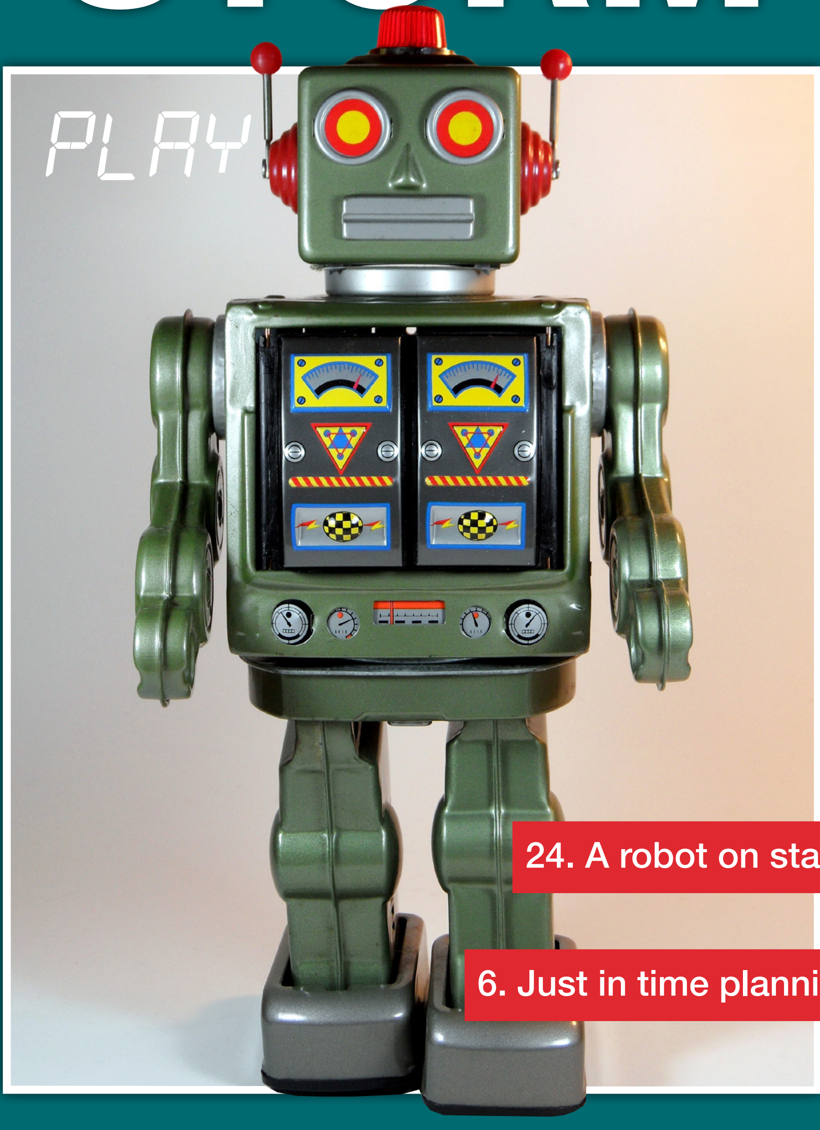
BRAIN STORM



24. A robot on stage

6. Just in time planning

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●○○ Entertaining article, no scientific content. A puzzle or a Cover related article are examples of this category.

●●○ Easily readable article on a scientific topic. Should be comprehensible, even without any prior knowledge.

●●● Scientific article that explores a certain topic in depth. Might assume the reader has taken a course that's related to the topic.

EDITORIAL

BY: *Steven Warmelink, editor*

Play. All your life you play. When you were but a toddler plush toys, blocks and coloring pages were prime sources of entertainment. Later on, playing tag with peers, riding your bike or watching T.V. took over those activities. Even now you probably enjoy playing an instrument, reading a good book, doing sports, playing card games or hanging out with friends. Although we gradually have less and less time to play as we get older, we generally always make time for it.

Aside from there being many ways to play, play also has many possible meanings. When the theatre is right up your alley, you should read Femke Nagelhout's piece on actors (and her interpretation of their possible A.I. successors) on stage. Playing can also be related to playing an instrument, which Merel and Sanne both attempt with each other's instruments in this edition's Switch.

For nostalgia regarding playing with LEGO, K'NEX and KAPLA, be sure to read up on Jonathan's column. For an interactive nostalgia trip you can even try your hand at beating your friends and family at our updated version of "Ganzenbord"! More of a puzzler? We've got another interesting puzzle lined up for you.

For me personally, playing is a big part of my life; I play instruments (or at least attempt to), play board and card games on a regular basis with friends and family (for up to 12 hours at a time!) and I play around with food by trying dishes and ingredients I have never cooked with before on a regular basis. I also don't refrain from pushing the play button to watch a good TV-series or film such as Steven Spielberg's Artificial Intelligence.

People always talk about A.I. in the sense of intelligence, planning and problem-solving skills. The Turing Test is even designed to compare an A.I.'s thinking and conversational prowess to that of a human party. However, to me, any A.I. will never be truly human-like until it decides it wants to play. Because what is more human than playing?

PHOTO: *Steven Warmelink*

BY THE BOARD

BY: *Tim Haarman, internal affairs*

Life is a game, and quite a difficult one at that. An ultra-hardcore open world RPG it could be called. From the moment we get spawned in we get only one life, and once that's used up it's game over. There's not even a thing such as character creation, you're assigned a random character whose pro's and cons you have to discover and deal with. No savegames, fast-traveling, minimaps or markers indicating danger. No pause-buttons, cheats or health bars. Not to forget there's no way of winning. And still, even without all these assists that are often so crucial in all kinds of games, we manage to get an average play time per character of around 80 years. Quite impressive, when you think about it.

