes in the motion very clearly, which will help them understand the physical concepts in a much better way. Another useful aspect of the model, which is in fact a very specific one, is that it will make a great tutorial for golf players. Given the map of golf field, they will be able to try any shot possible. They will be able to choose any golf club, and hit the ball with any possible angle and power. They will even be able to control the wind to try the same shot in different environmental conditions and see the results.

References:

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Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: My comments on category E models apply - category C may also be relevant. Your aspirations here are very ambitious, bearing in mind that a restricted scenario such as putting could make a non-trivial case study. A lot depends on the quality of the dynamic simulation that you venture; it may be that using Cadence will give added interest to the modelling exercise. It is good to bear in mind that the most interesting part of your model from an EM perspective relates to the areas for which you have the least well-developed construals. It may be a good idea to focus on the probable implications of choosing particular clubs for a shot rather than investing a lot of effort on trying to achieve realism in the flight of the golf ball (bearing in mind the formidable amount of data involved in mapping the domain alone). NB: empirical modelling --> Empirical Modelling

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18. **Name:**

    Submission ID: 49263706

    Provisional Title: Chess game

    Abstract: The paper will show how to make a chess game with Empirical Modelling tools. It will show that Empirical Modelling has the strength to model a game and also dependencies inside EM actually a strong point to make this kind of game. The paper show the technique used to model the game by using EM tools from the newest to some old one (TKEDen, Cadence, Scout, Donald, Eddi...). It can also tell the way the game can be implemented in the future like creating 3D games or making online game using EM tools.

    Model description: The chess game in Empirical Modelling based on 2 main things: the strategy and the graphics. Graphics will be divided into 2 main parts: the board and the chess pieces. There will be some small including like the chess pieces can change the colour when selected or the board can change from black and white to red and white up to the interest. The graphics will be designed by Donald (especially the board and the chess pieces will be imported by pictures from outside links). The strategies will be implemented by TKEden and Cadence. The strategies can be the possible moves of the chess pieces, how the pieces can be selected and move or it can be the rule of the chess game. Dependencies will be used a lot in the chess game strategies because it is the strong point of Empirical Modelling. For example, when the user select a piece, a list of possible moves for that chess piece will appear or players can undo their move easily by the way Eddi remember the last move of the chess piece (1 way of dependency of 2 EM tools). One and the most interesting aspect of the chess game. Cadence will become one of the main tool for modelling this project. Cadence will act as the tree or the observer for TKEden variables. User can change variable of the chess game from Cadence and then run it inside TKEden if they want too. This modelling is quite important because the project can be easily upgrade into 3D chess game with the help of Dasm due to the link between Dasm and Cadence. Variables of TKEden can be sent into Dasm quite easy with the help of Cadence.

    References:

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    Weighting: Paper - 3 / Model - 70 (Paper not exceed 7 pages)

Comments: This has elements of a category A modelling study, but also has potentially other elements in common with simulation exercises. I know that you have previous experience of model-building of this nature using a previous DOSTE-EDEN prototype - it will be interesting to see how far you can improve on previous work. Focusing on modelling the logic behind moves and the

dependencies associated with configurations of chess pieces is a good idea. There may also be more scope in the newer prototype for using Cadence to model contexts in a rich way: as when recording positions for instance. For a modelling study for WEB-EM-7, it would be sufficient to consider a subclass of chess positions e.g. rook and pawn endings.

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19. **Name:**

    Submission ID: 49261974

    Provisional Title: Cloud Computing in the Empirical Perspective

    Abstract: Cloud computing is the access to computers and their functionality via Internet or a local area network. This is accelerating the development of enterprises dramatically in terms of reducing large capital expenditure on hardware, software, and services. The key of cloud computing depends primarily on its architecture, monitoring and schedules. This paper is going to focus on utility of EM techniques in allowing users to observe cloud computing system's performance and interact with it. I will present the architecture of cloud computing and how it uses a global monitoring and schedules user requests to allocation different situations of computer resources, such as the CPU usage, network bandwidth, flash memory and disk stream.

    Model description: 1. Description Cloud clients are objects that have computer software, hardware, phone, or browser, which relies on cloud computing for application delivery. The model of cloud computing system takes three layers architecture. Cloud applications or "Software as a Service (SaaS)" deliver software as a service over Internet, eliminating the necessity to install and run the application on the client's own devices and maintenance and support. Cloud platforms or "Platform as a Service (PaaS)" deliver a computing platform or solution stack as a service, usually consuming cloud infrastructure in terms of the usage of CPU, memory and disk, and sustaining cloud applications. Moreover, cloud platform has the cloud controllers to represent and schedule the cloud system's resource state; communicate with the cloud infrastructure and evaluating the availability of client's requests. There is cluster controller that controls the set of node controllers in some different clusters. A node controller, which directly connects with host, controls the virtual machine instance on the host where it runs to execute, inspect, and terminate. This is the Cloud infrastructure or "Infrastructure as a Service (LaaS)" delivers a platform virtualization environment as a service. 2. Dependencies in the model After the client initializes a virtual machine in the cloud system, the client is allocated to an empty cluster that asks for node controllers to utilize server's physical resource, such as CPU usage, memory and disk. Hence, with the enhancement of requests on this cluster, the cluster controller would calculus to how many available physical resources can currently be scheduled. If the client uses different applications, the resources consumption replied from this cluster will be changed. Feedback information sends to cloud platform, the cloud controller. After cloud controller gets the feedback it will represent the situation on the screen. For example, each node controller at a cluster that indicates different computer resource, such as usage CPU, memory and disk respectively, is grey color if it is idle. But it will turn red (CPU usage), yellow (memory) and green (disk) by degrees, whilst client changes different applications. Therefore, a new client enters cloud computing system will be scheduled to another available cluster if the first cluster resource is going to be saturated.

    References:

    - http://open.eucalyptus.com/documents/ccgrid2009.pdf
    - The Eucalyptus Open-source Cloud-computing System, Daniel Nurmi, Rich Wolski, Chris Grzegorczyk, Graziano Obertelli, Sunil Soman, Lamia Youseff, Dmitrii Zagorodnov, in Proceedings of 9th IEEE International Symposium on Cluster Computing and the Grid, Shanghai, China.

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: I have made some general remarks relating to this theme under category G. My impression of the current status of research in the Cloud Computing area is that the issues are so diverse that it has become hard to develop theoretical models, so the idea of an empirical study seem good. Whether realistic modelling can be done using EM principles and tools is unclear: it may be that your model can only convey the general principles that a novice needs to know about scheduling strategies and concerns. You will find some precedents for scheduling studies in the previous WEB-EM procedings - using Cadence would be a good way to inject novelty.

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20. **Name:**

Submission ID: 49260029

Provisional Title: Simulation on Influence of physics on figure skating actions

Abstract: Influence of physics on figure skating actions Figure skating is one of the most popular sport, having practicing and learning figure skating for several years, the author is fascinating in perform some action such as spin and jumps and wanted to perform better each time, in the training the author figured out that the right body movement and position can optimize the successfulness of the performing action in figure skating. During the training by understanding that with actually practices on ice-rink about how some world class skater can perform such a perfect spinning actions, the author would like to produce a simulation of the figure skating to investigate some idea of techniques in simulation environment and use them in practices when on the ice rink. The purpose of this simulation model is to investigate the how influence of physics on figure skating actions can affect the effectiveness of action such as spinning and vertical jump performance. In this model the physic considered are the speed, force, momentum, body mass and friction, i.e. the general equation of involve spinning (momentum proportion to radius against the ice-surface can create speed of rotation).This idea can also be apply in the jumping action, there are many kinds type of jumping, some kind of jumping involve spinning in the air after the launch, such as Axel, which the spinning speed can also be demonstrate in the model and also with the time to landing, that will require calculation gravity and body mass. These physical aspects can be further develop in the model to match different kind of spinning actions and hence hope to find out the best way of spinning for each individual skater action such as when to entrance, when to reduce the diameter of hands and feet (if in one-foot spin) when spinning with calculations according to the body mass of each skater.

Model description: In creating this model, in simulation of the figure skater spinning which is the subject-oriented modeling. The role of this model frame work is to enhance concurrent activities between agents, In the result, it is expected that certain patterns of behavior can be observed. There will be two major display layouts which will be the screen showing the 2D figure and shape of the skater in a top up bird eye view which user in the graph can see the head of the skater and hands between the head each side on left and right. The other display layout which is next to the graphics is the control of the system. In this layout user can monitoring the input by buttons and fields and observer the change in constraints that apply to the current model, the modified detail of action will be showing in the graph layout. In this model dtkeden will be used, under the notation of dtkeden, DoNaLD for line drawing of displaying the area of spinning and skater detail, using SCOUT for screen layout to describe in the window for the user to observe the figures such as speed, rotational momentum and the force that apply to the skater. In achieving the jumping action in the simulation, the friction idea can use the Newton’s third law whereas is for every action, there is equal and opposite reaction to apply to the abreaction of the equation to build the model. There will be agents

that communicate together within the framework. Level of hierarchies are coordinates by agents in each level.

References:

- B.W. Firth(1967)Skating mechanisms,4(2),47-57
- Marianne Haguenauer, Pierre Legreneur, Karine M. Monteil(7 January 2005)Influence of figure skating skates on vertical jumping performance,39(4),699-707

Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: Both C and F categories are relevant here. This is a most interesting but very ambitious modelling study - particularly as you have in mind to use dtkeden, which has not been updated in the same way that other tkeden tools have. You may find it more appropriate to consider using Cadence-with-EDEN in networking mode in preference, though this is a relatively untried brand new tool. A feasibility study may be appropriate if you should have difficulty in making a satisfactory partial implementation - you could use this as a way to critique existing EM tools and suggest ways in which they can be more effectivelly deployed in the future. Realistically a family of small sub-models aimed at different elements of the modelling challenge would be an excellent achievement.

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21. **Name:**

Submission ID: 49259704

Provisional Title: Modelling of a Front-engine, Rear-wheel Drive Automobile Drivetrain

Abstract: In automotive design, drivetrain of an automobile refers to the elements of the automobile that are responsible for producing power and transmitting the torque to the driving wheels. These elements include the engine, the gearbox and the driveshaft. The place and role of a drivetrain is determined by the automobile layout. With respect to the driving wheels and the location of the engine, there are a few distinct categories. Some of these categories are front-engine, front-wheel drive (FF); mid-engine, front-wheel drive (MF); front-engine, rear-wheel drive (FR); rear-engine, rear-wheel drive (RR); rear-engine, front-wheel drive (RF) and four wheel drive (4WD). In modern automobiles, the engine is an internal combustion engine. Internal combustion engine means that the gas-air mixture is ignited inside the engine to produce power. There are variants of this type of engine, however the most widely used ones have cylindrical vessels and pistons. The fuel is ignited in these vessels called cylinders and force the pistons to move up and down. This vertical (or in some designs, horizontal) motion of the pistons are then converted to a circular motion which is transmitted to the wheels. If the engine is close to the driving wheels such as in front-wheel drive (FF) layouts, this transmission is relatively simple. However, if the driving wheels are far from the engine such as in front-engine, rear-wheel drive (FR) layout, a component called “driveshaft” is needed. The driveshaft is a rotating rod that transmits the motion to the parts that are connected to the wheels. In this project, some components of a front-engine, rear-wheel drive automobile will be modelled and the dependencies within the system will be studied.

Model description: A contemporary automobile is a very complex system with many interacting components that are dependent on each other. No component is isolated from other components. However, to model the entire system with all of its dependencies is rather difficult and impractical. So, this project will focus on modelling the power-generating and transmitting parts of a front-engine, rear-wheel drive automobile. The model will show the dependencies between the engine and the transmission, the transmission and the driveshaft, and the driveshaft and the wheels. The user will

be able to observe clearly that, unless the gear is in neutral, the wheels are dependent indirectly to the engine, so that as long as the engine is running, the wheels are turning. The implementation will be done using EDEN and DoNaLD. The user will interact with the program using a graphical user interface. This interface will include buttons for user input such as starting the engine, shifting gear, accelerating, etc. The interface will also include indicators for gear, speed, etc. The model will be a simple one, since it will not take all parts of the system into consideration and the drawing capabilities of DoNaLD is limited. Nevertheless, it will be a powerful one, because it will make a real-time simulation of an automobile and allow user control and intervention. The graphical user interface (GUI) of the model will be as user-friendly as possible. The model will be usable without the need of a lot of documentation.

References:

- http://en.wikipedia.org/wiki/Powertrain
- http://en.wikipedia.org/wiki/Internal_combustion_engine
- http://en.wikipedia.org/wiki/
- http://en.wikipedia.org/wiki/Front-engine,_rear-wheel_drive_layout

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: See my general comments on categories F and H. You have made a thoughtful choice of topic, and show good instincts about how to make your modelling study interesting without being over-ambitious. You may well find it useful to consult the references on ISMs alluded to in F, as your model lends itself well to modelling interactions between components. An LSD analysis in the spirit of that developed in conjunction with cruisecontrolBridge1991 may well be appropriate. As of now, there is a danger that your paper will be more of a report on the model than the exploration of a theme - good to look for an angle that helps to sharpen the focus of the modelling and suggests ways in which it may be used for illustrative purposes in your text. You may find some interesting possibilities here by comparing notes with the author of submission 45. It's unclear whether you intend to use Cadence in your model, but this could also give additional interest to your work.

