

Tutorial: Creating maze games

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Uses: version 5.0, advanced mode

Level: Beginner

Even though *Game Maker* is really simple to use and creating intricate games is easy, at first glance the possibilities might be a bit overwhelming and it is difficult to understand where to start. This tutorial is meant to show you how to make one of the more easy types of games: a maze game. In a number of steps it leads you through the process of creating a game. The nice part is that from the first step on we have a game that, in further steps, becomes more extended and more appealing. All partial games are provided and can be loaded into *Game Maker*.

The game idea

Before starting creating a game we have to come up with an idea of what the game is going to be. This is the most important (and in some sense most difficult) step in designing a game. A good game is exciting, surprising and addictive. There should be clear goals for the player, and the user interface should be intuitive.

The game we are going to make is a maze game. Each room consists of a maze. To escape the maze the player must collect all diamonds and then reach the exit. To do so the player must solve puzzles and monsters must be avoided. Many puzzles can be created: blocks must be pushed in holes; parts of the room can be blown away using bombs, etc. It is very important to not show all these things in the first room. Gradually new items and monsters should appear to keep the game interesting.

So the main object in the game is a person controlled by the player. There are walls (maybe different types to make the maze look more appealing). There are diamonds to collect. There are items that lie around that do something when picked up or touched by the player. One particular item will be the exit of the room. And there are monsters that move by themselves. But let us tackle these things one by one.

A simple start

As a first start we forget about the diamonds. We simply want a game in which you must reach the exit. There are three crucial ingredients in the game: the player, the wall, and the exit. We will need a sprite for each of them and make an object for each of them. You can find the first very simple game under the name `maze_1.gmd`. Please load it and check it out.

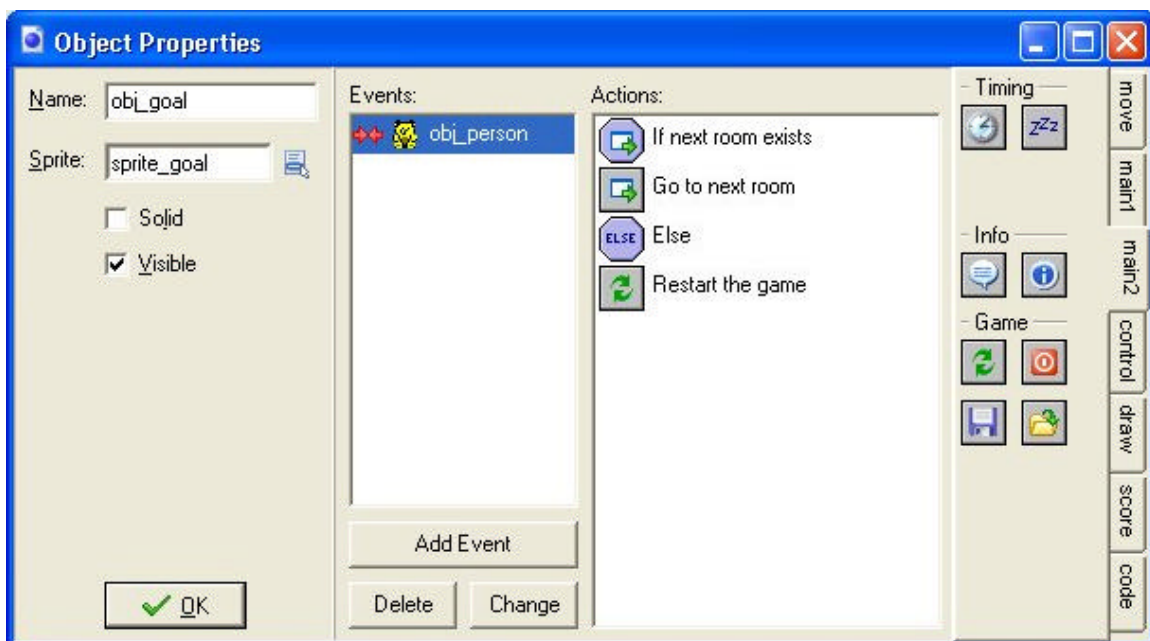
The objects

Let us first create the objects. For each of the three objects we use a simple 32x32 sprite:



Now we create three objects. Let us first make the wall object. We will give it the wall sprite as image and make it solid by checking the box labeled **Solid**. This will make it impossible for other objects, in particular the person, to penetrate the wall. The wall object does not do anything else. So no events need to be defined for it.