Just like most games, it starts out easy. In the first few levels you're being fed, you're told what to do and how to do it, and there are no difficult choices to make. The first bunch of years are the tutorials for life. Once you're past this stage the real game begins. A game of acquiring skills and making decisions. Most people will at this stage quickly find out that there are a lot of unlockables in this game, which require XP-points, resources or a specific skill-level to unlock. This is why the more experienced players unlock quests that are hard or impossible to unlock at earlier stages. Examples of this are "Own a house" and "Get a promotion".

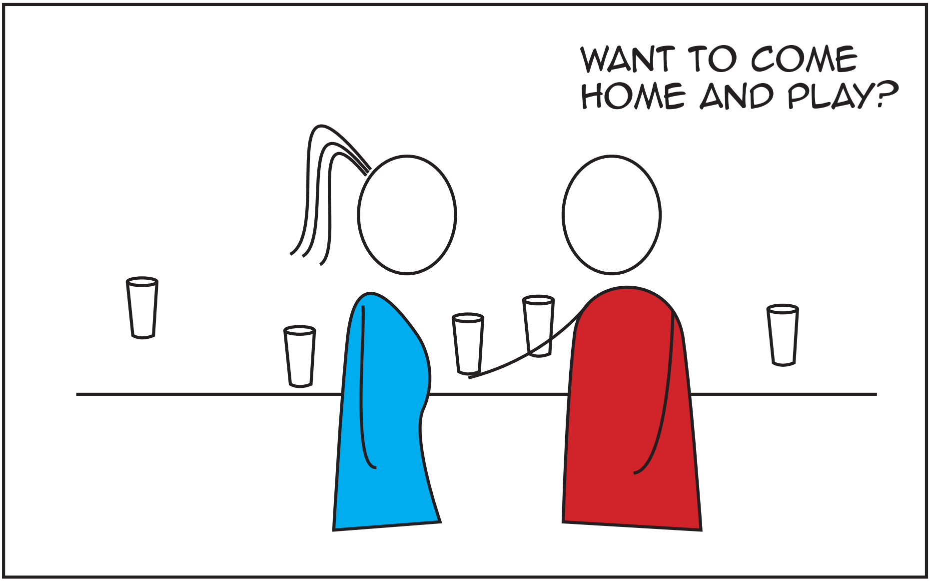
It's important to remember that there are many ways you can level up your character to satisfy these kinds of prerequisites. Studying is a good and obvious way of doing so, but so are activities such as going to a Cover-borrel which can help you get to know new players and to increase your social-skills level. You may think your constant ability to acquire new skills will get you to an overpowered state halfway through the game, but the developers have thought of that. The older you get, the faster your physical statistics start to drain automatically. You can combat this slightly by staying fit, but at some point the loss is simply greater than what you can possibly add yourself. In the end, this results in your character dying, so don't wait too long and make the most of that one life you have.

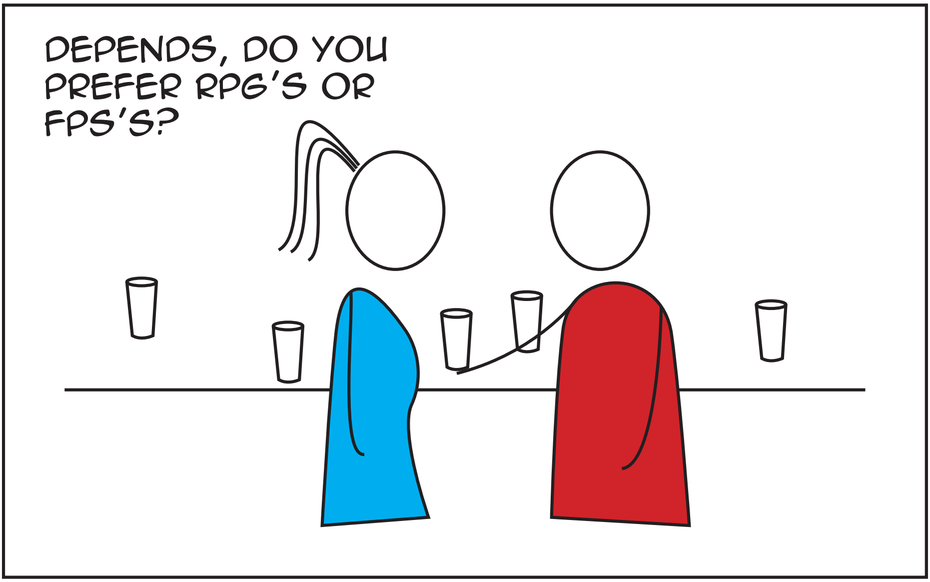
What will your storyline be? You decide. Play on.

PHOTO: *Tim Haarman*

by: Annet Onnes

COMIC





BY: Bas Hickendorff

JUST IN TIME PLANNING

Take a moment to think about what you will be doing after you have finished reading this Brainstorm. You probably have a good idea about where you will be the coming hour, but you are probably not so sure about what exactly you will be doing at five minutes past three the first Saturday next month. You might have a decent schedule for the courses you are currently taking, and probably even know which assignments to complete today, but you can probably only make guesses about what courses you will follow in this period next year. It seems that the specificness of the plans you make are proportional to how close the execution of your plan is. We seem to finish making our plans "just in time". This seems almost too obvious to think about, but when you do, it seems to be about the trade-off of "knowing exactly what to do at all times" versus "planning for stuff that might never happen".

In November 2011, I graduated with a master thesis on this topic. Well, among several other topics, because my thesis was about a certain challenge in the Robocup@Home competitions, called the General Purpose Service Robot challenge (and also because we AI'ers love to combine different fields). The challenge has changed a bit since 2011, but back then, in this challenge, a robot was given a spoken command (such as: "please get me something to drink"), then had to figure out what to do, and then actually do it. These commands could either be underspecified ("get something to drink"), erroneous ("get a drink from the kitchen" while there is no drink in the kitchen), or just complex, containing several steps ("find a drink, grab it, and then get back to me"). In my thesis I developed an architecture to deal with making plans for executing these kinds of commands.