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22. **Name:**

Submission ID: 49259536

Provisional Title: An EM approach to model railway traffic system

Abstract: The numerous number of trains operate around the UK has reinstated the importance of safely and accurately measured traffic control systems throughout the entire railway network. In places, where trains are to emerge into new routes or tracks, signal lights have to be visualised to acknowledge the train driver whether it is safe to enter a track. The signalling mechanism allows trains from different directions to drive at a smooth speed safely. With the enhanced development of communication networks in rural areas, trains are more covered, and GPS signals can be used to trace the position of a train within its travel progress. Around railway stations, nonetheless the many interchange junctions, where trains depart, arrive, and park are often more time intense and task-centre in managing the ordering of trains. With Empirical Modelling (EM), the difficultness corresponding to managing train orders can be seen how each dependencies are attached to other attributes within the scene visually. EM can be used to help with the understanding of various control mechanisms such that couch be used for real-world train station scenario. Empirical Modelling enables the constructions around the problem to be simpler as the techniques are to be based on collaborative experience during execution. The technique will take into account about the

environment and suggests considerations about the diversity of changes in observables. The critical element to enhance understanding is the use of dependencies to highlight the interactions with the model and the user (the controller). Primarily, the model is designed to be implemented using tkeden, though Cadence was also one of the options. The decision was made based on the complexity of the model and the approach to the EDEN environment is more directive and intuitive. There is disadvantages about the limitations in graphical interface as EDEN would produce artefacts showing the abstract visual presentation of the model.

Model description: The proposed model shall incorporate the use of objects and dependencies to manipulate how the logic of sequential processes similar to train ordering can be implemented and visually demonstrating the movements upon controller commands. The model will be developed under EDEN as the main construction tool (the tkeden environment) and by involving SCOUT (screen layout tool) and DoNaLD (line drawing tool) to enhance the visualisation features of the model. Nevertheless, the model will be engaged to the scenario where multiple trains are dependent on the order and commands of the controller, with consideration of the observable objects and dependencies between observables. Trains Conceptually, each train is modelled as an individual element represented by a rectangle. A train should follow a track as its travel path which may bend or ends. Trains are to commit to the commands from the controller in order to maintain smooth operations throughout the scene, train may proceed or stop upon controller commands, trains have to stay on the rail tracks lined within the station, the model scene. There are platforms to indicate the position for trains to park, for instance of arrival and loading. Henceforth, the model can also simulate the loading process of passengers, which could be seen as buffer modules in conventional programming and comparatively to observe the differences in using construal and observable elements in Empirical Modelling. Traffic Controls Track side signal lights are simulated as the traffic control mechanisms in the scene, located beyond the boundaries of the station; lights have observables of two signalling status, Red as stop and Green as proceed, which suggest the correlation of the dependencies with the controller. Furthermore, railway traffic control introduce the use of semaphores which are intended as signal indicators, where one is on then the other is set to off. The proposed model is going to take into consideration of some existing train order management systems. Many of the systems have integrated communication technologies for signalling, also with the observation of the environment i.e. high speed train passing stations, pedestrian crossings, signalling (distant signals, semaphores, speed warning etc), anti-collision mechanism. It is possible to simulate the idea of those mechanisms to the model and as the value added to understand better of the railway traffic control system.
http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/papers/downloads/113.pdf
http://www.hitachi-rail.com/products/operation_and_management/traffic_management_systems/index.html
http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web

References:

- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/papers/downloads/113.pdf
- http://www.hitachi-rail.com/products/operation_and_management/traffic_management_systems/index.html
- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web-em/01/trafficflow.pdf

Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: This is clearly related to category H modelling and also somewhat related to category B. There are many EM resources that you can draw on in this submission - worth looking at previous variants of CS405 to find material and models relating to railway operation and accident scenarios - in particular the railwayYung1995/railwayBeynon2010 and Clayton Tunnel models that you will (soon) find in the archive. There are fewer explicit references to railway scenarios in EM papers (as

far as I can recall), but paper #053 is one source that may be of interest. There are attractive possibilities in your chosen topic for achieving a good balance between visual, iconic, textual and logical elements. The kind of techniques that have been used to clone Scout windows using Cadence (cf. the Cadence Resources webpage) can be adapted quite effectively for making graphical layouts, and may be well-suited to your purpose.

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23. **Name:**

    Submission ID: 49259260

    Provisional Title:

    Abstract: Lifts have really changed the way we live our lives in the modern world- our 21st Century idea of vertical living in buildings. In the field of Empirical Modelling, much has been written and many models created relating to the stuff in our daily life. It's really hard to imagine what the life will be without lifts. It must be interesting to study how the lifts work, especially simulate them with Empirical Modelling. This project will design a model to simulate the working process of lifts. The main selection is to choose whether up or down, these two buttons outside the lift, other buttons represent each floor respectively, the other two buttons control the door opening or closing, when passengers get into the lift, if the close button isn't pressed in 20 seconds, and the door should open automatically 5 seconds later after the lift arrives at a certain floor, on the other hand, the lift should move again 5 seconds later after the door closed so as to ensure the safety of passengers. In addition, the alarm button is indispensable in case of an emergency. Another key point should be taken into consideration is the safety and capacity. For example, the capacity of the lift is 1300kg(about 15 persons), if the overweight is less than 100kg,the speed will be influenced, or the lift will scream to alert that there is a severe overweight, under other circumstances, it keeps a steady speed. EM consists of observation, dependency and agency that often occur in our daily experience, and it focus on the human –centered construction of models. The observables in this lift model are the speed, capacity of the lift and the time passengers should wait and all of these observables are linked together by the dependency. This model helps users to experience the interaction with this model and the computer.

    Model description: The interpreter will be used in this model is tkeden and there are also three definitive notations involved in the project: EDEN,DoNaLD and SCOUT. Because EDEN can support the concept of definitions and it has the usual arithmetic, relational and logic operators to handle the numerical variables. In the lift model, I will use EDEN to give the definitions for the moving directions of the lift and the action of the door. DoNaLD is a definitive notation for 2D line drawings. In the lift model, I will use it to draw the outline of the lift, the buttons, the door and the corresponding floors. Scout is a definitive notation for describing screen layout. By means of definitions, Scout primarily describes the geometry of the layout of windows in a display. Scout also serves as a link with other definitive notations.In this model,SCOUT will be used to define the region, content and attributes for DoNaLD window and image window. In my spare time, I will try to simulate this model by using Cadence, and compare EDEN with CADENCE about their advantages and disadvantages so as to understand them further.

    References:

    - Russell Boyatt, Antony Harfield and Meurig Beynon. Advanced Learning Technologies, 2006. Sixth International Conference, July 2006, 662 - 666
    - W.M.Beynon, Steve Russ and Willard McCarty. Human Computing: Modelling with Meaning.Literary and Linguistic Computing 21(2), 2006, 141-157.

    Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: My general comments on categories F and H models apply here. You have identified a good portfolio of issues that should be a suitable focus for a modelling study. Lifts have featured in one way and another in many different EM papers and models and the ingredients are in place to make an excellent construal. Whilst you have mentioned the use of Cadence as a "spare time activity" you may well find it useful to try to build on the prototypes afforded by the Donald lift discussed in the lectures and the Cadence lift discussed in Lab 2. Michael Jackson's paper on "What can we expect of program verification?" [http://mcs.open.ac.uk/mj665/GC6VC07.pdf] illustrates his line of argument with reference to issues that arise in developing lift systems - one of his key points is that the interaction between problems of diverse kinds makes it difficult to identify a suitable single decomposition such as is conventionally sort in modular software development. It could be useful for you to relate your EM model-building to this theme. The relevance of the Human Computing paper isn't entirely clear to me!

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24. **Name:**

    Submission ID: 49258364

    Provisional Title: empirical modelling with Python

    Abstract: I will write a framework, that gives the Python programming language empirical modelling abilities. The framework will implement dependant values and incrementally dependent values (is and := in Cadence respectively). I will then write a model of liquid flowing out a hole in a container, in both my Python framework and in Cadence. In the paper I will discuss challenges I will face implementing the Python empirical modelling framework. I will discuss how easy or hard it is to create the model in both implementations. I expect to say how Python will attract people to empirical modelling because it's syntax is better known with vastly more resources available teaching and documenting it. I will say how the many existing modules available to Python allow significantly more powerful models than Cadence or Eden are capable of: for example I could import a module that allowed for speech synthesis. I will discuss how easy it is for people to change values and relationships on the fly in both models (I expect this to be a weakness of my framework). I will discuss whether or not my framework allows for more complicated models than cadence or not. As empirical modelling variables can be stored in lists and programmatically assigned I expect more complicated models will be possible. I do not expect it will make it any easier to manage complicated relationship graphs however. I will discuss how using the Python framework is different to programming Python in a more traditional manner. In the appendices I will have a code listing of the framework, and a listing of both models.

    Model description: A model of a container being simultaneously filled and emptied. The container is to have a hole through which the liquid drains out. The user can set the size of the hole; the larger the hole is the faster the liquid will flow out. The user can set the height of the hole; the more liquid above it the faster the liquid will flow out. Liquid will not flow from beneath the hole. The container is to have a hose through which the liquid fills. The liquid will fill at a constant rate (it is not dependent on how full the container is currently). The diameter of the container can be set. The gravity of the world can be modified. By setting heavier gravity the liquid flows out the container faster. The outputs of the model will include the liquid level height, the speed of the water as it is leaving the hole and the rate that the water is leaving the hole. The interface will have a container, shaped like a square U. The liquid level will be represented by a blue square within the container. The flow into the bucket will be represented by a blue line, with thickness representing the rate. The hole will be represented by a gap in the container. The flow out of the container will be represented by a half parabola out of the container. The speed of the liquid will be represented by the size of the parabola. The rate of flow will be represented by the thickness of the parabola. The model will be

construed using my Python framework and for comparison Cadence. Static values, such as the size of the hole, the height of the hole, the rate of flow of liquid into the system, the container's diameter and world gravity will be set using the “=” operator. The user will be encouraged to change these values. Possibly a user interface slider will be provided to change these values. In this case the values would be set to be dependant on the sliders. Dynamic values such as the pressure at the hole will be set dependently on the other values in the system. The only value to be set incrementally dependent will be the water height.

References:

- http://scienceworld.wolfram.com/physics/BernoullisLaw.html
- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/teaching/cs405/cadenceresources/popedraft-23-11-2010-chapter4.pdf
- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/papers/113/

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: My general comments on categories F and J apply here. It will be interesting to see how you develop your challenging stance, in which you seem to be confident that EM principles and tools offer less than existing tools like Python. You may find it helpful to look at other students who have taken a similar sceptical stance: Tim Heron's MSc-by-research is one source of interesting studies in which object-oriented techniques combined with different modes of dependency maintenance are compared with EDEN-based modelling; one of the WEB-EM-3 submissions (relating to the ELS - a digital logic simulator) is a particularly forceful critique of EDEN. You need to be careful that you are comparing like with like: beyond question, there is some amazing computer-based modelling out there and there is no absolutely no way in which the efforts of our marginal EM research group can compete with this in certain respects. But "more powerful" means many things, and whilst e.g. functional programming languages are clearly far more powerful in some aspects than EM tools, I think we have given compelling evidence that they are comparatively ineffectual where the exploration of construals is concerned (cf. Lecture 11). [Nick also makes the case that Cadence has the potential to emulate a functional programming system and do much more.] Your case study seems to highlight one of the key issues here: you describe a scenario that seems to be ripe for direct application of a well-established mathematical theory leaving no scope for uncertainty about explanation and alternative construals (see EM paper #098 Experimenting with Computing for more discussion of this issue). It does seem unlikely that EM tools can offer much here other than generic mechanisms to simplify the expression of specific clearly identified dependencies. Is your use of lower-case "empirical modelling" rather than Empirical Modelling significant? It seems as if it might be, as it appears even in your title. If it reflects your scepticism about the idea of "EM", this would be a good issue to discuss at some point in your paper.

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25. **Name:**

Submission ID: 49258205

Provisional Title: Conventional Data structures and algorithms in Eden

Abstract: Most people believe algorithm is the heart to computing. No matter what, being part of computer science, EM should never ignore the importance of algorithm. Conventional programming relies heavily on data structures and algorithms to do task efficiently. While EM introduces a new approach in programming, which composes of definitive notation, the use of data structures and algorithms would probably assist the understanding and development in Eden. With the support of

algorithm and data structure, Eden can not only provide fast and responsive result, and also allow interaction with user and programmer. As Eden consists of definitive notation to observables, it is hard to imagine how imperative algorithm which requires state of observables works in Eden. Algorithm on definitions would be an interesting topic. This paper will illustrate the traditional data structures, for example array, queue, list, stack, heap, and algorithms like sorting, graph algorithm in terms of Eden. As well as look into programming paradigms such as recursion, iteration, dynamic programming, linear programming, etc. We will look into the general idea to covert algorithm on conventional imperative programming to Eden. It aims at provide connection from conventional programming to Eden so as to allow comparison and learning from each other. The long history of conventional programming would not be the opposite of empirical modeling, but complement. This paper will develop the topic with close reference to conventional programming, and at the same time gives importance, possibility, limitation and implication of the situation in Eden. It will possibly introduces the topic in several sections, with focus on data structures in Eden as well as algorithms in Eden. An interactive map model will be used to illustrate and demonstrate one of the most used algorithms, shortest path algorithm as well as related data structures. With the power of definitive script, we can see how easily a dynamic map model is built.

Model description: An interactive map model will be built to illustrate and implement the main focuses of the paper. With the use of Eden, the model will be built with definitive notation and allow agents to interact and customize the model. There will be many different pins or checkpoints on the map, where agents can interact with the model and introduce some customized checkpoints. For example, if you are going on travel, you would like to mark the checkpoints on your accommodation, travel hot spots, restaurants, train stations, airport, etc. If you are a university student, you would like to mark them on your room, class rooms, laboratories, bike piers, professor's offices, and a lot more. The model is designed to allow easy interaction for users. After dropping all the pins, the model can therefore compute and draw a shortest path which go through all the points. You can imagine Google Map draws a shortest path that go through all the required points at the lowest cost after you have dropped many pins on the map. All the points are having a graph structure, with weighted edges connect all the vertices. In conventional programming approach, what is needed is to develop a shortest path algorithm to go through the whole graph. In Eden, it would be interesting to see how the algorithm works with definitive vertices and edges. The model would also allow model maintainer to create obstacles on the map. Like the real world, there are always some buildings, trees, rivers, or whatever that obstruct the road. And most of the time roads are guiding our ways. Therefore, the model not only allows users to interact with, but also allows model maintainers to create obstacles to simulate the real world situation. Taking advantages of definitive script of Eden, the model will keep updating the shortest path dynamically so a responsive result is always available to the users.