Secondly, let us create the goal object. This is the object the player has to reach. It is a non-solid object. We decided to give it a picture of a finish flag. This makes it clear for the player that he has to go here. When the person meets it we need to go to the next room. So we put this action in this collision event (it can be found in the tab **main1**). This has one drawback. It causes an error when the player has finished the last room. So we have to do some more work. We first check whether there is a further room. If so we move there. Otherwise we restart the game. So the event will look as follows:

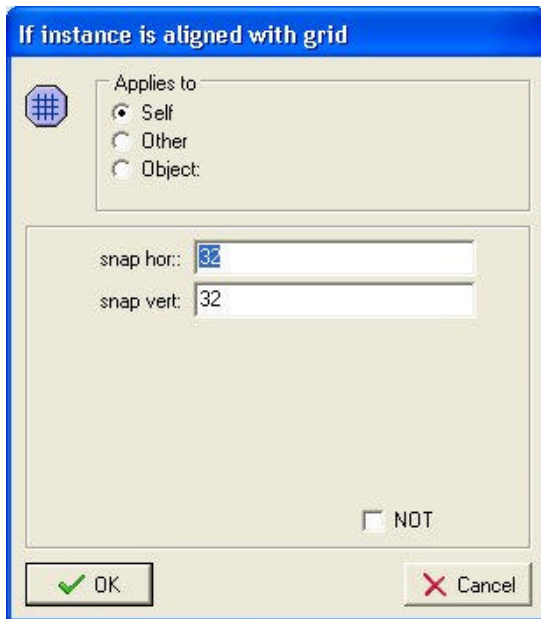


Obviously, in the full game we better do something more when the player finishes the last level, like showing some nice image, or giving him a position in the list of best players. We will consider this later.

Finally we need to create the person that is controlled by the player. Some more work is required here. It must react to input from the user and it should not collide with a wall. We will use the arrow keys for movement. (This is natural, so easy for the player.) There are different ways in which we can make a person move. The easiest way is to move the player one cell in the indicated direction when the player pushed the arrow key. A second way, which we will use, is that the person moves in a direction as long as the key is pressed. Another approach is to keep the player moving until another key is pressed (like in PacMan).

We need actions for all for arrow keys. The actions are rather trivial. They simply set the right direction of motion. (As speed we use 4.) To stop when the player releases the key

we use the keyboard event for <no key>. Here we stop the motion. There is one complication though. We really want to keep the person aligned with the cells of the grid that forms the maze. Otherwise motion becomes rather difficult. E.g. you would have to stop at exactly the right position to move into a corridor. This can be achieved as follows. In the **control** tab there is an action to test whether the object instance is aligned with a grid. Only if this is the case the next action is executed. We add it to each arrow key event and set the parameters to 32 because that is the grid size in our maze:



Clearly we also need to stop the motion when we hit a wall. So in the collision event for the person with the wall we put an action that stops the motion. There is one thing you have to be careful about here. If your person's sprite does not completely fill the cell, which is normally the case, it might happen that your character is not aligned with a grid cell when it collides with the wall. (To be precise, this happens when there is a border of size larger than the speed around the sprite image.) In this case the person will get stuck because it won't react to the keys (because it is not aligned with the grid) but it can also not move further (because the wall is there). The solution is to either make the sprite larger or, (in advanced mode), switch off precise collision checking and as bounding box indicate the full image.

Creating rooms

That was all we had to do in the actions. Now let us create some rooms. Create one or two rooms that look like a maze. In each room place the goal object at the destination and place the person object at the starting position.