One of the main ideas to deal with this is to delay making detailed plans until more information is known. More information can be obtained by letting the robot drive around, or letting it ask questions. The robot can start from a very high level plan ("drive to kitchen", then "make coffee", then "drive back"), and makes more detailed sub-plans when this is necessary and when new information becomes available. We call this "just-in-time planning". This is a useful technique, because the more information the robot has, the more accurate and doable its plans will be. Also, this way, the robot avoids making plans for eventualities that do not occur, and keeps the amount of possible actions small (which is nice from the perspective of searching for the best action among the possible ones).

> "knowing exactly what to do at all times" versus "planning for stuff that might never happen"

To implement this, we built a system that uses "scripts" for the high level plans (a script contains a series of steps to perform some task, but contains nothing about robot specifics, such as motor control or localisation). It would then, just as far in the future as needed, break those scripts down into smaller pieces, and eventually into low-level behaviours programmed in the robot. It would also try to actively find the information necessary to make the steps in the script more specific, for example by asking questions. When testing in the lab, the system worked well, but testing of the system on the RoboCup 2011 competition in Istanbul it turned out to be quite a disaster. This was because being able to reason about scripts is nice, but if the robot just crashes into a table because of an obstacle avoidance failure, you can't reason yourself out of that. Concluding that hardware led to all kinds of problems that I do not enjoy solving, I decided to focus my career on software, and left running that software on hardware to others.

Scrum is essentially doing just-in-time-planning

After graduation, I became a programmer at Rabobank, via the outsourcing company Ordina. Both Ordina and Rabobank are quite massive companies, and so this turned out to be a completely different kind of programming than what I was used to at the university. Not because of the language or systems used, but because of the many, many people having a say in how the software should work, and the fact that producing the software is distributed over so many people.

In university, you can spend a day developing a new feature for a robot, decide you like it, and put it in. In a big company, this is a whole other story. There are people writing specifications, other people writing the code, yet other people testing the code, and then again other people deciding this is not the functionality they want. This might sound negative, but it is almost unavoidable when you have hundreds of people working on the same (set of) systems.

Because working on a project with so many people can easily get out of hand, many methods were developed to structure the work done by the different teams. One of the most successful methods is Scrum. Scrum is one of the many "agile" approaches, that focus on being able to react quickly on a changing environment (usually changing requirements for the software). This is done by treating software development in a very iterative way. All work is done in so called "sprints", which is a time-boxed period (usually 2 weeks) in which a team builds certain functionality. After the sprint, the work is reviewed with the stakeholders in a demo, and a new sprint is planned. The meaning of "Planned" in the Scrum is actually closer to the meaning of it in A.I. than the meaning in business. Its less about deadlines and more about breaking down tasks in more and more specific plans (sounds familiar?).

PHOTO: Nao planning

There are several other ingredients needed to successfully implement Scrum, but the planning of a sprint is the element I want to highlight here, because I realised it has something in common with my master thesis: Scrum is essentially doing just-in-time-planning. Only, instead of a robot performing a task in an environment full of uncertainties, it is now a team writing and testing software in an environment full of uncertainties. The same challenges apply: there is uncertainty about what needs to be done exactly, there is uncertainty about whether some tasks will succeed at all, tasks might be much more complex than foreseen, or a task might actually not be achievable at all, because some assumptions are wrong. I find it fascinating that we can apply the same kind of solution in robotics, and in software development. That solution is only working out the details of that what you need right away, and keep your plans more vague when the moment of execution is further away.

Although I did enjoy working at such a big company, and Scrum certainly made working there more fun, I missed the more creative part of software writing that I was used to at Artificial Intelligence. I therefore moved to a company called Fox-IT which specialises in IT security. (not to be confused with either the crappy pdf-reader or the TV channel). This turned out to be an environment quite similar to university, in the sense that a lot of experimental, cutting-edge work is done, with a lot of room for your own creativity. The company is much smaller than I had previously experience with, and this gives a lot more freedom in your work, but also a lot less structure. Again, Scrum came to the rescue. It helps us to get more and more clear what exactly we should build by iterating, and specifying just those parts of the software we are about to build. Of course we also look a bit further ahead from time to time, but we try to do this on a more conceptual level. This requires practice, but funnily enough, the principles of Scrum, apply just as well to learning Scrum itself, so we keep iterating. I do not know if agile methods have found their way into the curriculum yet, but if not, I encourage you to try it out!

Well, it seems I have finished this piece just-in-time for the deadline, really in the spirit of both the topic under discussion, as well as my general style of study when I was writing my thesis.

PHOTO: *Bas Hickendorff*

ZERO-TOLERENCE MATH: A DEFENCE OF NO MATH

BY: *Michael Wilkinson*

In this paper I extend the concept of "No Math" which was first introduced by Harris (2000) during the Florida elections. The results of this work show the existence of a hitherto unknown class of numbers, dubbed politically correct numbers. It is also shown that all other numbers are either illegal or irrational, and should therefore not be taught to children. The "zero-tolerance" math developed here drives us inexorably to the conclusion that "No Math" is the only kind of math suitable for schools.

THE BIRTH OF "NO MATH"

It is comparatively rare that politicians introduce new concepts to science, but the 2000 Florida elections were an exception. Boldly, and controversially, Harris [2] introduced a completely new way of obtaining a correct result to a complicated mathematical equation by simply defining a value to be correct, rather than resorting to actually doing the math. This approach should appeal to school children of all ages. The correctness of her approach was challenged, and upheld by the highest (judicial) authorities, so there should be no remaining doubts about the validity of her approach. Her approach was heralded in MINI-AIR 2000-11-04 [3] as the dawn of a new era in mathematics: No Math.