References:

- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web-em/05/search-and-rescue.pdf
- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web-em/01/greedy.pdf
- http://www.dcs.warwick.ac.uk/report/pdfs/cs-rr-412.pdf

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: Your proposal seems to have something in common with categories D and J. There is an interesting thread in your thinking, but it seems to me somewhat confused. Before I had grasped Nick's research on Cadence, I would have been inclined to dismiss some of the proposals you're making here as misguided. For instance, I had never considered it appropriate to "co[n]vert algorithm on conventional imperative programming to Eden". A definitive script is after all primarily a "representation" of state, whereas an algorithm describes a behaviour that realises a

functional goal. What we have tried to do with EDEN models is to venture translations in the other direction - closing down the open interaction to develop a conventional algorithm, somewhat as is illustrated in the heapsort model, but with more automatic translation mechanisms (see ~wmb/public/projects/tools/translators/). I doubt that algorithms can be expressed in a definitive way using EDEN, but Cadence offers the potential to specify programs whilst at the same time retaining a high degree of openness in interaction and interpretation that is characteristic of EM. On that basis, I would recommend that you look at Cadence rather than EDEN as a potential target for translation of algorithms. The modelling case study you propose suggests yet another potentially fruitful link between EM and algorithmics - concerned with dynamic algorithms (see Wikipedia, which mentions dynamic algorithms for computing shortest paths in graphs by way of illustration). This proposal is probably one we should discuss further.

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26. **Name:**

Submission ID: 49257792

Provisional Title: Viability of Modelling Real World Objects for Educational and Historical Purposes

Abstract: This paper will look at the benefits of empirical modelling in order to simulate objects that would be impractical to build in real life, or that whilst possible to build would be impractical to experiment with or bring into a classroom setting. In order to do this I will look at the trebuchet model I will have built (or will have built) and analyse how effective it might be, firstly at helping school children to understand physics such as the laws of motion, secondly at helping historians analyse the use and complexity of siege weapons or other objects used in the past, and thirdly at helping both students and historians understand the effect changing each component of a trebuchet might have on the results when it is fired. I will then look at other potential uses of empirical modelling of physical objects and physical laws with regard to aiding education and historians. Then finally I will examine the efficacy of Eden in allowing me to create such models, thus examining ways in which it is a suitable tool and ways in which it is unsuitable. Some things, such as the gravitational interplay of planets, cannot be simulated in real life with ease. Equally, something could be built or simulated, but would be impractical, for example a trebuchet. It is perfectly possible to build one, but it is unreasonable to expect a teacher to bring one into a classroom. Thus there is clear benefit in modelling these things in a way that is sufficiently accurate that the models can be used for demonstration and education purposes. Additionally it is often impractical in real life to change models that you may have created. Even if a teacher was to make a small replica of a trebuchet, they could not with ease change the size and weight of its various components, and certainly couldn't easily allow each student to do so individually and experimentally. This is one of the clear benefits of empirical modelling. It allows people to experience and experiment with objects that they would normally not be able to use or change so easily. This paper will thus examine the potential benefits of simulating various physical items. Equally, it is worth noting that whilst the potential benefit of modelling may be clear, it is not necessarily the case that eden and other similar tools are the best way to go about doing it. They have many benefits over more traditional methods, in that they are inherently changeable by the user, giving them almost unlimited flexibility in modifying and playing with the model, in ways the initial designer might never have anticipated. However, these strengths can also be potential weaknesses. Thus this paper will compare empirical modelling tools to more traditional techniques with a view to contrasting their relative strengths and weaknesses

Model description: I plan on modelling a trebuchet (a type of ancient siege weapon that could throw rocks or other heavy objects). It will be shown from a side view, and will comprise of several basic parts. The main body, the arm, the pivot, the sling, the counterweight and the ammunition. The user will be able to “fire” the trebuchet, thereby throwing a rock across the screen. In order to model this I

will use various basis laws of physics, such as newtons laws of motion, gravitational potential energy and its transformation into kinetic energy. I will supply the user with the ability to modify various features of the model, namely the height of the trebuchet, the length of the arm (both length before and after the pivot), the sling length, the weight of the counterweight, the weight of the ammunition and the strength of gravity. These factors will all influence the performance of the trebuchet. It is perhaps worth noting that there are various "golden values" that a good trebuchet should possess. These are essentially ratios that should be maintained between the lengths and weights of various components. The ratios between parts should be shown on my model such that, through experimentation, a user can for themselves discover these ideal ratios. The purpose of this model is threefold. Firstly it is to demonstrate (perhaps to children in school learning about things such as the laws of motion) how various physical laws and formulas can be used to realistically model physical processes. Secondly it is to demonstrate the functioning of a trebuchet, with reference to physics. This will of course be of interest from a historians point of view, as there is benefit in being able to view and experiment with models of devices used in the past. Thirdly, the final, and in some ways most important, purpose of the model is to allow the user (once again perhaps students in an educational environment, or alternatively historians) to experience first hand how the firing of a trebuchet is affected by the interplay of the various components, thus realising what effect changing each component can have. They will be able to change all the various settings, attempting to optimise the "output". (the output they are trying to optimise of course being the path of the projectile). Hopefully the user will discover how important it is, in a properly functioning trebuchet, for each component to be a specific size/weight in ratio to the other components.

References:

For related information on educational based empirical modelling:

- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/papers/downloads/047.pdf

For information relevant to the construction of my model:

- http://www.real-world-physics-problems.com/trebuchet-physics.html
- http://members.localnet.com/~lorilee35/theory.html
- http://www.algobeautytreb.com/trebmath35.pdf

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: See my general comments on categories C and F. You have a good focus for study in the trebuchet, as its simulation lies in a familiar class but its mechanism is unusual, and may be less comprehensively understood than other mechnisms. It may be useful to consider meta-issues such as how critical are the mechanical parameters involved (such as points of impact etc) Because of its distinctive resonance, I would recommend using the word 'trebuchet' in the title of your paper. It may also be worth discussing your paper and model with others involved in simulations of a somewhat similar nature, where the movement of bodies in a gravitational field is the central focus: see submissions 4, 11 and 43 for instance.

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27. **Name:**

Submission ID: 49256989

Provisional Title: Uses of Empirical Modelling in a dart simulation

Abstract: There are numerous of dart tournaments which are famous around the whole world, especially in United Kingdom. This paper discusses the application of Empirical Modelling(EM) in constructing a small simulation of a dart game, focused on the principle, mechanism and rules. Through EM, the dart, as a real-world game, can be created in a quite different way from other forms of software development. EM has its own special features, ways and means on model implementations. Through the model of dart simulation, the paper will illustrated what are the differences of EM, give the reasons why use the EM and show the shortage of EM. At last, some suggestions to improve the EM will be given.

Model description: Empirical Modelling, as comprehended from the denotation, is based on experiment and observation, which is about making real-world artefacts to support people thinking. Compared with conventional programs, EM is more personal and cognitive. It does not pay too much attention on how to promote the functionality and efficiency, but the experienced and observational aspects. Consequently, EM contains two key features which are agent-oriented and definitive. That is to say, EM makes use of a fundamentally agent-based approach in programming related the notation of LSD, and also a definition-based script. Furthermore, three main concepts are involved in EM: observable, agent, and dependency. Observable means the models can be perceived and identified, and agent should be reckon as a real-world similarity in structure of model and data, finally the dependency is trying to show the relationships between different observables in the same artifact. In the dart simulation, the merits of using EM can be easily presented, especially to reveal the features and concepts which have been mentioned before. Firstly, in general, two different views are designed. One is the frontage to receive the users' operations like controlling the launching point and angle, and another is flank to present the whole process of darting like tracking the dart. Secondly, there are several factors influenced the motion of dart. People are one of the most significant effects, the height, strength, and accuracy of different individuals would definitely change the darting result. What's more, external effects like air drag, gravitational force, distance and position from target and darter also play a vital part in the targeting process. As the other factor, dart itself with different shapes and weights used in the same circumstance would show a totally different phenomenon. Thirdly, considering these factors together, this simulation becomes extremely complex and inestimable, so there should be a panel to show the results like deflection, and the information of all above the factors. Finally, in this model the real-world dart competition can be stimulated focused on how to get a score, which should be set the double ring and treble ring to get the double or treble score. All of these designs are aiming to present the agency, dependency, and observable of EM, which shows the convenience of constructing a quite complicated and multi-variate relative artifact by EM. Additionally, the simulation also offers an opportunity of learning the world wide dart game, and a complex physical influence behind the game.

References:

- DCS University of Warwick. EM tools home page. World Wide Web page, 2010.http://www2.warwick.ac.uk/fac/sci/dcs/research/em/software/ DCS University of Warwick.
- EM introduction home page. World Wide Web page, 2010.http://www2.warwick.ac.uk/fac/sci/dcs/research/em/intro/
- The general rules of darts. World Wide Web page,2010.http://www.mostdartgames.com/general.html

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: I like the way in which this proposal gives scope for both category E and A modelling, as well as elements of category C. Your account of EM is in the right spirit and it would be good to see this reflected in your paper and modelling study. The scope of your proposal is quite broad, and it may be unrealistic to build a comprehensive detailed model. EM is best oriented towards combining

many viewpoints, though, and it would be a pity not to exploit this. It may be good to make relatively simple and approximate models of various aspects of the situation and focus on the way in which EM can bring these perspectives together.

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28. **Name:**

    Submission ID: 49255964

    Provisional Title: Bowling a cricket ball: an empirical modelling simulation

    Abstract: This paper presents and discusses an attempt to model the physical mechanics behind the act of bowling a cricket ball using Empirical Modelling techniques. The scenario will be described and discussed along with an explanation of the parameters and dependencies involved in calculating the trajectories of the ball. Bowling a cricket ball is actually a complex physics calculation - much of the skill of bowling well comes from understanding and mastering the rules that govern the movement of the ball. Being able to calculate the path of a ball is also important as an umpire, because many decisions as to whether a batsman is out Leg Before Wicket are dependent on whether the ball is going to hit the stumps. The Hawkeye system currently used by professionals is used for this purpose. There are many factors that the movement of the ball is dependent on. Dependencies can include the effect of the height of the bowler, pace of bowling and texture of the pitch on the height of the bounce of the ball. A corresponding EM model that illustrates these dependencies, developed in the Eden tool, is introduced with a description of its implementation and use. Limitations of the current modelling approach are discussed - limitations such as complex environmental factors that may be beyond the scope of this paper to incorporate. Possible extensions to the scenario and model will also be discussed, such as incorporating a batsman. A batsman could be simulated, and the model could be extended to incorporate new dependencies. These dependencies could include the speed and timing of the batsman's swing, the effect it has on the trajectory of the ball, and the part of the bat with which the ball is hit. These factors can then be combined to provide a prediction of the distance and direction of the ball after the hit. Finally, the suitability and effectiveness of the Empirical Modelling approach to this problem will be assessed with conclusions.

    Model description: The model will simulate the trajectory of the cricket ball when bowled - this could include both side view (essential) and front view. Side view would enable the user to study how the pace and bounce of the ball change, whereas front view would show the line that the ball takes and possibly incorporate spin bowling, and therefore the change of direction that results from the ball bouncing on the pitch. The side view would be influenced by the bowler's height (affects the angle the ball moves at), how far down the pitch the ball bounces (also affects the angle), the pace of the ball (affects the speed of the ball and the size of the bounce) and the nature of the surface (a soft surface would absorb some of the ball's impact, thereby slowing it down, causing less bounce; a hard surface would do the opposite). These would all be parameters that the user would be able to change, to see how the trajectory of the ball varied. The front view would work in a similar way, but rather than being concerned with the pace and bounce of the ball would capture the direction. This would be influenced by the following dependencies: the angle of attack from the bowler ('over' or 'round' the wicket, would affect which side of the wicket they bowl and therefore the angle that the ball moves), the line they choose to bowl (they may not choose to bowl directly at the stumps), whether it is a seam ball, swing ball or a spin ball (i.e. Whether it bounces normally or whether a particular type of spin is used to modify the direction that the ball moves in after it bounces, and whether techniques have been applied to make it move in the air), the exact point the ball pitches - this can be important because bowlers' footmarks create 'rough' areas that can give unusual bounce and makes spin balls turn more because the seam grips the surface better. The model will be fully visualised, probably in TKEden, and will allow the user to change each of the parameters to study the results. There will be

a graphical representation of the bowler, ball, pitch and stumps, enabling the user to see if the ball would hit the stumps or not.

References:

- http://www.physics.usyd.edu.au/~cross/cricket.html Physics of Cricket, University of Sydney Physics Department
- http://en.wikipedia.org/wiki/Bowling_(cricket) Wikipedia on bowling - includes links to sub-sections on specific types of bowling: seam, swing, spin.
- http://journals.pepublishing.com/content/x4mg041863656w11/fulltext.pdf
- A calculation of cricket ball trajectories C J Baker, School of Civil Engineering, University of Birmingham

Weighting: Paper - 60 / Model - 40 (Paper not exceed 6 pages)

Comments: This is a category E modelling study that really appeals to me, with some strong components of category F modelling. What you have in mind is quite ambitious, and it will be important to build up your model stage by stage. Modelling physical processes in EM can involve building up a rich model of observables and dependencies that can't be evaluated in real time, but can be used to replay activities in real-time. Simon Yung's billiards simulation, in which the effect of billiard ball impact is first modelled in detail, then simulated with a replay procedure, illustrates this idea. It would be interesting to see to what extent this strategy could be modified if Cadence were to be used, as this allows so much ore efficient simulation of processes. No matter how efficient the implementation, the idea of compute intensive precalculation followed by a real-time replay may still be topical however, as there is no absolute limit on the depth of realism and accuracy that we'd like to achieve in general. Without wishing to dismay you, I should mention that there is already an interesting but neglected existing model on pretty much the same theme that you are proposing - see semcricMahmood2002. Whilst you don't need to build on that model, the topic is quite rich enough for there to be scope for this. Developments in machines, tools and practices since 2002 - in particular faster machines, the advent of Cadence and new possibilities for generating graphics - may all be helpful.