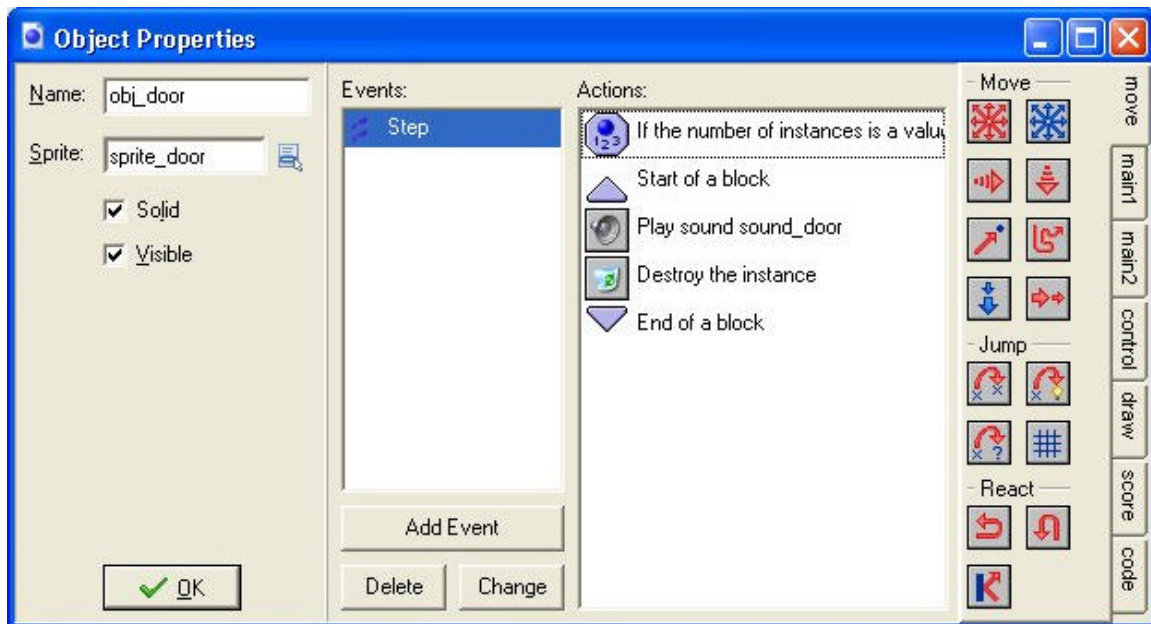
Done

And that is all. The first game is ready. Play a bit with it. E.g. change the speed of the person in its creation event, create some more levels, change the images, etc.

Collecting diamonds

But the goal of our game was to collect diamonds. The diamonds itself are easy. But how do we make sure the player cannot exit the room when not all diamonds are collected? To this end we add a door object. The door object will behave like a wall as long as there are still diamonds left, and will disappear when all diamonds have gone. You can find the second game under the name `maze_2.gmd`. Please load it and check it out.

Beside the wall, goal, and person object we need two more objects, with corresponding sprites: the diamond and the door. The diamond is an extremely simple object. The only action it needs is that it is destroyed when the person collides with it. So in the collision event we put an action to delete it. The door object will be placed at a crucial place to block the passage to the goal. It will be solid (to avoid the person from passing it). In the collision event of the person with the door we must stop the motion. In the step event of the door we check whether the number of diamonds is 0 and, if so, destroys itself. There is an action for this. We will also play some sound such that the player will hear that the door is opened. So the step event looks as follows:



Making it a bit nicer

Now that the basics of the game are in place, let us make it a bit nicer.

The walls look pretty ugly. So let us instead make three wall objects, one for the corner, one for the vertical walls, and one for the horizontal walls. Give them the right sprites and make them solid. Now with a bit of adaptation of the rooms it looks a lot nicer. Giving the rooms a background image also helps.