To an outside observer, the No Math approach may seem arbitrary, but this is by no means the case. The answer chosen by Harris consists of politically correct numbers, i.e. those numbers which suit the political climate best. This requires a shrewd insight into politics, something which most mathematicians have studiously avoided (obviously), but which they can no longer afford to do.

In this paper I will show that No Math must replace all other forms of math education at schools, unless we wish to let the children, who are the hope for the future of mankind, to grow up learning either illegal or irrational concepts at school.

THE ILLEGAL NUMBERS (A TECHNICAL DISCUSSION)

Let us take a quick, technical look at the concept of "illegal numbers."

Phil Carmody has recently shown the existence of two illegal prime numbers of 1904 and 1401 digits [1]. They were labeled "illegal", because they could be used to decrypt DVDs, allowing any school kid to gain access to DVDs that they legally bought abroad on their own DVD-player. This is obviously illegal, and could lead kids to become terrorists or drug smugglers.

Prime numbers of more modest length are also used in data encryption, which could also corrupt our youth. If this be true, should we as responsible adults allow our children to use such prime numbers? More worrying still, where should we draw the line? If an N-digit prime number is illegal, is $N - 1$ digits safe? Could the use of small prime numbers, which after all can be used for easily crack-able encryption, not lead to an addictive response which will ultimately lead to an uncontrollable urge to use ”harder” encryption, and therefore the use of large (N digit or worse) primes?

We must therefore embark on a “zero-tolerance” approach, i.e. N = 0 for the lower bound of legal prime numbers.

IS RATIONALITY LEGAL?

This conclusion about prime numbers has profound implications for the legality of other numbers. Integer numbers can be factored into prime numbers, i.e., they are products of primes. A consistent zero-tolerance approach states that the product of illegal numbers must be illegal, and hence all integer numbers (other than -1, 0, and 1) are illegal (even those which are politically correct).

We must now turn our attention to rational numbers. Though their name suggests they are beyond suspicion, they are obtained by dividing two integer numbers. Thus they are part of an illegal number. Zero-tolerance again declares that part of an illegal thing must be illegal in itself, so rational numbers are out as well (including 1 and -1)!

THE INESCAPABILITY OF “NO MATH” IN SCHOOLS

The situation we are left with is that the only numbers we can use legally in schools are 0 and the irrational numbers. However, can we allow our children to study irrational numbers? Are they not irrational enough as it is.

Worse still, if we do allow them to perform math which only gives 0 or an irrational number as a result, the effect may be catastrophic for the environment. The reason for this is that writing down the answers (if irrational numbers other than those like π or e) requires an infinite string of digits, and therefore an infinite amount of paper and time. Students could not reasonably be expected to finish their assignments on time, nor teachers to correct them on time.

Zero-Tolerance Math now achieves a totally different meaning: ONLY the number 0 may be used.

HOORAY FOR NO MATH

Zero-Tolerance Math is obviously the only math for children. The advantages are equally obvious: correcting assignments boils down to checking that each assignment has been answered with a 0, and students can simply pick the correct answer without doing calculations. This shows the fundamental connectedness with No Math. In my view they are one and the same.

I believe that math education should be completely overhauled all over Earth. A UN task force should be set up, preferably led by eminent No-Mathematicians, possibly even Harris herself. I do not doubt children all over the world will be grateful. If we fail in this task, children all over the world will continue to be exposed to illegal and irrational numbers on a daily basis, even in the very schools to which we entrust them.

REFERENCES

[1] P. Carmody. The world’s first illegal prime number? URL=http://asdf.org/~fatphil/maths/illegal.html, March 2001.

[2] K. Harris. The Florida 2000 election results. Florida State Department, November 2000.

[3] A salute to K. Harris. MINI-AIR 200-11-04, November 2000.

COLUMN

BY: *Jonathan Hogervorst*

Play. Moby's so-called album, one of my favourites, would become his best-selling one. Ten years later he would release *Wait for Me*. I'm not sure which of the two I like most. However, both are great albums and definitely worth a listen.

When I was a kid, I used to play in my postal office. My father worked from home and I had my own working corner in his office. The postal office consisted of a desk, a pay phone, and a post box, all made out of yellow cardboard.

When I was working there, selling stamps to my parents, it'd feel like I was doing a very important job. I'd neatly write down every sale in the register as if my life depended on it. (As I'm searching for a nice image, it turns out there exist DDR *Kinderpost* editions — my feeling might have been shockingly accurate in retrospect.)

PHOTO: *phone and post box*

I'd also play with other toys. Building toys are probably most popular among children, especially those who later end up at Cover. Of course we had LEGO. We probably got it as a gift from someone who's children outgrew LEGO, since it was just a big box of random building blocks.

The only complete set I can remember is the police station (6386, for the experts). When I was playing with LEGO, I'd often build that one. (I'm now viewing the building instructions online. Oh, the nostalgia!) Some time later I'd buy a beautiful airplane (probably 3451).

Besides LEGO we also had K'NEX. By attaching rods to connecters you could build large 3D structures. The system allowed for larger and more flexible constructions than LEGO. I think I liked it more for that reason.

The design of LEGO allows for an insane number of possible combinations. Danish mathematicians researched this, ultimately writing an actual paper [1]. (Yes, it's typeset in LaTeX.) Apparently the math [2] is very complicated and for some cases it seems impossible to find a general formula. However, we do know that six 2 by 4 blocks of the same colour can be combined in 915 103 765 different ways. (If you ever need to impress a math student in a bar... You're welcome!)

On the other hand, the design of LEGO (and K'NEX) is limiting. A construction toy that's limitless is KAPLA. It consists of wooden blocks with dimensions in the ratio of 1:3:15. These dimensions allow for all possible combinations of blocks.