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29. **Name:**

Submission ID: 49254102

Provisional Title: AN EMPIRICAL APPROACH TO PENTE

Abstract: This paper discusses the use of Empirical Modelling to demonstrate the Americanized version of a Japanese board game, Pente. Modelling a real time strategy board game analyzes each move of the player to determine the further sequence of the game and the end result eventually. The paper examines the various rules that are permitted in the game and their consequences. The player is expected to apply thought before every move and make a decision to choose the correct strategy of either collecting stones in a row or capturing opponents' stones in order to win a game. This can be classified as educational technology since it encourages the player to experiment with different strategies. The aim of this project is to model Pente in the EM perspective and develop a working model in EDEN.

Model description: The paper demonstrates the applicability of EM in Pente by creating a model of a sample game. The game comprises of a 19x19 grid with two players 'X' and 'O'. The players move alternatively placing X's and O's on the grid. A player can capture coins of the opponent by

surrounding a pair of the opponents' coins on either side, i.e. horizontally, vertically or diagonally. A game is won if a player collects 5 coins in a row or captures 5 pairs of the opponents' coins. On analyzing the different possible scenarios in the game board, I have summarized the following rules and their inferences. If a player has 4 coins in a row, he is said to be 1 move away from a win. Moreover, if the 4 coins are unbounded from both ends, it is a guaranteed win. If a player has 3 coins in a row, he is 2 moves away from a win, and if the opponent fails to block it, it increases his probability of winning. There are certain scenarios which guarantee an almost certain win. One clear example would be if the player had 2 sets of 4 coins in a row. The most effective strategy for winning a game is to be offensive. This can be done by making rows with more coins so that the opponent concentrates on breaking the rows instead of collecting his coins into a row. The player should spread his moves across the board by building upon existing rows. Another way of winning a game is by capturing the opponents' coin pairs by surrounding them on either side. On capturing 5 pairs of coins, the captured coins are removed from the board and the player wins. Hence, the concepts of Empirical Modelling can be used to demonstrate the inference rules in the game Pente.

References:

- 1. W. M. Beynon and M. S. Joy. Computer Programming for Noughts-and-Crosses: New Frontiers. Proc. PPIG'94, January 1994.
- 2. W. M. Beynon. Empirical Modelling for Educational Technology. Proc. Cognitive Technology '97, pages 54–68, 1997.

Weighting: Paper - 60 / Model - 40 (Paper not exceed 6 pages)

Comments: This is a good category A modelling study. To date, we have found it quite difficult to make the transition from games like OXO where there are only a small number of pieces and locations to games like Go that involve many more pieces and locations. (A student who proposed a study of Go for his WEB-EM submission recently did not in the end complete his model, and this could reflect the limitations of EDEN.) I would strongly recommend trying to get away from the very messy ways in which we have tried to visualise complex positions of this nature using EDEN in the past (81 cells in a Sudoku grid is bad enough, but 361 points on a grid is much worse!), and seek ways of simplifying the representation of positions etc using cloning in Cadence (cf. the prototype Scout interface on the Cadence Resources page). If you can make this breakthrough, this will be very creditable in itself, and also open up new possibilities for exploiting EM/EDEN where it is most effective. Bear in mind that you will be achieving a great deal if you can merely model simple dependencies of the sort that are represented in the OXO laboratory models - to deal with strategic issues may well involve yet another challenge - the representation of possible sequences of moves, which has not yet been done effectively even in the case of simple games. I think that in your title "An Empirical Modelling approach ..." is to be preferred to An Empirical approach ... " as these convey something quite different.

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30. **Name:**

Submission ID: 49253654

Provisional Title: Understanding The Effects of Spin In Table Tennis Through Empirical Modelling

Abstract: This paper models the effects of spin on a table tennis ball during its trajectory across a table tennis table and upon contact with a variety of different types of bats. A table tennis ball's trajectory across the table varies depending on what type of spin is currently on the ball and the speed at which the ball is travelling at. Whilst experienced table tennis players can usually predict

where the ball is going to go, novice players may not be familiar with how spin can affect the path of a table tennis ball. Once the ball has reached the other side of the table the opponent must return the ball. The spin imparted on a ball will affect the type of strokes the recipient can use to successfully return the ball. An incorrect stroke can result in the ball flying off into the net or away from the table. Different types of rubbers on a table tennis bat such as inverted rubbers, long pimples, short pimples and anti spin give rise to different effects on the ball when it makes contact with a bat. The speed and spin on the ball can change depending on the rubber used on the bat and the type of stroke played. The majority of table tennis players use inverted rubbers on their bats and thus most players are very familiar with the effect of inverted rubbers on a ball. However rubbers with pimples or anti spin are not so commonly encountered and will give players playing against them a lot of trouble if they are unfamiliar with the effects of these rubbers on the ball. This very often results in them loosing the match rather badly and feeling frustrated and confused. This model will assist novices to the sport in the effects of spin during a balls trajectory and on contact with different types of bats. Also the model will show them what can be achieved by using spin in a game. For regular players the simulations on how the rarer types of rubbers affect the ball will provide important reminders on what to expect.

Model description: I initially wanted to do a 3D simulation of the ball's trajectory and how different types or rubbers give different effects. However after Nick's hint in the Cadence lecture today to stay away from 3D I have decided to do 2D simulations instead. My current line of thought is to show the simulation from a birds eye view and from the side simultaneously as this will show both the sideways movement of the ball as well as any change in height. I will also clearly show the current spin on the ball, perhaps using a rotating circular arrow, to make it easy for the user to know what is going on. Furthermore I plan to have a simple interface to easily switch between different types of rubbers and for producing different types of spin. I also plan to allow the user to control the speed of the simulation. I am leaning towards using Eden for this model as I am currently not sure if Cadence will provide any advantages.

References:

The links below provide an introduction to the effects of spin in table tennis.

- An introduction to spin in table tennis. http://tabletennis.about.com/od/spin/a/spin.htm
- Effects of spin on long pimple rubbers. http://tabletennis.about.com/od/longpimples/ss/lp_kill_spin.htm
- Effects of spin on anti spin rubbers. http://tabletennis.about.com/od/antispin/a/playagainstanti.htm

Weighting: Paper - 30 / Model - 70 (Paper not exceed 7 pages)

Comments: This is an interesting blend of category E and F modelling. The challenge may be to know how to achieve this blend most effectively. To make a simulation of the physical situation that is really convincing is far beyond the scope of a submission of this nature - in part because (unlike say firing a gun) hitting a table tennis ball is highly dependent on human skill. Ideally, this is the kind of activity to be modelled using an input device like a wiimote (something that has been enabled both in EDEN and - more realistically where real-time movement is concerned - in Cadence, but has so far been little exploited). Whatever you do by way of physical simulation is bound to be greatly simplified, and it may be appropriate to focus not on the mechanisms that generate spin, but rather on the strategic implications of using spin in matchplay. Whilst it is definitely a good idea to steer away from 3D modelling, I think it's likely that Cadence-with-EDEN would give an appropriate mix of process-like and agent-like ingredients.

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31. **Name:**

Submission ID: 49253046

Provisional Title: A simple Diving simulation

Abstract: Diving is a kind of sport of jumping or falling into water from a platform or spring board, it's also an internationally-recognized sport that is part of the Olympic Games. Because of this, it's would be very interesting to design an EM modeling to simulate a diving process. Empirical Modelling is a new method to model using computers based on user's observation on experimentation. The model is made up by definitions and dependencies. Thus, observation is one of the key principles of Empirical Modelling. So, this project would simulate the diving process through setting several parameters about diving. The graphical user interface of this project includes four main parts: type selection, difficulty of figures area, parameter setting area, and simulation area. The project procedure can simply describe as below: Firstly, select the type of diving (platform or springboard) and select the high of diving platform (1m, 3m, 7m, and 10m) in type selection area. Secondly, select and define the difficulty of diving action, it's hard to score if you choose a highly difficulty action, conversely, choose a plain high diving action is easy to score; this is complete in difficulty of figures area. And then, in the parameter setting area, it will select the parameter of athlete take off angle and athlete take off efforts, if possible , it also can add some other parameter such as wind direction. Different parameter setting would lead to different result. In the last place, all the result would show in simulation area, includes: score, entry position etc. The observables in this diving simulation are the diving type selection and parameter setting. The dependency is a relationship links these all observables together through how these are linked when they changed. The model also allows user to concentrate their experience and interacting with this model based on the dependency.

Model description: Tkenden is the software which used for this model; all definitions can be supplied in this definitive system through these three definitive notations: EDEN, DoNaLD, and SCOUT. In my diving simulation model, all definitions for parameter setting includes take off angle, take off efforts and other parameter would given by EDEN, because EDEN is a general purpose language which has the usual arithmetic, relational and logical operators to control the numerical variables and it can support the concept of definitions as well. DoNaLD is the definitive notation for 2D line drawing, and it also can draw any kind of shape which could be used in this model. So, I will use DoNaLD method to draw the diving platform, swimming pool and related objects in this diving simulation model. The SCOUT function method is a kind of definitive notation to describe screen layout, therefore the SCOUT will be used to define the region, content and attributes for DoNaLD widow or image window in this model. In a word, the GUI will combine with SCOUT and DoNaLD method function. If possible , I would design a same model used CADENCE, because CADENCE can design a better GUI than use EDEN, and on the other hand ,it also can help me to understand the advantages and disadvantages between EDEN and CADENCE.

References:

- W.M.Beynon, Steve Russ and Willard McCarty. Human Computing: Modelling with Meaning.Literary and Linguistic Computing 21(2), 2006, 141157.
- Meurig Beynon, Roderick R Klein, Steve Russ. Humanities' Computings (extended abstract only). In Digital Humanities 2006: 1st International Conference of the Alliance of Digital Humanities Organisations, Conference Abstracts, ParisSorbonne, France, July 2006, 1720.

Weighting: Paper - 40 / Model - 60 (Paper not exceed 7 pages)

Comments: This is a good example of category F and E modelling. In principle, I think that using Cadence to model the physical processes involved in diving and EDEN, DoNaLD, and SCOUT for visualisation is well-conceived - hopefully, the use of 'is' definitions together with 'willbe' definitions in Cadence will be well-suited to that purpose. (This is probably a better idea than trying to build two independent models and comparing them.) You needn't be too ambitious by way of realism in the diver model - modelling the motion of a simple jointed system already represents a significant achievement. You may find it useful to look at the work done by Simon Yung on simulating pendulums at /dcs/acad/wmb/public/projects/simulations/pendulum - this is not well-documented but may have some relevant features. Iam once again (cf. submissions numbers 23 and 39) puzzled by the inclusion of the paper on Human Computing in the references, as this doesn't seem structly relevant.

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32. **Name:**

Submission ID: 49252835

Provisional Title: The Offside Rule: an Empirical Approach

Abstract: This paper will discuss the use of Empirical Modelling in demonstrating and explaining the offside rule within the game of football. A model is created using a modelling approach based on the principles behind Empirical Modelling and related software and tools. This model will be used to help summarise and explain the offside rule as well as helping to teach people when the rule applies and when it does not. The model will provide a means of investigating the different outcomes given different rules and situations. The experimental approach this model uses offers the option that it could be used within the area of Educational Technology, as it helps the user build up an understanding of the offside rule by explaining each sub-rule in stages, building up to the complete rule. The paper goes onto evaluate the model and the overall approach, as well as assessing the suitability of current Empirical Modelling tools for the topic.

Model description: I will be creating a model that demonstrates to users the different factors involved in the offside rule. This will involve showing different factors such as if a player is behind the ball or if the ball is played backwards. These different factors will be explained using the model to help demonstrate to the user what position the players involved would be in and at what point they are either onside or offside. This model will hopefully be able to be used as an educational tool, teaching people to understand the offside rule, which still to date is one of the most debated topics in football. Hopefully an option may also be included to allow users to manipulate players into different positions and be informed if they are onside or offside. I hope to model this using only EDEN as I feel it offers all the tools I require and do not feel the need to use cadance also.

References:

- http://www.fifa.com/mm/document/affederation/generic/81/42/36/lawsofthegame_2010_11_e.pdf
- http://www.fifa.com/lotg/football/en/flash/start.html http://asktheref.com/Soccer/Referee/Articles/6/
- http://www.fifa.com/mm/document/afdeveloping/refereeing/5.%20law%2011_554.pdf
- http://www2.warwick.ac.uk/fac/sci/dcs/research/em/

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: This model relates to categories E and H primarily. This is a good choice of topic, as it has a clear focus without being too tightly circumscribed, and clearly engages with the ideas of observation and sense-making. It reminds me of a submission to WEB-EM-6 that related to American Football, where the model focused on the configurations adopted by players in particular attacking movements etc. The latter submission used Cadence (or tkeden-2.10 as it then was) quite successfully, and I think you may find that you can exploit Cadence-with-EDEN effectively likewise. Another way of enhancing your model might be to give LSD accounts of the agents involved (as in Neil Turner's 5-a-side football simulation from the EM projects archive) and perhaps take into account the perspectives of the linesman, who ideally needs to make judgements from precisely the right position on the line.