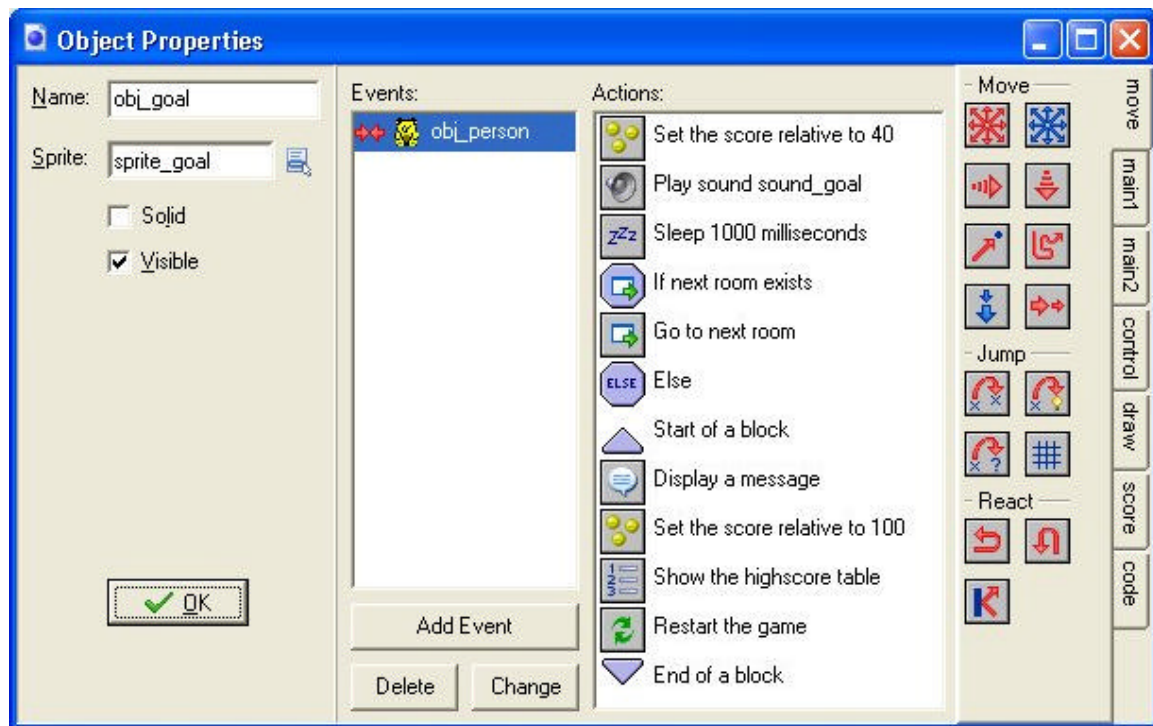
To avoid having to specify collision events of the person with all these different walls (and later similar for monsters), we use an important technique in *Game Maker*. We make the corner wall object the parent of the other wall objects. This means that the wall

objects behave as special variants of the corner wall object. So they have exactly the same behavior (unless we specify different behavior for them) Also, for other instances, they are the same. So we only have to specify collisions with the corner. This will automatically be used for the other wall objects. Also the door object we can give as parent the corner wall.

Score

Let us give the player a score such that he can measure his progress. This is rather trivial. For each diamond destroyed we give 5 points. So in the destroy event of the diamond we add 5 points to the score. Finishing a level gives 40 points so we add 40 points to the score in the collision event for the goal with the person.

When the player reaches the last room a high-score table must be shown. This is easy in *Game Maker* because there is an action for this. The goal object does become a bit more complicated though. When it collides with the person the following event is executed:



It adds something to the score, plays a sound, waits a while and then either goes to the next room of, if this is the last room, shows a message, the high-score table, and restarts the game.

Note that the score is automatically displayed in the caption. This is though a bit ugly. Instead we will create a controller object. It does not need a sprite. This object will be placed in all rooms. It does some global control of what is happening. For the moment we just use it to display the score. In its drawing event we set the font color and size and then use the action to draw the score.

Starting screen

It is nice to start with a screen that shows the name of the game. For this we use the first room. We create a background resource with a nice picture. (You might want to indicate that no video memory should be used as it is only used in the first room.) This background we use for the first room (best disable the drawing of the background color and make it non-tiled.) A start controller object (invisible of course) is created that simply waits until the user presses a key and then moves to the next room. (The start controller also sets the score to 0 and makes sure that the score is not shown in the caption.)

Sounds

A game without sounds is pretty boring. So we need some sounds. First of all we need background music. For this we use some nice midi file. We start this piece of music in the start_controller, looping it forever. Next we need some sound effects for picking up a diamond, for the door to open, and for reaching the goal. These sounds are called in the appropriate events described above.

Two issues are important here. Because we can pick up a number of diamonds in rapid succession, it is good to set the number of buffers for this sound to e.g. 4. This means that the sound can be played four times simultaneously. Secondly, when reaching the goal, after the goal sound, it is good to put a little sleep action to have a bit of a delay before going to the next room.

Creating rooms

Now we can create some rooms with diamonds. Note that the first maze room without diamonds we can simply leave in. This is good because it first introduces the player to the notion of moving to the flag, before it has to deal with collecting diamonds. By giving a suggestive name to the second room with the diamonds, the player will understand what to do.

Monsters and other challenges

The game as it stands now starts looking nice, but is still completely trivial, and hence boring to play. So we need to add some action in the form of monsters. Also we will add some bombs and movable blocks and holes. The full game can be found in the file `move_3.gmd`.