The beauty of KAPLA lies in it's simplicity. It doesn't have Star Wars themed sets. It doesn't need batteries. You can't loose an important brick. It doesn't even come with manuals. It's just hundreds of identical plain wooden blocks.

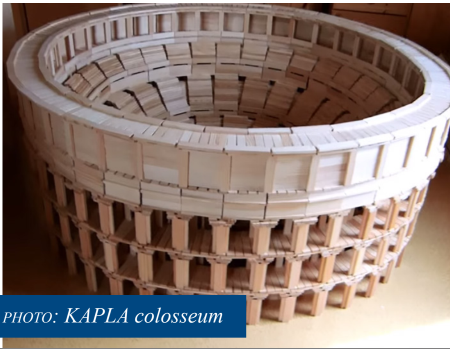


PHOTO: *KAPLA colosseum*

This simplicity results in total freedom. When building with KAPLA you're only restricted by your imagination. People have built castles, boats, trains, animals, bridges, and everything else you can image, all with no more than that simple wooden block.

While play might seem to be a primarily pleasurable activity for children, it does provide way more value. Building toys are important in cognitive development. They stimulate logical thinking, creativity, concentration, perseverance, and patience. These are all valuable qualities for the rest of your life.

Of course we don't stop playing after leaving childhood. Most people play video games, which also have have positive effects: problem solving, fast decision making, and hand-eye coordination can be trained by playing (certain) video games.

Tabletop games are also still played after childhood. Games like Catan or Risk can be really fun, while probably also training problem solving and logical thinking. And they can be played without any display, which is also occasionally pleasant.

Where has creativity gone? Of course we're still being creative while photographing. Or designing an application (visually or code-wise). Or playing a tabletop game. However, the creativity involved in these activities seems narrow: you're solving a well-defined problem within strict boundaries.

As children we used to make drawing, where fantasy animals and object would appear out of nothing. We would start constructing with our toys, not yet knowing how the building would end.

While our 'applied creativity' is definitely important, I wonder whether we shouldn't also keep using our broad creativity. Maybe we can put a box of KAPLA in the Cache? Then we can play with that, while listening to Moby.

[1] http://arxiv.org/pdf/math/0504039.pdf
[2] http://nl.wikipedia.org/wiki/LEGO#LEGO-wiskunde (Dutch)

studyboard

The game is played using 2 dice.

A player can move double the amount of tiles if he/she would land on a “toy tile”.

To win the game you need to end on the borrel. If you throw too high to end up on 63, you need to walk back.

Have fun!

6 During a company visit you manage to fix a graduation project. Move 6 tiles ahead.

19 You have to study for you exam. Skip one turn.

31 Your bike has been stolen! Stay here until another player lands on this tile.

42 You join a study trip but of course you have to catch up on your courses. Go back 3 tiles.

52 On your way home from the monthly Cover-borrel, you get a fine for cycling without lights. Go back 3 tiles.

58 You received a negative BSA. Go back to start.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SWITCH: ACCORDION &

BY: *Merel Wiersma & Sanne Bouwmeester*

'Play' can mean very different things to different people. You can play video games or board games, but you could also be in a theatre play. For some people however, when they think of play, their first association might be to play their instrument. In this edition Sanne and Merel switch instruments! Sanne played Merel's accordion while Merel played Sanne's violin.

Sanne: One man orchestra

Merel and I switched instruments. She got to play on my violin and I had a go at playing the accordion. My experience started when Merel placed her accordion on my lap. Several straps were repositioned and strapped around me. She quickly explained the accordion basics. Your left hand is positioned over white circular buttons. One of these buttons is slightly dented; pushing that button and pulling the bellows results in the tone c. On the other end of the accordion is a miniature keyboard; you use your right hand for these keys. Pushing buttons on either side allows for air to flow when pulling the bellows, which is how the accordion makes its sounds.

At first, I just made very loud tones. I tried alternating and combining the buttons on both sides. Soon I was making very dramatic sounds. The accordion can make a wide variety of sounds depending on what buttons you press, what switches you pull and a combination of these two. The accordion has so many possibilities, I felt like a one man orchestra.

After playing a lot of dramatic sounds and joking about it, Merel played me some merrier tunes. She quickly alternated some of the round buttons on the left, creating a simple background noise. I tried to match a tune with my right hand but I couldn't manage to do it; I couldn't figure out how the buttons were positioned, but the low tones seemed to be in the middle, both up and down being higher. I tried to copy her, but I just couldn't alternate the buttons that quickly.
I then handed back the accordion and I was in for a surprise. Where I expected three rows of white round buttons on the left, there were six. That must have been why I had so much trouble figuring out the order of the notes on the left.

PHOTO: *Sanne playing the accordion*

VIOLIN

Merel: The not so crying violin

Beautiful, smooth, light wood, pointing out in a perfect curl. A very elegant instrument, with a bow of horsehair. It's very contradictory what kind of evil, crying cat sound you can make with it if you press too hard with the bow.

Surprisingly enough I didn't really make such an evil sound the first time I tried to make something of it without any clue how to. Maybe because I really expected it and was very careful. After a few tries I unexpectedly succeeded in making three (kind of) pure tones, namely the open ones. As soon as I tried to make some other tones putting the fingers of my left hand on the strings, it got very complicated.