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33. **Name:**

Submission ID: 49251990

Provisional Title: Objects Collision Model for Physics Teaching And Learning

Abstract: The subsequent movement of two objects after a collision between them is sometimes with great abstract, which always makes physics-learning students feel confused and also brings difficulties to physics teaching. This paper uses Empirical Modeling (EM) approach to develop a model of physical collision between two objects, simulating the collision process and meanwhile giving a concrete view of the process to physics students to help them gain a better understanding of it. Only ideal, non-deformed objects are considered in the paper, and some fundamental formulas used in the model are introduced. Section one is a brief introduction of the background, like some concept of empirical modeling and why lots of students feel it very difficult to learn physical collision; section two introduces the formulae and observables used in the model; section three describes in detail about two main functions – collision and zoom, and how to implement them; section four gives the conclusion for building such a model.

Model description: USE OF EM CONCEPTS EM aims at teaching people useful things via observation and experience with models. The collision model here provides good opportunities to students to observe the movement of two colliding objects where they can learn some basic knowledge about physical collision and get some concrete impression about the process of collision. Several observables and dependencies are also defined in the model, which means changes to some observables may lead to the change of other observables. DEPENDENCIES AND OBSERVABLES The dependencies in this model are the weight of the two objects which is decided by the acceleration of gravity and the mass of objects, the friction which is determined by both the coefficient of sliding friction and the weight of objects, and the speed of the passive object which is given by the collision from the initiative object. All these observables are able to be modified by the user, like students, during the model is running, to change the premises and environments of the collision. FORMULAE USED To understand the movement of the two objects, theoretical physics formulae are used in the model. For example, Conservation of Momentum, m1v1 + m2v2 = m1v1’ + m2v2’, which is used to compute the velocity and direction of the movement of the two objects after their collision; and Conservation of Kinetic Energy, 1/2m1(v1)2 = 1/2m1(v1’)2 + 1/2m2(v2’)2, if there is no energy lo ss in the collision. In these formulae, v1 and m1 respectively represents for the speed and the mass of the initiative object before the collision, and v1’ represents for its speed after the collision; and so do v2, m2, and v2’ to the passive object. Hence, at the beginning, v2 is 0; while after the collision, v2’ becomes non-zero, whose direction is the same as v1. METHOD FOR COLLISION DETECTION AS only non-deformed and square-shaped objects with sliding friction are in consideration, the collision detection is relatively simple, which is to check whether the two target vertices (one on each object) are overlapped. If so, two objects collide, or they have not, yet.

References:

- [1] Karl F. Kuhn, Basic Physics: A Self-Teaching Guide (Wiley Self-Teaching Guides) 2nd Edition edition, John Wiley & Sons, 25 April 1996
- [2] Books Llc, Computer Physics Engines: Collision Detection, Soft Body Dynamics, Cuda, Physx, Physics Engine, Bullet, Physics Processing Unit, 3 May 2010

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: This is a classical piece of dynamical simulation in the spirit of C and F style modelling categories. You will find a useful precedent in the EM billiards model developed by Simon Yung. It illustrates some of the challenges involved in making a good model of collisions using EDEN - see also the brief discussion in EM paper #048. Since EM tools have developed significantly since Yung's model was developed, it's worth developing new models on the same theme. My main concern with this kind of simulation is that you are working with text-book construals (as your references suggest), and this detracts from the idea of making construals in situations where you are uncertain. (It's also difficult to compete with conventional software that is designed to exploit known theoretical construals - cf. Experimenting with Computing EM paper #098 and my comments on proposal 24.) Ideally, I think you need to look for some way of making the model-building less routine in the design sense, so that the experiential elements are more prominent. You might like to discuss these possibilities with others cf. submission 48. Some sentences don't quite make sense to me, and I don't know whether you have failed to write what you intended; e.g. the phrase "is sometimes with great abstract" is a strange construction.

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34. **Name:**

Submission ID: 49250303

Provisional Title: Emprirical Modelling in Educational game: Paper fighter

Abstract: This paper considers the use of Emprirical Modelling to building a game model for eductional use for young children to learn parabola. The EM model describes a game that two naught pupils fight to each other in the classroom with thrown weapons made by paper. Affacting by some elements, the parabola will change and the players need to estimate the track before thrown so that the opponet can be hit. This EM model will basicly use Candence to deal with the logic and Donald to design the user interface. Finally the EM model will be tested by changing the elements, whether or not EM is sigificant to be adopted into educational game according to the complexcity and the playablility.

Keywords: Emprirical Modelling, parabola, educational game, candence, Donald

Model description: Model study Educational game is more and more population in this centry and absorbing the attetion of the game designers. Educatonal games can be defined as the games which are designed to teach the players some certeain skill or some knowledge while they play. As the EM model designer , how to combine EM and educational game is significate. Paper fighter is designed as an educational game adopted from a game of tank field with EM designing tools. Candence will deal with the logic of the game and Donnald will be in charge of the user frame designing . As an observer, eden will build connection with Candence and Donnald. Different from the original game the main objects which can be seen as the palyers are two boys. The boys will stand in the one side of the classroom and fight with each other using some pieces of paper. In order to hit the other easily, they make the paper into papar plane and paper ball. Due to the distance of the two players, the thrown weapons(paper ball and plane) will glide in the distance following parabola. The parabola will change depending on the distance between the two players and the skape of the weapon. Beside those elements, there is always some wind in the classroom(from air conditionars or funs) which

effects the tack of the weapon. Through the game the player can not only gain some impression on what is parabola like and how the parabola changes but also some experienment of the speed and acceleration. The complexcity of the model and the playability will the two main issues to evalue whether or not EM is fitful for educational games.

References:

- J.Dost¨¢l, 2009, Educational software and computer games - tools of modern education,Journal of Technology and Information Education. Palacký University, Olomouc, Volume 1, Issue 1, p. 24 - 28.

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: The main ingredient here is category F modelling and perhaps C modelling. Though you mention parabolic trajectories, this is presumably only plausible for paper balls, not paper planes. (In fact, you may be using the word 'parabola' where you mean 'trajectory', I suspect.) I'm not convinced about the "educational" or the exact form of the "game" aspect of the simulation you propose. Some of the issues that arise here are similar to those discussed in connection with the table tennis proposals (see submissions 30 and 41). I imagine that the aerodynamics of paper planes is quite difficult to capture theoretically - you may like to look at Paul Ness's sailboat simulation - and EM paper #036 - in the archive to see how a model based on empirical data might be framed. Unfortunately, it's probably not easy to perform experiments to get the kind of empirical evidence you need to predict the trajectory of a paper plane. Perhaps the best way to develop your theme is to explore how process-like definitions in Cadence might lead to plausible predictions about the flight of a paper object: in that way you may be able to express dependencies between forces generated by wind etc in such a way as to reflect the feedback loop linking speed of motion with force exerted by the wind.

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35. **Name:**

Submission ID: 49250008

Provisional Title: Visualising User Models for Keystroke Dynamics using Empirical Modelling (application area- Artificial Intelligence)

Abstract: Keystroke dynamics is a behavioural biometric that hypothesises that an individual can be identified from their habitual typing rhythms. To make identification algorithms possible, user models are built from timing information extracted from each user typing set phrases of text. Each user model consists of many keystroke features, such as the time a certain key is held down for, or the time between one key being released and the next being pressed. This is a considerably large amount of information, such that it is impossible to visualise what is going on with the data just by looking at the numbers. This paper develops a model that allows the user modeller to empirically explore the data and through interaction with the model, attempt to notice patterns in the user models that could potentially be exploited to enhance the accuracy of a keystroke dynamics security protocol. Despite the application here being applied to keystroke timing data, the actual model could be used for visualising and identifying patterns between variables in any large data set.

Model description: To be implemented in EDEN (donald, scout etc.) but possibly could use CADENCE too.. Visually the data is represented as a grid, with each row representing a different user and each column a different keystroke feature. Similar to the sudokucolourHarfield2007 model, the colour of each square depends on the value in square. The model would include interactive

controls like the sudoko model to allow the colour settings to be changed to potentially make it easier for the user to see patterns. There is scope for using the tool in different ways, i.e: 1. each keystroke feature is assigned a colour and the size of the square is dependant on the magnitude of the data value 2. the colour of each keystroke feature changes dependant on the magnitude of it's data value etc. depending on what turns out to appear be a good way of visualising the data Further interactation with the model could be provided by possibly allowing to sort the data or attempt drawing some sort of crude bar charts to compare users. That all said, the idea above doesn't seem that polished and I like cricket and love playing around with data so I'm kind of intrigued by what could possibly be involved in the Twenty-20 cricket modelling task

References:

- Keystroke Dynamics: Online User Authentication using Keystroke Dynamics (third year project final report)
- Building User Models for Keystroke Dynamics on Random Sample Text (Matthew Carter and Sarabjot Singh Anand, 2010)
- EM AI Papers: #050 #078

Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: This modelling study is interesting and unusual - some relevant comments appear under category K and possibly H. There's good scope to explore the kind of techniques used in the Sudoku model, and see whether they expose patterns. Eddi may be a useful tool. You may also find the attribute explorer related models (cf. attributeexplorerRoe2000) of interest. I'm not sure to what extent you had thought of your study as primarily about data analysis of accumulated data (as might be equally relevant to the Twenty-20 data), but I think there is even greater EM interest if you introduce some live data capture aspect into your model. One of the good things about the keyboard is that it provides a raw channel for experiential input that reflects individual user skill etc, so it could be an excellent entry point for EM activities in which there are observables associated with the human agents and accessible to the system. Perhaps it would be good to develop an LSD account of the situation so as to highlight this. I like the word 'interactation'!

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36. **Name:**

Submission ID: 49249615

Provisional Title: The Implications of Constructing Classroom Experiments in an Empirical Modelling Environment

Abstract: There are a number of ways in which Empirical Modelling (EM) can be implemented in education to enhance the learning process for a subject. This paper specifically looks at the implications of EM being used as a technological companion to enhance learning of concepts that are hard to understand by students without practical demonstrations and personal experience. Traditionally, students in classrooms conduct experiments in science lessons to learn something that cannot be understood easily simply by text, graphics or spoken language. They need to be able to interact with artefacts and experience the effects of this interactions first hand. We look at how and why this process is essential in some cases by analysing human psychology. We discuss applications of EM as a technology to replace or enhance classroom demonstrations. This can be for scenarios where experimentation may not be possible or as a revision tool where the student has unrestricted access to the "virtual apparatus." The implications of an EM framework with these ideas in mind have a significant impact in dealing with problems such as distant learning, learning for subjects with

accessibility issues, adaptive learning systems and education in poverty-struck regions. The paper looks at a model of Richard Feynman's “Double-Slit experiment” as a typical demonstration of a classroom experiment designed to teach subjects radical new concepts in physics. This experiment is highly suited to the topic at hand because it is an example of demonstration that is difficult to set up and interact with en-mass and it attempts to convey a concept that is widely accepted as being very difficult to perceive for the human mind – especially considering it is taught at school. The experiment is a suitably challenging to set up in an EM environment as it involves implementing the processes of quantum physics. These processes are different from the traditional notions of physics which are straight-forward to implement in a computing environment. However, we will show that with sufficient thought to dependency and agency, concepts such as wave-particle duality can be displayed and perceived well enough – and with the ability to interact with the model, the subject's learning experience is enhanced. We finish by evaluating the effectiveness of potential EM-based frameworks that can be used with the mentioned ideas in mind. Suggested further work discusses delivery of EM-based learning content and learning strategies to keep in mind specifically for the classroom environment.

Model description: The model to be built for this exercise will be a reconstruction of the classical "Double-Slit experiment" which was used by Richard Feynman to help subjects understand radical new concepts in quantum physics. The main idea shown by the experiment is that light seems to behave as a wave and a particle at the same time. The experiment comprises a source with light that travels past a barrier with two slits to form patterns on the other side. The formation of these patterns show that light is behaving both, as a particle, as well as a wave. The model will have to show physical artefacts such as the light source, the barrier with slits, the formation pattern and the back-board. Additionally, it can show the pattern of waves and particles as humans visualise them in their minds - possibly as different modes (i.e. a "wave agent" and a "particle agent"). There are a vast number of visualisations that can be added to further enhance the conception of the underlying concepts, such as the distribution of waves and the rotation of a "probability clock". While the model can be built and displayed in Cadence, ideally we would want the subject to interact with the model by changing variables such as the distance of the light source, the distance between slits and the distance of the back board. These changes can either be typed in or taken in via panels in Eden. There are possibilities for further extension of the model. For example, the apparatus can be changed to include an additional set of slits to show the pattern formations resulting from that. There is also a possibility of re-using the implemented dependencies to further improve the display (and hence the perception) of the underlying experiment by adding additional views (e.g. bird's eye-view and side-view concurrently).

References:

- Marjanovic, O. (2007). Using process-oriented, sequencing educational technologies: Some important pedagogical issues. Computers in Human Behavior, 23 (6), 2742-2759.
- Beynon, W. M. (1997). Empirical Modelling for Educational Technology. Cognitive Technology, 1997.
- 'Humanizing the Information Age'. Proceedings., Second International Conference on, 54-68. Cynthia, M. T., & Sternberg, R. J. (2009). Developing experience-based (tacit) knowledge through reflection. Learning and Individual Differences, 19 (4), 530-540.
- Price, S., & Oliver, M. (2007). A Framework for Conceptualising the Impact of Technology on Teaching and Learning. Educational Technology & Society, 10 (1), 16-27.
- Wake, J. D., Dysthe, O., & Mjelstad, S. (2007). New and Changing Teacher Roles in Higher Education in a Digital Age. Educational Technology & Society, 10 (1), 40-51.
- Guldberg, K., & Pilkington, R. (2007). Tutor roles in Facilitating Reflection on Practice Through Online Discussion. Educational Technology & Society, 10 (1), 61-72.