Monsters

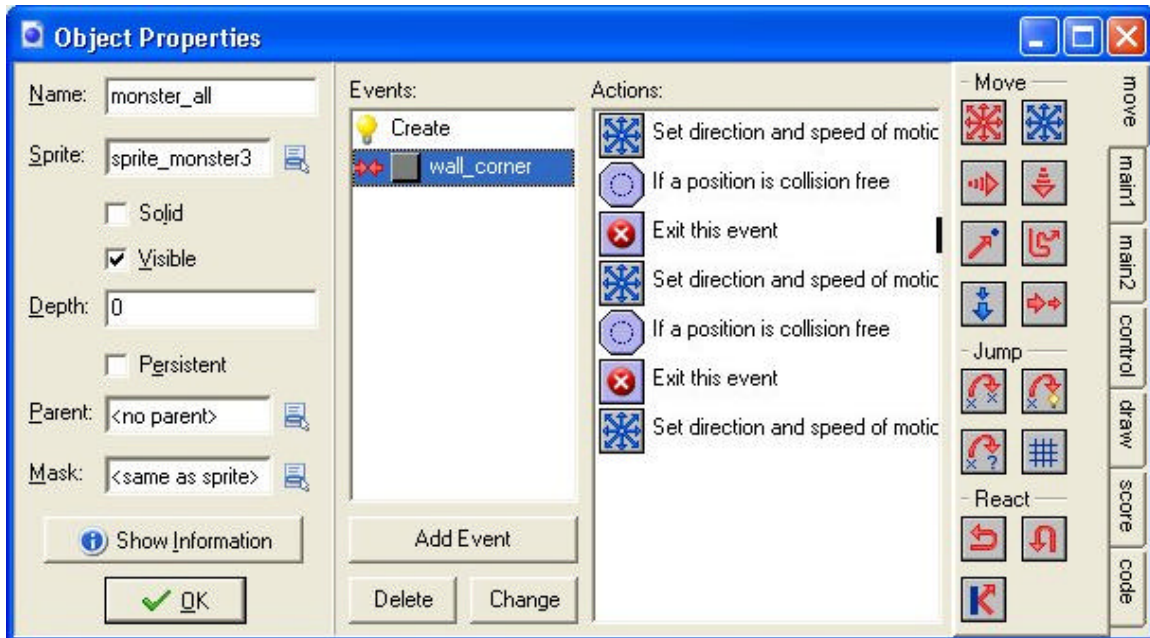
We will create three different monsters: one that moves left and right, one that moves up and down, and one that moves in four directions. Adding a monster is actually very simple. It is an object that starts moving and changes its direction whenever it hits a wall. When the person hits a monster, it is killed, that is, the level is restarted and the player loses a life. We will give the person three lives to start with.

Let us first create the monster that moves left and right. We use a simple sprite for it and next create an object with the corresponding sprite. In its creation event it decides to go

either left or right. Also, to make life a bit harder, we set the speed slightly higher. When a collision occurs it reverses its horizontal direction.

The second monster works exactly the same way but this time we start moving either up or down and, when we hit a wall, we reverse the vertical direction.

The third monster is slightly more complicated. It starts moving either in a horizontal or in a vertical direction. When it hits a wall it looks whether it can make a left or a right turn. If both fail it reverses its direction. This looks as follows:

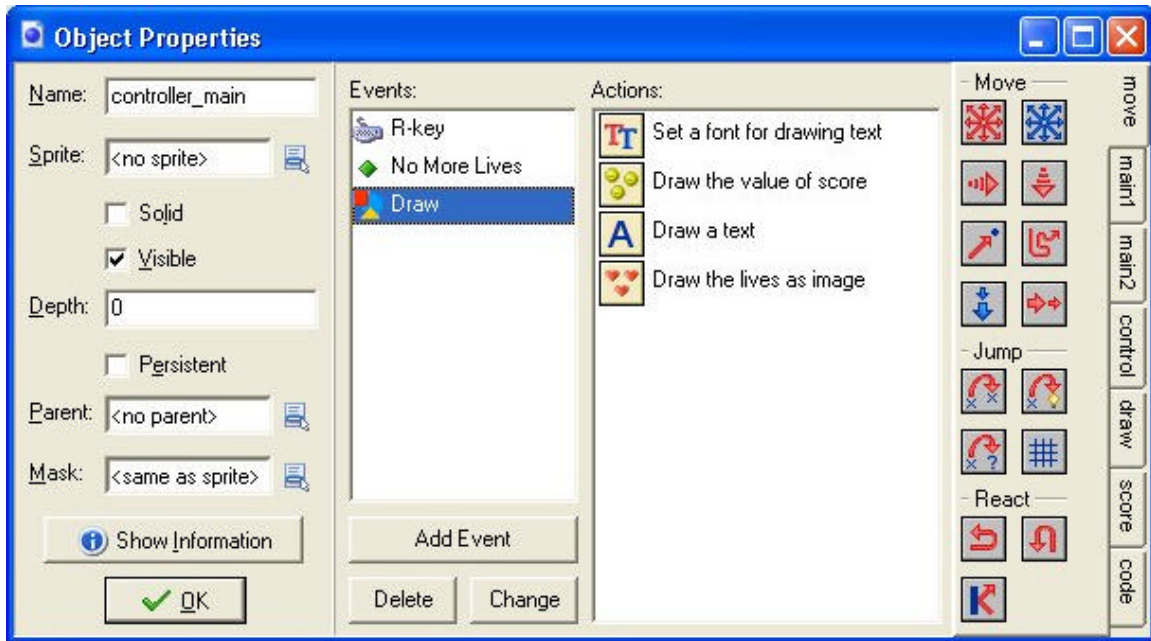


To avoid problems with monsters being slightly too small, we uncheck precise collision checking and set the bounding box to the full image.

When the person collides with a monster, we have to make some awful sound, sleep a while, decrease the number of lives by one, and then restart the room. (Note that this order is crucial. Once we restart the room, the further actions are no longer executed.) The controller object, in the "no more lives" event, shows the high-score list, and restarts the game.

Lives

We used the lives mechanism of *Game Maker* to give the player three lives. It might though be nice to also show the number of lives. The controller object can do this in the same way as with the score. But it is nicer if you actually see small images of the person as lives. There is an action for this in the **score** tab. The drawing event now looks as follows:



Bombs

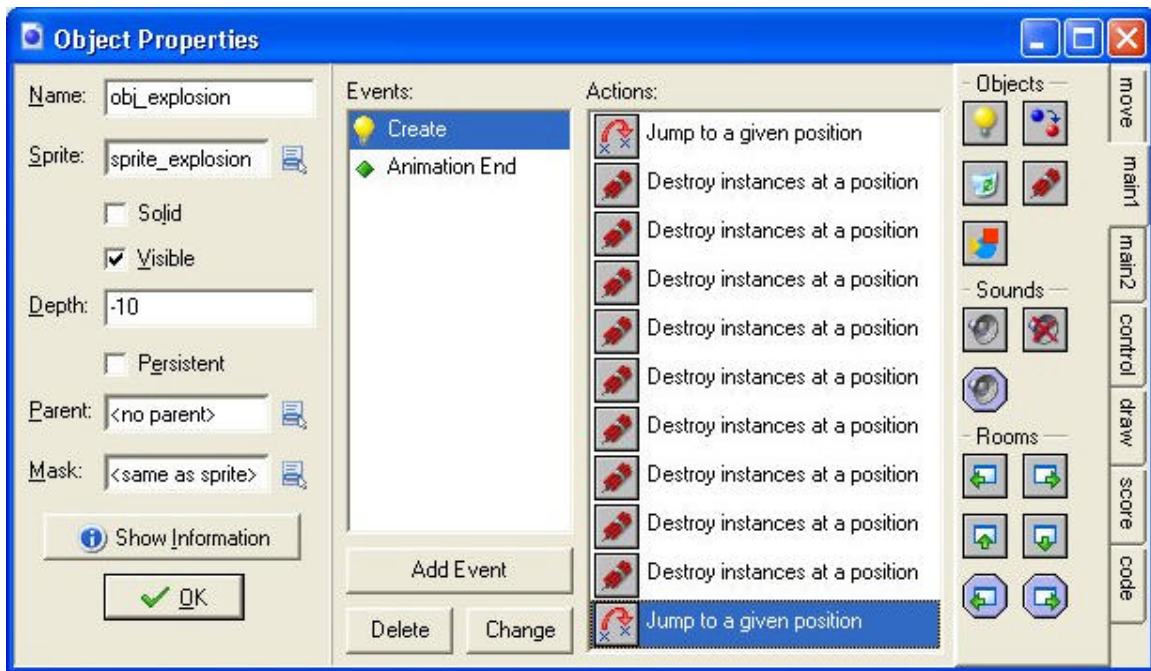
Let us add bombs and triggers to blow them up. The idea is that when the player gets to the trigger, all bombs explode, destroying everything in their neighborhood. This can be used to create holes in walls and to destroy monsters. We will need three new objects: a trigger, a bomb, and an explosion. For each we need an appropriate sprite.