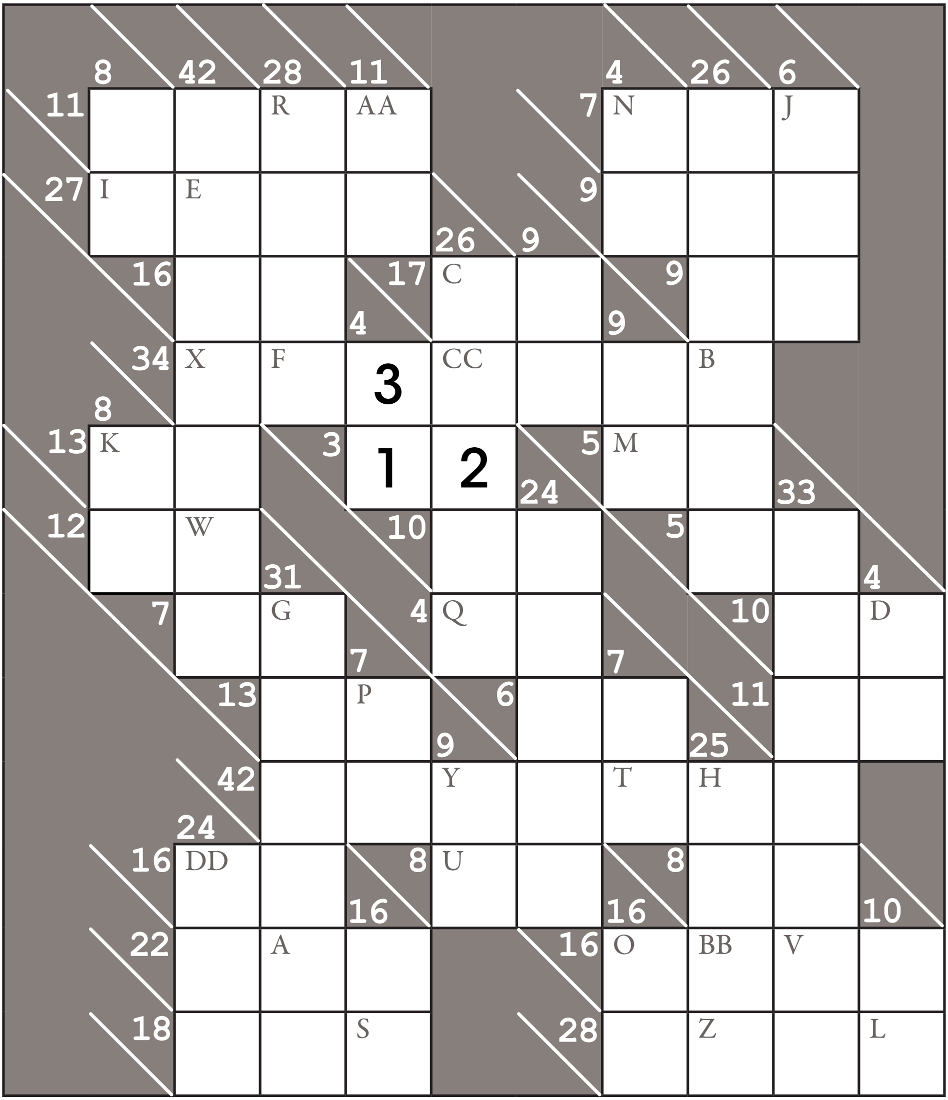
I can play some guitar, but then you can orientate your fingers' position because of the frets. Playing the violin, you just have to know where to put them. Also, you need to keep focusing on how to use the bow. After a while, I also found out where to put my fingers. Secretly, I was a bit proud of the sounds I could get out of this beautiful instrument.

But then Sanne showed me a couple of things you can do with a violin. She showed some different manners of drawing the bow: from making a long sound using the whole bow, to making a very short sound. Also, the place of the bow on the violin matters: the higher the bow is positioned on the neck, the softer the sound. Of course, you can also do a lot of different things with your fingers. This is more like a guitar. You can press on a string, or just lay your finger on a string. By doing the latter, you can make some special floating sounds. Combining this and a lot more skills, and the violin sounds as beautiful and fragile as it looks. Very impressive!

PHOTO: *Merel holding the violin*

PUZZLE

BY: Steven Warmelink



Fill in all the squares (which are either blank or have faded letters) on the grid on the left using only the numbers 1-9 so that the numbers you enter add up to the corresponding clues. The number below the line refers to sum of the numbers of the column below this square, the number above the line refers to the row to the right of this square. Duplicate numbers are not allowed within the same run. To help you get started, we already filled three squares.

The Sudoku on the right has various starting letters which correspond to certain squares in the puzzle on the left. Solve the Sudoku, fill in the numbers found below and send the solution to brainstorm@svcover.nl before April 7th 2015 to have a chance to win a prize!

A				B			C	D
E	F			G	H	I		
					J			
	K		L		M	N		
		O				P		
		Q	R		S		T	
			U					
		V	W	X			Y	Z
AA	BB			CC				DD

ROBOTS AT HOME
FROM RESEARCH TO REALITY

BY: *Amir Shantia*

Robotics research has been around since the 1950s when the MIT servomechanism laboratory demonstrated computer assisted manufacturing. The meaning of Robotics has evolved from first having brainless manufacturing robots in strictly engineered environments to devices that can perceive the environment and continue their operation in dynamic and complex environments.
Unlike the advancement of personal computers and cell phones in our daily lives, robots are struggling hard to find a place at our homes.

The commercial availability of domestic robots is currently limited to small service robots such as vacuum cleaners, lawn mowers, and experimental robots for developers. The big problem is the high price in comparison to the given functionalities.

> Robots are struggling to find a place in our homes

However, the need for bigger and more tangible commercial robotic services is being felt by the major political bodies. Several research projects are currently funded in the United States and Europe in the areas of healthcare and healthy ageing which requires robotics and ICT solutions in order to close the gap between the end users and the current robotic market.

The first requirement toward this goal is that these robots must be priced congruent with their abilities.

The Cognitive Robotics Laboratory of the Artificial Intelligence department has joined the current trend of focusing more on smart software solutions combined with low-cost hardware requirements, to facilitate the process of creating cheaper robots with reliable functionalities. With this goal in mind, since late 2010, we focused on designing a domestic service robot that can reliably carry out challenging tasks, such as object recognition and manipulation, navigation, human detection and tracking, and human robot interaction (HRI) in a household setting.