Weighting: Paper - 40 / Model - 60 (Paper not exceed 7 pages)

Comments: This seems to be oriented towards category F modelling. The duality that the slit experiment illustrates should be amenable to treatment in terms of construals, and the idea of focusing on how visualisation can serve an educational purpose is good. The references you have gathered together here are interesting - though curiously they omit the EM paper that appeared in the JETS issue cited. It looks somewhat (especially if you have good reasons for citing each of the references specified) as if you potentially have enough material to make a more substantial paper. As is usual in relation to visualisation linked to a theoretical model (cf. comments on proposal 24 and 33), there's an uncomfortable feeling that you arre not really exploiting the scope for open interpretation that EM affords. Perhaps this could be addressed by introducing something more interactive into the model that might be useful in checking the learner's construals.

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37. **Name:**

    Submission ID: 49247136

    Provisional Title: Digital Circuit Elements

    Abstract: Understanding individual digital circuit elements like the various logic gates along with multiplexers (mux) and demultiplexer (demux). The inputs to these circuit elements can be thought of as observables while the circuit elements can be considered as the definitions in Empirical Modelling terms. The model is developed on the tkeden platform. This model is aimed at being used for teaching purpose to help students understand the working of these individual elements and progressively move towards understanding predefined circuits by having the freedom to turn the inputs on and off. Furthermore, this represents the practical example of the application of Empirical Modelling for educational purposes.

    Model description: The aim here is to make students understand the working of the individual logic gates, mux and demux. To achieve this the model proposes to present progressively complex circuits. First, the users will be made aware of the functioning of the digital circuit components by having the liberty to change inputs and see the reflecting changes. Next stages would involve showing various combinations of these circuit elements from simple to complex.

    References:

    - EM for learning to understand numbers in non-decimal bases
    - Teaching trigonometry using Empirical Modelling
    - An educational system for modelling mechanics problems

    Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: This proposal has something in common with modelling categories F, G and H. The department has made use of simulation tools based on traditional software for teaching digital circuits in its first-year Computer Organisation and Architecture module. In WEB-EM-3, one of the students with very considerable programming skills set out to reproduce similar functionality with EDEN and found it quite an unhappy experience (see the ELS model cited in connection with submission 24 to WEB-EM-7). You may be able to borrow / adapt visual components from that model, and may also wish to consider the possibility of using Cadence instead of EDEN. A related proposal is number 44. As with the "EM for learning ..." paper you cite, it may be a good idea to limit the scope of your modelling study to a specific focus and invest effort into writing about the learning aspects. A relevant question might be: why should there be any merit in making a simulator using EM rather than using conventional programming techniques?

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38. **Name:**

Submission ID: 49239716

Provisional Title: Using Empirical Modelling to show the movement of a boat in moving water

Abstract: Modelling moving systems is a complex task that traditional computer science is not ideal for. I intend to model the movement of a boat in moving water, taking into account it's direction, rudder, power source and wind. This is a task for which empirical modelling is very suited, and is ideal for solving the problem. I intend to break down the construal into various sections, starting from a boat with no rudder, power or wind, and adding the various parts one by one to show the effect of each change. As a keen kayaker myself, I know how the various outside factors affect the movement of my boat and so will be able to translate my knowledge into the construal in order to show others how the concept functions. It is my belief, as taught by Meurig, that the educational significance of Empirical Modelling is highly important and this model will demonstrate this, as my own knowledge and experience can be passed on through the container of the construal. This is the basic concept around which the construal will be constructed.

Model description: The problem of modelling a boat in moving water has several factors: The direction the boat is facing in. If the boat has momentum, this will affect the direction it actually moves in. It will also affect the rotation of the boat as the current may push the boat around. The momentum of the boat - or it's speed. This will affect the future position of the boat. The position of the rudder - this will affect the rotation of the boat The speed of the engine - this will affect the speed of the boat The wind speed and direction - the wind will push the boat, thus affecting the boat's position. Different current speeds may potentially be modelled, but this will most likely be out of the scope of the task as it adds a huge amount of complexity when crossing from one current speed to another (called breaking out in kayaking). This is however a potential direction for future work. All these factors interplay simultaneously on a boat in moving water at the same time, and so Empirical Modelling is ideally suited to this task.

References:

- http://www.kcs.dircon.co.uk/mainSite/pages/stars/star4.htm (see ferry gliding)
- http://www.pyb.co.uk/information/features/carving.php

Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: The comments on modelling categories F and H are probably most relevant to this study. Your approach reminds me strongly of a saiboat simulation made by Paul Ness, as documented in the projects archive, and described in EM paper #036. His model was based on empirical observations about sailboat motion drawn from his own experience - we later tried to account for some unexpected characteristics of his model using 'standard science', only to find that we couldn't give a good account in this way. It transpired that the intuitive model Paul had come up with matched well to the empirical models that were in fact being used by engineers, which were derived from wind tunnel experiments, not from theory. In a somewhat similar spirit, one of our visitors once remarked that the motion of the steam trains in our reconstruction of 19th century railway operation was uncharacteristic - as it indeed was, being based on the cruise control simulation (and a "petrol engine"). The lack of an authoritative theory for your model here is good in one way, but of course is problematic in other ways. How you validate it is hard to say for sure: in Paul Ness's case, his concern was to show that certain kinds of interaction did provoke distinctive responses - such as capsizing the boat, and it was just this kind of testing that discredited our reductionist school physics

counter construals. You've not mentioned what tools you'll use, but it may be worth exploring the potential for using Cadence here, as there is a lot of interaction between process-like observables in the picture (visualisation can still be in EDEN).

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39. **Name:**

Submission ID: 49235384

Provisional Title: Empirically Modelling a Golf Game

Abstract: This model simulates a golf game that provides user experience as the a golf player. The player will stand at the tee ground and hit the ball to the green which is 200 yards far away. If the ball falls into the green area but not falls into the hole, the player will get 1 scores. If the ball falls outside the green, the mark will be zero. However, if the ball falls into the hole, the player will get 3 scores. Also, there is rough on the left and water on the right. If the ball falls into rough or water, the mark will be zero. Two users can play as Player A and Player B at the same time. The system will automatically calculate the scores to Player A and Player B. Both of them have 10 chances to hit the ball. The winner will be the one gets higher mark after 10 hits. The golf performance will be determined by the player's hit and the wind. The player's hit strength ranges from 0.0- 5.0 and the player can hit the ball with different angles. The wind has strength and directions. The wind strength ranges from 0.0 – 10.0 and the wind has left direction and right direction. The player needs to observe the wind strength and direction and determine his/her own performance. The path of the ball will be traced and calculated. Empirical Modelling is a new method to model using computers based on user's observation on experimentation. The model is made up by definitions and dependencies. Thus, observation is one of the key principles of Empirical Modelling. The observables in this golf game are the player's hit strength and angles and the wind's strength and direction. The dependency is a relationship links these observables together according to how they are linked in change. This model allows user to concentrate experiencing and interacting with the model based on the dependency.

Model description: The definitive system I used for this model is tkenden. Definitions can be supplied in this system are three definitive notations: EDEN, DoNaLD and SCOUT. EDEN is the general-purpose language that can support the concept of definitions and it has the usual arithmetic, relational and logical operators to handle the numerical variables. In my golf game model, I use EDEN to give the definitions for the player's hit strength and angles and the wind's strength and direction. Also, the EDEN will define how to find out the position of the ball falls down and calculate the scores for both Player A and Player B. DoNaLD is the definitive notation for 2D line drawing and the shape is displayed in the form of a line drawing. In my golf game model, I will use DoNaLD to draw the golf course with the tee ground, the green, the hole, the water, the rough and the player. SCOUT is a definitive notation to describe screen layout. In the golf game model, I will use SCOUT to serve as link within the definitive notations. The SCOUT will be used to define the region, content and attributes for DoNaLD window and image window in this model. Also, the SCOUT can be used to declare the window that is sensitive for user to kick mouse and press the keys. By this way, the user can interact with the model and play the game successfully. After creating the model with EDEN, I may use CADENCE, the new prototype which is centred on DOSTE interpreter to create the same model. I may define some separate observables in Cadence and EDEN and link them together to share these observables. By this way, I can understand how CADENCE uses in conjunction with EDEN. Also, I can understand more about both advantages and disadvantages of CADENCE and EDEN, and give some advices on their future development.

References:

- Meurig Beynon, Roderick R Klein, Steve Russ. Humanities' Computings (extended abstract only). In Digital Humanities 2006: 1st International Conference of the Alliance of Digital Humanities Organisations, Conference Abstracts, Paris-Sorbonne, France, July 2006, 17-20.
- W.M.Beynon, Steve Russ and Willard McCarty. Human Computing: Modelling with Meaning. Literary and Linguistic Computing 21(2), 2006, 141-157.

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: As I stated on the closely related proposal number 17, my comments on category E models apply - category C may also be relevant. Relative to submission 17, you seem to be putting less explicit emphasis on faithful modelling of the golf ball trajectory etc, and so are taking a more abstract user-like perspective. Note that the term 'user' is not one much favoured in EM - 'use' being the result of some kind of circumscription of experience and interpretation. Dangerous for that reason to use the term 'user experience', which has it's own established meaning. At the moment, you seem to be adoptiing a perspective that is somewhat "closed world" - you have decided some details of the model and rules in advance for instance, whereas it's more appropriate to think first of modelling "an environment in which some golf-like activity takes place" in terms of observables, dependencies and agency. Using Cadence may well be a good idea, as it will add technical interest to your model, but it will enough to use Cadence-with-EDEN rather than to venture two models and compare them. You need to take more care with language and spelling - I think you mean 'click' not 'kick' mouse, and should spell tkeden correctly. Your choice of references here is quite mysterious to me - they seem unrelated to the theme of your submission!

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40. **Name:**

Submission ID: 49204363

Provisional Title: Modeling a Rocket movement Using Empirical Modeling Principles in 2D Space

Abstract: Analyzing Rocket Movement is a very hard task taking in account all the forces that will affect the rocket during its flight. And trying to model this movement in traditional or object-oriented programming languages will force a limitation on how we interact and learn from this model especially when trying to change or extend the parameters affecting the movement of the rocket in an easy and obvious way! But Empirical Modeling principals introduced new concepts that will allow the building of robust models that can be manipulated and extended at run time, which introduce more interactive models for learning and interaction. Eden and Cadence were introduced to be used as IDE (Integrated Development Environment) to build Models using EM principles.

Model description: In my Work I will be using both Eden and Cadence which will allow taking advantage of both Tools features in Building EM models. My work will be focusing on building a model for rocket movement that can be used to explore EM principles also to make others ,who are interested in the field of Rockets and Aerodynamics, interact and learn from a lively model demonstration. Rocket movement is influenced by several forces and is the focus of several fields of study like Aerodynamics and Gravitational forces. And there is a strong relation with thermodynamics and gas dynamics to study the effect of how other factors can affect the movement of the rocket. I will be focusing on the most important forces that will affect the movement in 2D space, trying to build an Interactive model which will allow manipulation of Parameters (Like : weight, Dimension, Fuel amount and Type, Gravity …) and will show the rocket movement in 2D graphics. Eden will be used to build Observables and dependencies which will show the UI (User Interface) elements and the rocket movement in 2D space. Cadence will be used to build Observables and dependencies to model the rocket and the different forces which will affect the rocket movement.

Eden and Cadence will be interacting with each other using principles of Handler and Oracle to pass messages between them.

References:

- NASA documentation on Rocket Guide: http://exploration.grc.nasa.gov/education/rocket/bgmr.html
- Also will be Using EM site documents and publications

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: See my general comments on category C and F modelling. I'm not familiar with rocket science but by reputation it should be quite difficult (as opposed to what is reportedly "not rocket science"). I would imagine that Cadence-with-EDEN is a good medium to use for your simulation, since I'm presuming that the rocket behaviour will have some conspicuous elements of feedback involving process-like observables where e.g. the consumption of fuel changes the weight dynamically etc. Though it may seem that motion of a geometric object is the best way to give vivid expression to an observable, I'm not sure that is the best way to highlight all the interesting and educational interactions (for instance, it may be easier to gauge the speed of a vehicle from a speedo than from watching an object move across the screen). Perhaps there is a case for visualising the interaction between diverse observables in a different kind of interface (like a dashboard style), where modelling in category K may be relevant.

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41. **Name:**

Submission ID: 49138714

Provisional Title: An Educational tool - Teaching how to serve spinning ball and hit spinning ball in Table Tennis

Abstract: This paper primarily deals with the potential of using Empirical Modelling (EM) as a simulation tool to teaching people learn how to serve spinning ball and hit spinning ball in Table tennis(Ping Pong). Table tennis is a popular sport in Europe and Asia, and it was origin from Britain in the end of 19th century. With origin, European people like to play tennis but this kind of sport is easy to affect by the weather and playing field. So they put tennis indoor, on the table, and it became to another type of sport, it named table tennis. The rules of table tennis are not hard, one player stand in one side of table and serve the ball. Another people stand in the opposite side to hit the ball back. Points will scored by a player when he/she makes his/hers opposite player to fails to return the ball. However, a profession player or a skilled player can serve many types of spinning ball to altering ball's trajectory, and this is very lethal to the opposite player, because spinning ball can cheat opposite player and make him/her hit ball with wrong direction to lose the ball. So the techniques for serve ball and hit ball are absolutely very important for table tennis players. Author prepare to use Empirical modeling to approach to analyse the techniques by how to serve spinning ball and hit spinning ball in table tennis. Because EM (Empirical modelling) is a suitable tool to demonstrate the procedure of serve ball and hit ball in a simple and intuition way. With expectation, with EM's help, this simulation can showing three frequent types of spinning ball.: Back spinning ball, Right spinning ball and Left spinning ball. So the people who want to learn table tennis can get some basic knowledge and skills of serve spinning ball and hit spinning ball in the correct way through EM's help.