The bomb is extremely simple. It just sits there and does nothing. To make sure monsters move over it (rather than under it) we set its depth to 10. Object instances are drawn in order of depth. The ones with the highest depth are drawn first. So they will lie behind instances with a smaller depth. By setting the depth of the bomb to 10 the other objects, that have a default depth of 0, are drawn on top of it.

The trigger is also rather simple. When it collides with the person it turns all bombs into explosions. This can be achieved by using the action to change an object in another object. At the top we indicate that it should apply to all bombs.



The explosion object just shows the animation. After the animation it destroys itself. (You have to be careful that the origin of the explosion is at the right place when turning a bomb into it.) The object also must destroy everything it touches. This requires a little bit of work. First of all, we do not want the explosion to destroy itself so we move it temporarily out of the way. Then we use actions to destroy all instances at positions around the old position of explosion. Finally we place the explosion back at the original place.



Note that this goes wrong if the person is next to the bomb! So make sure the triggers are not next to the bombs.

It is important to carefully design the levels with the bombs and triggers, such that they present interesting challenges.

Blocks and holes

Let us create something else that will enable us to make more complicated puzzles. We create blocks that can be pushed by the player. Also we make holes that the player cannot cross but that can be filled with the blocks to create new passages. This allows for many possibilities. Blocks have to be pushed in a particular way to create passages. And you can catch monsters using the blocks.

The block is a solid object. This main problem is that it has to follow the movement of the person when it is pushed. When it collides with the person we take the following actions: We test whether relative position $8 * \text{other.hs} / \text{other.v}$ is empty. This is the position the block would be pushed to. If it is empty we move the block there. We do the same when there is a hole object at that position. To avoid monsters running over blocks we make the corner wall the parent of the block. This does though introduce a slight problem. Because a collision event is defined between the person and the corner wall and not between the person and the block, that event is executed, stopping the person. This is not what we want. To solve this we put a dummy action (just a comment) in the collision event of the person with the block. Now this event is executed instead, which does not stop the person. (To be precise, the new collision event overrides the collision event of the parent. As indicated before, you can use this to give child objects slightly different behavior than their parents.

The hole is a solid object. When it collides with the block it destroys itself and the block. We also make the corner wall its parent to let it behave like a wall.

With the blocks and holes you can create many intriguing rooms. There is though a little problem. You can easily lock yourself up such that the room can no longer be solved. So we need to give the player the possibility to restart the level, at the cost of one life. To this end we use the key R for restart. In this keyboard event for the controller we simply subtract one from the lives and restart the room.

This finishes our third version of the maze game. It now has all the ingredients to make a lot of interesting levels.

Some final improvements

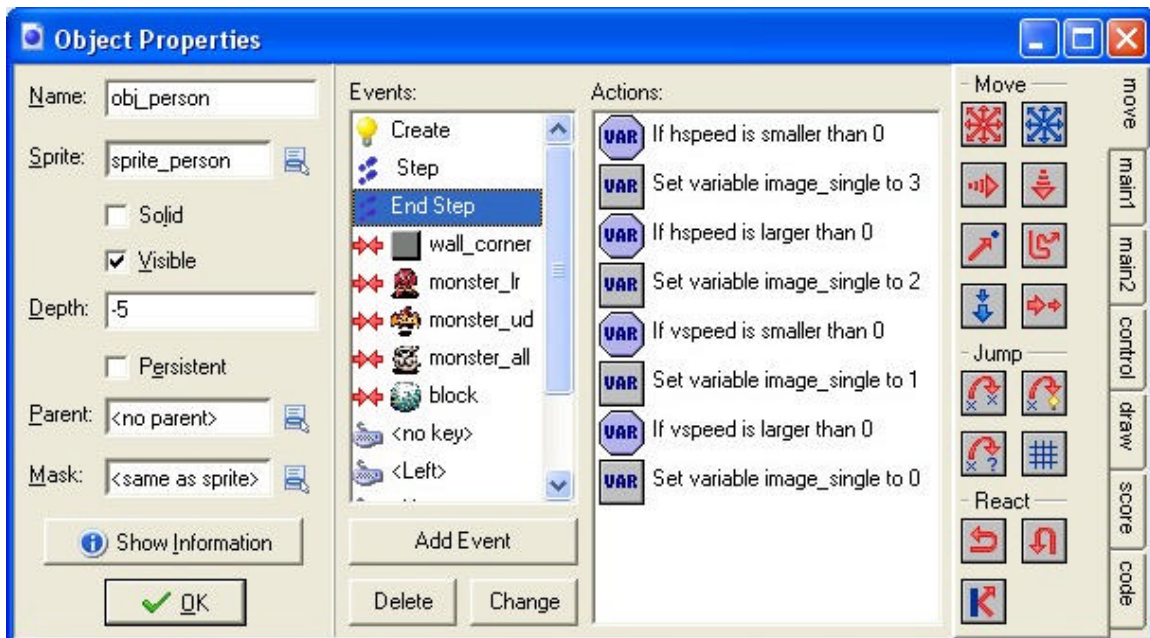
Let us now finalize our game. We definitely should improve the graphics. Also we need a lot more interesting levels. To do this we add some bonuses and add a few more features. The final game can be found in the file `maze.gm8`.