The idea of domestic robotics is not limited to one robot that can do all the tasks. A more realistic view would be a seamless integration of all our devices with some possible actuators at home. Imagine a Roomba (automatic vacuum cleaner) cleaning the floor, while the house is being warmed up for you to arrive. In the meanwhile, another robot prepares ready-made food for your dog, and a shopping list is sent to your mobile phone to let you know that you are low on milk!

Performing and integrating of all these functionalities requires years of research, testing, and of course a large budget. In this article, I will briefly present our work in the area of navigation.

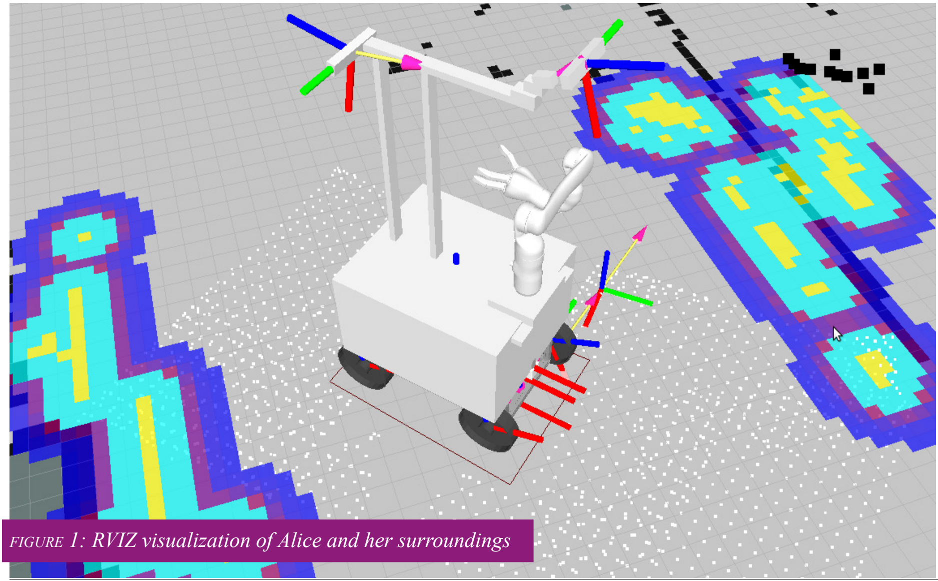


FIGURE 1: *RVIZ visualization of Alice and her surroundings*

ALICE Navigation

Currently, the most well-known and commonly used approach for solving the localization problem — knowing where you are — is through a precise process of mapping the environment using 2D or 3D sensory data and their required algorithms. These methods generally consist of three major parts: spatial alignment of data frames, loop closure detection, and a global fine-tuning step. The navigation module of our team is now mainly based on grid occupancy and adaptive Monte Carlo localization (AMCL) methods. Occupancy grid maps solve the simultaneous localization and mapping problems by generating incremental probabilistic grid maps. These grid maps are usually two-dimensional, but nowadays with use of time of flight camera and rotation 2D lasers, 3D grids are also popular.

The localization of the robot in a map, however, is not sufficient for a successful navigation. The robot needs to first plan a path to its destination, and navigate there safely while avoiding dynamic and static obstacles in the three-dimensional environment.

Our robot, Alice [1], first calculates a global path to its destination, considering its projected footprint on the two dimensional map. Next, it uses two time-of-flight cameras to look at the surrounding environment. Alice is aware of her body, so it will filter out herself from the three dimensional point clouds which are extracted from these 3D sensors. Finally, Alice calculates a local plan, in which she simulates possible solutions in her head. She starts to move as soon as a safe path is found, and will change course if an obstacle appears in her way. Alice, and its surrounding can be seen in Figure 1. The black and grey parts of the figure are part of the recorded map. The colored pixels on the map are 2D projections of obstacles that are

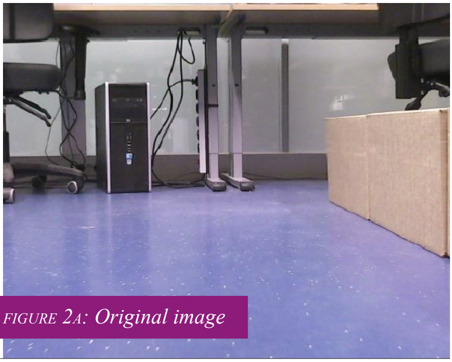


FIGURE 2A: *Original image*

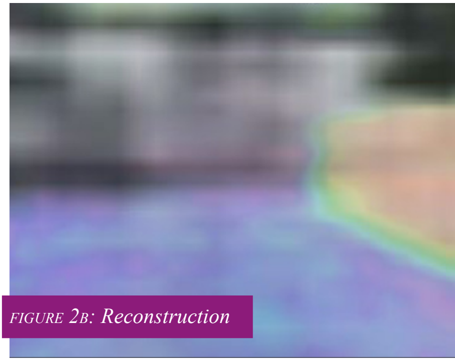


FIGURE 2B: *Reconstruction*

seen by the 3D sensor and the laser range finder. The small white pixels represents the downsampled view of the 3D sensors.

In addition to the traditional localization methods, we do research on vision based localization systems. In our visual method, the robot brain trains a deep neural network that describes the robot's perception of the environment. These compressed perceptions are then mapped to actual location values by using the mentioned AMCL and grid mapping methods as semi-supervised training systems. After this training phase, the robot can estimate its position by only using camera images.

More specific, the robot takes several pictures from the environment with an RGB camera during the training phase. In addition, estimated robot position values will be recorded by using the AMCL method which requires a laser range finder. The raw images will be sub-sampled and processed using a stacked denoising autoencoder, which is a deep neural network with an special pre-training phase. A corrupted version of the input images will be given to the neural network, and the neural network should try to reconstruct the original image from the corrupted version. Finally, a second neural network is used to map the encoded images from the stacked denoising autoencoder to position values. The performance of the estimation at this moment heavily relies on the target labels, and the quality of the images. An example of the reconstruction of the scene using the deep network can be seen in Figure 2.