Model description: Central concept of this modeling is to elaborate a model of phenomenon in table tennis. There is a previous modeling named Interactive Empirical Model Design Simulation of Aircraft that can refer to the Table tennis model. That Aircraft simulation is a 2D simulation tool, it will be much better if it uses 3D, but developing time is a vital element in the whole develop schedule. Aircraft simulation tool uses three different definitive notations such as EDEN, DoNaLD and SCOUT. EDEN is a general purpose language that supports the concept of definitions such as scalars, strings, lists. DoNaLD is using for definition the 2-D line drawings. SCOUT is using for windows, displays, screen lay out and attributes. In the modeling of aircraft, the whole plane is observable, the tail fin and wings of plane are agency. The air flows around the wings are dependency of the modelling. After plane take off (click the 'take off' button in the screen) from land, user can try to change states of modeling ('Turn left' wing or 'Turn right' wing), then the state of plane will be change (origin author of this modelling using air flow to show how did state changed). The information of plane is showing in the top left corner of screen to tell user the operating on plane is success or fail. Concern about the modeling which will be developing in the future (Table tennis), author also prepare to use EDEN, DoNaLD and SCOUT. EDEN can be used to check and control constraints that must be observed between table tennis table, hollow ball and racket. DoNaLD can uses to construction the table tennis table, hollow ball and racket and air flows. SCOUT will use to provide a view port window to the whole experiment and displaying information such as ball's spinning, error message, hit direction.

References:

- W.M.Beynon. Empirical Modelling for Educational Technology. Proc. Cognitive Technology '97, University of Aizu, Japan, IEEE, 54-68, 1997. [047]
- Nicolas Pope and Meurig Beynon. Empirical Modelling as an unconventional approach to software development. Proc. SPLASH 2010 Workshop on Flexible Modeling Tools, Reno/Tahoe Nevada, USA, October 2010 [113]
- W.M.Beynon. Definitive principles for interactive graphics. NATO ASI Series F, Vol 40, Springer-Verlag, 1083-1097, 1988.[005]
- Interactive Empirical Model Design Simulation of Aircraft URL: http://www2.warwick.ac.uk/fac/sci/dcs/research/em/publications/web-em/04/aircraftsimulation.pdf

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: This topic is somewhat similar to submission 30, which always relates to spin in table tennis, and to modelling categories E and F. From the model description, it seems that the emphasis in this case is more on F (how spin is generated) than E (how spin affects the responses and strategies of players in a game). I don't know enough about the physics of the situation to be able to judge whether your construal of how spin is imparted by a table tennis bat is plausible. Certainly, there is sufficient technical difficulty in making a reasnable construal. Though you haven't mentioned the possibility of using Cadence here, it may in principle simplify the modelling significantly - giving that aerodynamics generates many process-like observables. A major problem in making the link with learning basic skills in serving is of course that there is no suitable interface for this purpose unless you consider input via a device such as a wiimote (cf. comments on submission 30).

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42. **Name:**

Submission ID: 49134723

Provisional Title: Empirical Modelling of a Retail Queueing System

Abstract: One of the key goals of modern high street retailers is customer satisfaction. Big names in the retail industry such as Argos want to provide an excellent standard of service, in order to retain their customers and maintain a strong brand image. Furthermore, customers expect these companies to provide a professional, efficient service within minimal waiting time. • If the retailer does not have enough cashier staff to meet the demand for service, then the number of waiting customers shall increase. If this continues some customers may choose to leave the queue or express their frustration. • If however the retailer has too many cashier staff, then they are likely to be underworked and become an expense for the business. The optimal situation is for there to be the correct number of staff and resources available in store so that a customer can be served immediately when they request service. In the real world this is very difficult to ascertain, because of the wide variation in customer wants and needs. Take for example the variables transaction length and the period of time before a new customer joins the queue. These have a high degree of variation, so will need to be represented as average values. I intend to research current retail queuing systems to obtain suitable values for these variables. The paper will be comprised as follows. It will begin with an overview of the problem discussed, followed by a discussion of the model itself. Any particularly important aspects of the model will be highlighted here, perhaps with code fragments to explain their functionality. Next, I will focus on the limitations of the model, of which I suspect there will be many. Social factors for instance are incredibly unpredictable. Customers may enter the queue as groups of people, rather than singular customers, making calculations much more challenging. This will also be an opportunity to express which of these limitations were caused by unpredictability of human nature, and which ones were restrictions of the Eden software. Upon considering limitations, I'll look at the models suitability. Could it realistically be used to model this scenario? The paper will close with a suitable conclusion that outlines the key findings of this investigation.

Model description: There will exist two main parts of the model, the 'queuing line' and the 'serving area'. Customers will go through the queue in a first in, first out (FIFO) fashion. They will be represented in the queuing line by a symbol (for now say a green circle). New customers will join the queue by appearing at the back. The serving area will display a number of serving points (tills). Each of these serving points can be operated by a casher (represented as a red circle). If a cashier is not occupied at a given time, then the first customer in the queue will interact with the available cashier to complete a sale. Upon the completion of the sale the customer is no longer required for the model. The process continues whilst there remain customers in the queue. To add complexity to the model, the user will be able to change particular variables to obtain a desired outcome. These variables could include (but are not limited to), • The number of customers in the queue • The rate at which new customers join the queue • The time taken for a transaction to be completed. • The number of tills available. • The number of cashiers available to operate the tills. • The 'skill level' of the cashier (determining the speed they can carry out a transaction). If the empirical model represents the environment correctly, then a retailer could use it to make important predictions such as the following. • The estimated wait time from a particular point in the queue (which could be relayed to customers as a means of reassurance or honesty). • How long a particular customer waited in the queue (from the point they joined the queue, to the point where they were served by a cashier). • The optimal number of cashiers that need to be working to meet the demand (given the length of the queue or the rate at which new customers are joining the queue).

References:

- 1) G A Vignaux, The Bank: an example of SimPy Simulation, 2007-10-26.
- 2) Ming Kin Lai, Queueing Theory, 2007-02-02. 3) L. Kleinrock, Queueing Systems, Vol. I: Theory. Wiley, New York, 1975.

Weighting: Paper - 60 / Model - 40 (Paper not exceed 6 pages)

Comments: This modelling study relates to category H. There are of course some very effective tools for building business simulations of this general kind, and I think it would be good to see some references to these included. There is a danger that if your "observation regime" is too abstract and rule-based, then you gain nothing by using EM (cf. the comments on submission 24 relating to simulation from scientific theory). It's where action is primarily guided by personal observation, and people have autonomy (e.g. to queue jump) that EM is more relevant. From that perspective, observables like "the optimal number of cashiers" and the "current length of the queue" are also somewhat objective and impersonal in character. It is the openness to the unexpected and unpredictable that you need to be able to exploit in an EM model. The idea of incorporating other meta-observables that might be supportable with current technology may be of interest: for instance, might it be possible that the number of items to be processed for those people in a particular queue could be maintained by dependency, ***as if*** *it could be determined in real-time? A possible source of inspiration here where there is a contribution from meta-observables might be the restaurant simulations by Roe and Hutchings (restaurantRoe2000, restaurantHutchings2005). You don't say anything about the EM tools you propose to use. The visualisation used by in trafficlightMendis1997 might be of an appropriate kind. Using Cadence to model the queueing process would add technical strength to your model, and compensate to some extent for any kint of closed-world about it.*

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43. **Name:**

Submission ID: 49128728

Provisional Title: Modelling with dependency - Understanding our solar system using empirical modelling

Abstract: Our solar system is comprised of the sun and many astronomical objects, the eight well known planets amongst other dwarf planets and asteroid belts. Each of these celestial objects has a different physical composition and therefore has varying properties, for example the gravitational force exerted. Many dependencies exist within the planets of our solar system, orbits, length of days, temperature and chemical composition to name a few, this construal will provide a unique learning experience to modellers demonstrating how these concepts are related. Previous research has shown that technology-enhanced learning has had limited uptake and influence, this paper will focus on empirical modelling as a technological environment for learning. Initially identifying problems with existing computer based educational programs, and instead proposing that empirical modelling construals can be used as a more targeted educational aid. This paper will also identify issues such as how learning works, before demonstrating how empirical modelling can be used to achieve such requirements. This construal's theme is modelling with dependency- drawn from Benyon's 2007 paper . Thus the aim is to create appropriate dependencies within the solar system model so that a human interpreter can make connections between the observables within. The construal will allow a modeller to gain understanding from a non traditional viewpoint, they will be subjected to observables in the form of celestial objects, the agents that make changes to observables and dependencies which arise between observables. This experimental method of teaching allows a modeller to work out for themselves the connections between observables and thus to work out the dependencies which are taking place. Seemingly simple experimentation will hopefully result in the modeller learning about real world dependencies. The paper will conclude with the findings from the experimental solar system model with respect to a modeller's learning experience.

Model description: The solar system model will demonstrate the sun and eight planets and their interdependencies: • Names of planets • Ordering of planets (from the sun) • Orbital path • Rotation on axis (tilt) • Natural satellites (if any) • Length of day – the rotation period (and relative to Earth) • Orbital period – length of year (and relative to Earth) • Physical composition • Temperature • Mass (and relative mass to Earth) There is also scope to add asteroids and comets to the construal, providing a full solar system dependency learning experience to modellers. The construal will be

created using Cadence, though if many difficulties appear this is subject to revision back to using Eden. Scout (Definitive notation for Screen layout) will be used for modeller interaction, such as to set or change observable values. Donald (Definitive Notation for Line Drawing) will also be used for 2D graphics such as the orbital paths and the coordinates celestial objects will rotate around. LSD Specification of the observables in the solar system construal (the agent is a celestial object): 1. State observables – name, order from the sun, orbital path, rotation on axis (tilt), natural satellites, length of day, orbital period, physical composition, temperature, mass 2. State oracles – rotation on axis (tilt) 3. State handles – Mass, Temperature, physical composition, rotation on axis, orbital path

References:

- http://www.ifets.info/journals/10_1/10.pdf - - Computing technology for learning - in need of a radical new conception
- http://www.technology-in-education.co.uk/view-online-magazine/digital-magazine-archive/
- M. Beynon, A. Harfield, Lifelong learning, Empirical Modelling and the promises of constructivism, Journal of Computers, 2 (3), 43–55.
- M. Beynon, S. Russ, Experimenting with computing, Journal of Applied Logic. 6 (2008) 476-489.
- http://www.astro.uu.nl/~strous/AA/en/antwoorden/planeten.html#1_27

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: This model is principally in category C, though the wide range of observables over and above those relating to dynamics raises other issues. This model looks really quite ambitious, and the choice of Cadence seems like a good idea, since it has the sort of features that can conceivably overcome problems that would be faced in trying to use EDEN alone. You should not be too concerned if it proves more difficult than you imagine to meet your goals: given the lack of prior experience in this area, modelling the core dynamics using Cadence would itself be a considerable achievement, I think. Your model has themes in common with submissions 4 and 11 and it would be worth discussing your model with them also.

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44. **Name:**

Submission ID: 49122939

Provisional Title: Definitive Procedural Calculations

Abstract: Calculators are very procedural tools, but at a component level, when dealing with boolean bits of data, they lend themselves very well to definitive modelling. I aim to construct a model using Cadence (and possibly EDEN for graphics) of a calculator at this level to provide a tool for understanding the workings, and experimenting with various ways the components can fail (for example, a bit being stuck ON, an LCD display getting mixed up, 2 buttons being swapped, or a button not working, a logic gate not working, etc.). This model can also be compared to a simpler, purely definitive model which serves the same function.

Model description: The model will contain various components of a calculator, including binary data storage (8-bit stores) and manipulation (add, multiply, subtract and divide, all taking 2 stores as input and outputting to another), LCD display (taking a binary store input and outputting a decimal numeric representation to the screen), a simple interface (number buttons, 1/x, +, -, *, /, = buttons), and if time, a full calculator from these components. A couple of other components will also be necessary for the full calculator; a decimal->binary converter for interpreting button presses, and a

binary store with memory for storing the previous number. Binary stores could communicate through bools or strings of the style "00100101" (strings would make it possible to extend it to 16-bit, 32-bit, etc. logic without much trouble, but would be more work to implement) The model will allow standard interaction through pressing buttons and seeing output, as well as a graphical representation of the internal workings (e.g. all binary stores rendered to the screen, etc.) Users will also be able to damage parts of the model, for example by making a bit always true, to see how this effects the operation. If possible it would be nice to make the components reusable, so that complex "circuits" could be made (for example, linking a multiply block with an add and another multiply to create an interpolation gate). If there is extra time, it could also include a sine implementation based on an optimised 8-bit sine algorithm.

References:

- The only really complicated part is the division operator, which I plan to adapt this method for; http://www.bearcave.com/software/divide.htm (this will mean converting the loop into a static sequence of actions of set length) Outputting to the LCD can then be done by combining several of these division stages; a divide by 10, using the remainder as the right-most digit and the output into another divide by 10, and repeating. The rest of the logic required is based on very simple principles.

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: I classified this modelling study as category G (computing systems related) and also thought of it in ISM terms (cf. category F). Having looked more carefully at what you're proposing here, I see that it neatly illustrates the limitations of the exclusively definitive-script style vision of EM that has dominated my vision of EM until recently - when it was challenged by Cadence: there is a sense in which your models of physical artefacts are in fact process-like in character, showing a kind of duality between the continuous-change and latent-change models of experience. It may or may not be of interest to consult the ELS model from WEB-EM-3 if you're not already familiar with this - it's highly critical of EDEN - but perhaps does the kind of thing that you are here engineering via Cadence (cf. my comments on submission 24). Another somewhat related submission is 37. The model you have in mind is of "incidental interest" as a possible alternative way of implememting arithmetic in Cadence (cf. the discussion in Chapter 4 of Nick's draft thesis).