Better graphics

The graphics of our current game is rather poor. So let us do some work to improve it. The major thing we want to change is to make the person look in the direction he is going. The easiest way to achieve this is to use a new image that consists of 4 subimages, one for each direction, as follows:



Normally *Game Maker* cycles through these subimages. We can avoid this by explicitly set the variable `image_single`. This variable indicates which subimage to show (0 is the first one). Now in the end step event of the person we check the value of the variables `hspeed` and `vspeed` that indicate the horizontal and vertical speed. Based on it we set the image index:



We use the end step event here because this one is executed just before drawing the room so we are sure that the values of the variables is the final value here. That is all. (Well not quite. In the creation event we have to set the `image_single` to 0 to avoid it rotating at the start.)

A similar thing we can do for all the monsters.

Bonuses

Let us add two bonuses: one to give you 100 points and the other to give you an extra life. They are both extremely simple. When they meet the person they play a sound, they destroy themselves, and they either add some points to the score or 1 to the number of lives. That is all.

One way streets

To make the levels more complicated, let us add one-way streets that can only be passed in one direction. To this end we make four objects, each in the form of an arrow, pointing in the directions of motion. When the person is completely on it we should move it in the right direction. We do this in the step event of the person. We check whether the person is aligned to the grid in the right way and whether it meets the particular arrow. If so, we set the motion in the right direction. (We set it to a speed of 8 to make it more interesting.)

Frightened monsters

To be able to create pacman like levels we give every monster a variable called `afraid`. In the creation event we set it to 0 (false). When the person meets a new ring object we set the variable to true for all monsters and we change the sprite to show that the monster is indeed afraid. Now when the person meets the monster we first check whether it is afraid or not. If it is afraid the monster is moved to its initial position. Otherwise, the player loses a life. See the game for details.

Now let's make a game out of it

We now have created a lot of object, but we still don't have a real game. A very important issue in games is the design of the levels. They should go from easy to hard. In the beginning only a few objects should be used. Later on more objects should appear. Make sure to keep some surprises that only pop up in level 50 or so. Clearly the levels should be adapted to the intended players. For children you definitely need other puzzles than for adults.

Also a game needs documentation. In *Game Maker* you can easily add documentation. Finally, players won't play the game in one go. So you need to add a mechanism to load and save games. Fortunately, this is very easy. *Game Maker* has a built-in load and save mechanism. F5 saves the current game, while F6 loads the last saved game. You should though put this in the documentation.

You find a more complete game, including all this in the game `maze.gmd`. Please load it, play it, check it out, and change it as much as you like. In particular, you should add many more levels (there are only 20 at the moment). Also you can add some other objects, like e.g. keys that open certain doors, transporters that move you from one place in the maze to another, bullets that the person can shoot to kill monsters, doors that open and close from time to time, ice on which the person keeps moving in the same directions, shooting traps, etc.

Finally

I hope this tutorial helped you in creating your own games in *Game Maker*. Remember to first plan your game and then create it step by step (or better, object by object). There are always many different ways in which things can be achieved. So if something does not work, try something else. Good luck!