In Conclusion

I gave you some insight towards our efforts in combining the traditional localization methods such as Adaptive Monte Carlo Localization with our visual localization.

If you want to know more about our robot Alice in terms of Human Robot Interaction, manipulation, object recognition or other robotic projects, please take a look at our website [2] or come by in the Cognitive Robotics Lab on the second floor in the Bernouilliborg.

[1] http://bit.ly/BorgAlice
[2] http://www.teamborg.nl

{kxa} De dataspecialisten

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KxA software innovations is gevestigd in de provincie Groningen. Het is een uniek bedrijf dat innovatieve, gekke, grote, kleine, spannende, mooie, maar natuurlijk ook normale maatwerk software-opdrachten uitvoert. De overeenkomst tussen al deze projecten is dat het gaat om data in alle vormen en maten, bijvoorbeeld:

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BY: Femke Nagelhout

A robot on stage

PHOTO: Femke as Gretel

'Play'. 'Play' can mean many things. To me, it mainly means a play in the theatre. Playing a character, acting out a play. Because I'm an actress. Well... Actress is a big word. Wanna-be actress. Well, I act. In plays. Several times a year, for several years now. Yeah? Okay. And of course, I'd love to continue doing that for the rest of my life. But try earning money with that. Jobs are disappearing left and right, and in the world of theatre it's not easy at all to achieve a breakthrough. Then again, if we look to the not too far away future, it might not turn out to be so bad for me after all.

Jobs are disappearing, that's for sure. Those with job security are engineers and computer scientists. And those two facts go hand in hand. Jobs disappear because automatons and robots take over. And who design and produce these automatons and robots? That's right, engineers and computer scientists. Having people stand at a treadmill in a factory, performing the same action over and over again? Nah, an automaton can do that way faster. Hiring cleaners? Don't be silly, a robot can do that just as well, if not better. Take a taxi? Don't prepare yourself for a nice conversation, as cars drive automatically nowadays. Even surgeries can be performed by robots: bye doctor!

Of course, this has many advantages. It is way more efficient to have a robot as an employee than humans. A robot doesn't tire, doesn't need payment, food, holidays or break-time. A robot doesn't make mistakes, and if it does, it's easily fixed (have you tried turning it on and off again?). On top of that, a robot can learn from its environment and actions, becoming smarter and better all the time. Show-offs.

But a robot surely can't do everything, I wonder. How about the arts? There is no way a robot can be an artist, right? A small hour of research confirms the sad opposite. It can. Writing a novel? Yes. Composing a masterpiece? Sure thing. Painting better than Da Vinci? Why not. Giving you an artsy haircut? Easy! Good thing artists aren't usually sensitive, caring people, or this news would have sent half of them into a depression. But what about acting though? Could a robot do that?

Robots can, in appearance, resemble humans to the point of being creepily realistic. In Japan, they made a robot of which you can hardly tell if it's real or not, that's how perfect she is. Of course, she is a sex robot, but that's beside the point. They may look real and sound real, but can robots express human feelings? Can they convey emotions in a realistic way? Because acting is something very human. The key of acting is conveying emotions in such a way that the audience forgets that what they're looking at is fake. Of course, a robot could perhaps be programmed to believe it is actually Romeo. For the robot it would be real, but the audience still knows it is fake. Maybe it would get better if the robot gets programmed with that knowledge: okay, the audience knows you're not really in love, but try and convince them otherwise. Maybe it could work.

> Painting better than Da Vinci? Why not.

But should we want to? Should we want to toss aside that most human aspect of theatre? Using a robot as an actor is actually double deceiving. An actor normally deceives the audience already, by pretending he is someone else. A robot-actor would add another layer to that: a robot pretending to be a human pretending to be someone else. Unless it's a play about robots or unless the robot has been programmed to be the character. But can a robot even think that it is a 17th century boy in love? And if it is smart enough to think that, and to learn from his environment, will he not wonder why he is on a stage and people are looking at him?

PHOTO: *AARON painting*

A robot would be trustworthy enough to know his lines and his cues, but can it be subtle enough to pretend like it's not programmed? To make a robot an actor, it would need knowledge of its character, of what it has to do on stage, of emotions and how they work, of the actions of his fellow actors, of the audience and their reactions, and how to react to those reactions... Which rather sounds like just a human. So why go through the trouble of making a robot that is so human it can act?

Of course, robots aspiring to work in the theatre do not have to worry. There's always a backstage. Many an actor has cursed the technician for not turning on their microphone on time. Or for leaving them standing in the dark to deliver their lines. Or for spilling coffee over their fabulous costumes. Many a great actor has sighed in desperation when they didn't get their champagne and burgers on time (which is an excellent combination, trust me). To prevent such mistakes, digital mixers for sound and light are used in many theatres. But even then, those damn technicians can still mess up. So there's your chance, robots! Make sure the sound and light works perfectly, do the heavy lifting and bring don't forget to bring us our food. We're waiting.

As useful and efficient as robots may be, they are not quite cut out for being actors. Expressing emotions and putting a moving play on stage is just a bit too human to be done by automatons. And don't try, please. Leave the robots off-stage for now. At least give me a chance at finding a job.

Femke Nagelhout is a nineteen year old student at the RUG, where this avid reader (114 books in 2014) is studying English language and culture. Femke has been an active member of the Groningen University Theatre Society (GUTS) since she came to Groningen for her study in 2013. In her first year she played parts in both the plays GUTS brought to the USVA theatre. Before GUTS, she did the musical training program MUZT for three years. Besides being on stage, she also loves to write and she can proudly say that she has written two published books.


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COLOPHON

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