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45. **Name:**

Submission ID: 49119927

Provisional Title: Internal Combustion Engine with Gear

Abstract: Most of us use a vehicle powered by an internal combustion engine every day of our lives. Yet most of us are not familiar with even the most basic principles behind this incredible invention, which has helped shape our world the way it is today. This educational model attempts to describe the fundamental workings of the internal combustion engine to the novice user, as well as to explain how the power it generates is delivered through the gears in the transmission. Mechanical artefacts are perfect candidates for empirical models. The interaction between the different parts of the device and the effects they have on each other can be modelled effectively with dependencies. For example, the combustion of the air and gasoline mix inside the engine projects the piston downwards inside the cylinder, which in turn rotates the crankshaft by means of the connecting rod. Empirical Modelling's main software tool, tkeden, provides the necessary functionality, in particular dependency, to model these cause-and-effect relationships in a simple yet efficient manner, and

present them clearly to the user through the use of DoNaLD. Anyone who has driven a car will know that engine speed (RPM) reduces when the next gear is shifted. Even if they are not knowingly aware of it, this concept will be familiar even to people who have never driven, such as children, indirectly through the characteristic sound of an engine going through the different gears. The emphasis of this model is on explaining these familiar phenomena, which most people would find difficult to explain.

Model description: The model will be divided into three main parts: the engine, the transmission, and the controls and instruments. Only one cylinder of the engine will be displayed for the purpose of simplicity and clarity. The main functional parts of the engine will be displayed, in a purposefully simplified, diagrammatic fashion, while secondary parts, which only serve to enable or enhance the operation of the main parts, will be ignored. The main parts include the cylinder, piston, crankshaft and connecting rod, along with the intake and exhaust valves and the spark plug. The engine part of the model will also be animated, with the speed of the animation dependent on the amount the throttle pedal (described below) is depressed. Annotations will be updated as the different parts operate to describe their current status, e.g. exhaust valve open or closed. The transmission will be intentionally simplified to resemble a bicycle transmission, which will be more familiar to users as it is clearly visible on bikes. While this is factually inaccurate, it greatly improves the user's understanding of the model, and the underlying mechanical principle described is identical to that used in a car transmission, albeit implemented differently. The engine's clutch and the active gear will be displayed and animated, with the size and gear ratio of the active gear representing the gear currently in selected by the user. The controls and instruments sections will allow the user to interact with the model. An engine start/stop button will act as the ignition, a slider will represent the throttle (accelerator pedal), and an H-shifter will allow the user to select the active gear. A tachometer (rev counter) will also be displayed, which will be directly linked to the speed of the engine animation, and therefore also to the throttle and active gear. Finally, the model will be able to detect inappropriate use of the controls and engine. For example, if the user shifts into fifth gear from first gear, the engine will stall, and if the user shifts into first gear from fifth gear, the engine will blow up and the transmission will break.

References:

- Cruise Control Model: cruisecontrolBridge1991 http://empublic.dcs.warwick.ac.uk/projects/cruisecontrolBridge1991/
- Engine reference: http://www.howstuffworks.com/engine1.htm
- Transmission reference: http://auto.howstuffworks.com/transmission.htm

Weighting: Paper - 40 / Model - 60 (Paper not exceed 4 pages)

Comments: This is a good example of a category F style modelling study. It is probably a good idea to consider whether the ISM concept I mention in relation to this category of models is suited to talking about the model you are constructing. It may also be useful to consider whether a simple LSD account of your model can be given (cf. Bridge's cruise control model). I know that at an early stage you had seen James Allderidge's engine simulation also - showing that you could link his model to his would be a good additional feature illustrating a significant characteristic of EM as a whole. (Of course, this - it seems may involve - reconstructing Allderidge's model, alas! - though I shall continue to look out for it ...) You may also find it interesting to compare notes with the author of proposal 21 - integrating your models in some way might be of mutual interest.

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46. **Name:**

Submission ID: 48920469

Provisional Title: Inferences About The Game of Mastermind

Abstract: Mastermind is a simple two player code-breaking board game. One player is assigned the role of code-maker who sets a code (four code positions are filled respectively with a code peg that can be one of seven different colours in any particular order). This code is hidden from the code-breaker, the opponent, and they have ten guesses in order to find the correct sequence of code pegs. After each guess, the code-maker notifies the code-breaker how many of his pegs are in the correct place, and how many are of the right colour. From this, the code-breaker can infer certain facts about the possible set of remaining codes. This project aims to build an empirical model of the game of mastermind and to visualise in a tabular form the set of inferences that can be made from the results of a player's guesses. In doing this, we can explore all possible inferences that can be made about the state of the game at every move. It is also possible to warn the player if they make a guess that is certain to fail. These kinds of dependencies highlight the power behind empirical modeling. If the user of the model adopts the role of a programmer or as someone who analyses the underlying model, the dependencies can be changed at will. This provides insight into how the model works and helps the end user to better understand the dynamics of the game of Mastermind in addition to the logical thought process that is required in order to break the code. At the end of the project, the end user (and indeed the model author) should have gained knowledge of the best strategies to win at a game of Mastermind, and to understand the conditions that need to be checked in order to ensure that each subsequent guess yields new information for use in making the following guess.

Model description: There are two main visual components and one main logical component to the model, as follows: Interactive Board: Comprised of ten rows of four guess peg slots (most likely modeled as circles, that pegs can be placed in), ten rows of guess score slots (one set of four guess result slots per guess row), A submit guess button, a current guess row, buttons to interact with the current guess row. Board Explanation - The user can select their guess using the interaction buttons that select a position and a colour. Once they are happy with their selection the submit button can be used to 'commit' the guess to the board and to have it scored. The guess is then transfered to the next available row on the board and the result is calculated. The score pegs are then displayed adjacent to the guess for the player to analyse. If the user guesses the correct code the result, a congratulations dialog is displayed and the interaction buttons are disabled. If the user has not guessed correctly after their tenth and final guess, the result is displayed, a commisseraions dialog is displayed and the interaction buttons are disabled. Inferences Table: Comprises of ten rows of multiple textual columns. The columns comprise of multiple text labels that display the inferences that can be made about the model for the corresponding row or guess. Explanation - For any given guess the model has to establish whether each element of the guess results in a score peg being displayed to the user. This peg has to be placed in a random score peg. If the element we are considering is a colour that has been used in the secret code, a white score peg is required. If the element we are considering is the correct colour in the correct position that has been used in the secret code, a red/black score peg is required. Using these results, we can establish which of the guess orbs are fully-correct (correct colour in the correct position), semi-correct (correct colour in the wrong position), or not-correct (colour not used in the code). These conditions of each orb can be displayed as text labels. The inference display can be hidden or shown as necessary via an interactive button. Game Engine and Inference Logic: Comprises of a set of dependency functions that update as guesses are committed. The game engine is also responsible for creating a random code initially.

References:

- AN ALGORITHM TO PLAY THE GAME OF MASTERMIND - T. Mahadeva Rao. http://portal.acm.org/ft_gateway.cfm?id=1056607
- HUNT THE WUMPUS: AN EMPIRICAL APPROACH - Cole, University of Warwick, 2005 {"wumpusCole2005" - University of Warwick Empirical Modeling Library}
- Investigations into the Master Mind Board Game, Break the Hidden Code - Toby Nelson, Feb 1999.

- http://www.tnelson.demon.co.uk/mastermind/ ONLINE JAVA APPLET TO PLAY MASTERMIND - 2010 Demand Media, Inc.
- http://thinks.com/java/mastermind/mastermind.htm ONLINE JAVA APPLET TO PLAY MASTERMIND 2 - Keith Drakard, June 1998.
- http://www.irt.org/games/js/mind/ YET ANOTHER MASTERMIND STRATEGY - B. Kooil, University of Groningen, The Netherlands, 2005.
- www.philos.rug.nl/~barteld/master.pdf

Weighting: Paper - 30 / Model - 70 (Paper not exceed 3 pages)

Comments: This is an excellent instance of a category A modelling exercise. It's a fine idea to carry forward the principles illustrated in Cole's Wumpus model to the Mastermind context, and it may be worth bearing in mind the possibility of applying a similar idea in other contexts also (I could imagine how it could be applied to Sudoku solving for instance). Though such extensions are beyond the scope of what you need for this modelling study, they could perhaps be helpfully / briefly discussed in your paper. You don't mention whether you intend to use EDEN or Cadence, but both may be useful (as illustrated in the wordgame example Lab 6). Certainly it would be good to see the object-like features of Cadence being used to simplify the description of the model, even though this may not be as essential as it is in the case of the PENTE proposal number 29. Whilst the main role of your model may be to demonstrate sound inference in the puzzle solution, it may also be of interest (especially from an EM perspective) to consider how you might represent the reasoning errors that we are prone to make when solving puzzles of this nature.

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47. **Name:**

Submission ID: 48622104

Provisional Title: Understanding exchange rates – An EM learning approach

Abstract: The exchange rates of currencies are of importance for every international company in the world. As a consequence, it is necessary to understand how these exchange rates are constructed and by what factors, i.e. observables, they are influenced. Trying to explain them, finance scholars employ four theories, which are dependent on each other. They make clear why there is a certain exchange rate from one currency into another. The dependencies between the theories have been given names. For instance, the Interest Rate Parity relates the difference in interest rates to the difference in forward and spot rates, whereas the Expectations Theory relates the expected change in spot rates to the difference between forward and spot rates. Students may rely on numerous books explaining these theories, but even with examples provided, there is often little chance of getting an instant intuition of what happens when one or several observables change. My model shall enable students to apply interactively what they have found in the literature about how the currency system works. The corresponding paper will describe in more detail how the theories relate to each other and how the Empirical Modelling principles are being manifested in the model. It will also show why in this case Empirical Modelling is superior to the standard approach of programming in Computer Science both from the viewpoint of the developer and the user.

Model description: The EM model will be based on the dependencies of the four theories as described above. Observables subject to change are the following, whereby A refers to currency A and B refers to currency B: interest rate of A, interest rate of B, forward rate A to B, spot rate A to B, expected spot rate A to B, expected inflation rate A and expected inflation rate B. The spot rate is the rate at which a market participant can exchange currency A to currency B, whereas the forward rate describes the rate at which one can buy or sell a currency forward, i.e. setting up a contract today to

buy or sell a currency at a fixed point of time in the future. As basic functionality, a list of all the observables will always show their current value. The interactant will be provided with input fields to change the current values of observables. These changes will affect the current values of observables, which helps the interactant to establish an intuition of how the currency theories interrelate. At the moment, I do not have a clear plan of how exactly my model will look like. But this is well in line with the Empirical Modelling idea of exploration evolving during the modelling process. This contrasts the thorough planning and setting of functionality required before starting a project in traditional programming.

References:

- Richard A. Brealey, Stewart C. Myers, and Franklin Allen. Principles of Corporate Finance. McGraw-Hill, Ninth International Edition, 2008.
- Karl Georg King. Uncovering Empirical Modelling. Master Thesis, University of Warwick, 2006.
- Soha Maad. An Empirical Modelling Approach to Software System Development in Finance: Applications and Prospects. PhD thesis, University of Warwick, 2002.
- Chris Roe. Computers for Learning: An Empirical Modelling perspective. PhD thesis, University of Warwick, 2003.
- W.M.Beynon and Chris Roe. Computer support for constructionism in context. In Proc. of ICALT'04, Joensuu, Finland, 2004, 216-220.

Weighting: Paper - 50 / Model - 50 (Paper not exceed 5 pages)

Comments: This looks like a very well-conceived modelling study to which my comments on category H modelling are perhaps the most likely to be relevant. Whilst in that context I've emphasised the importance of not having completely uncontroversial construals, it is quite appropriate to use standard construals in an educational context, especially where the learner is unlikely to find these construals obvious. The idea of animating accounts given in textbooks is a good one - it is represented in graphicspresHarfield2007 which is based around EM models I made when lecturing from a standard textbook on graphics. It may even be that you could profitably use the EMPE for your model-building (as was done in Antony Harfield's model), as this would give you means to annotate your interactions and so assist explanation. You might also be able to use Cadence in maintaining the underlying relationships between financial observables in your model, though - as of now - I'm not sure that the EMPE can be incorporated in Cadence-with-EDEN (I don't think it can on ubuntu). (My brief discussion of category K modelling may also be of some interest where visualising the impact of parameter changes is concerned.)

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48. **Name:**

Submission ID: 50237169

Provisional Title: Understanding Collision

Abstract: A collision can be defined as interaction between two objects that have made contact with each other. As in any interaction, a collision results in a force which is being applied to the two colliding objects.Newton's third law of motion which says "action and reaction is always equal and opposite" applies to collision of two objects. Physical quantities such as Mass,Velocity,Momentum,Kinetic energy of the objects can be used as variables . Basically, Collisions are of two types such as elastic and inelastic collision. The proposed model depicts the

effects collisions between objects. This model will help to understand various effects of change of variables in collision.

Model description: The main aim of this model is to introduce the effects of collision between objects. This model will experiment various terms such as if the bodies come from particular angles , with different velocities and different masses then what will be the effect on their mass and velocities,energy after collision.When two bodies collide, then kinetic energy,linear momentum remains same in elastic collision whereas it changes in inelastic collision.

References:

- Nelkon, M. and Parker, P., 1977, "Advanced Level Physics," 4th ed., Heinemann Educational Books, London.

Weighting: Paper - 70 / Model - 30 (Paper not exceed 7 pages)

Comments: This is a classic simulation with links to modelling categories C and F. Your model proposal is quite similar in character to submission 33, and many of my comments on that submission apply also to yours. In your modelling description, you have described your vision in terms that suggest a way in which you can perhaps counteract the somewhat constrained nature of the construal you are obliged to adopt in simulating collisions. Perhaps you could develop on the idea of how different kinds of physical object respond depending on the angle of incidence on collision and their physical characteristics. It would be interesting to put this in the context of a human (perhaps even a child's) expectations of outcomes. For instance, if we have spherical / 2d circular bodies of different nature and dimensions - like a balloon and a ball bearing, what do we expect to see when they collide? Making an environment in which this could be posed as a interactive challenge in prediction would add a more empirical educational ingredient to the scenario. This is of course just a suggestion!
