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Four-step puzzle design

by Asher Einhorn on 05/28/15 01:32:00 pm

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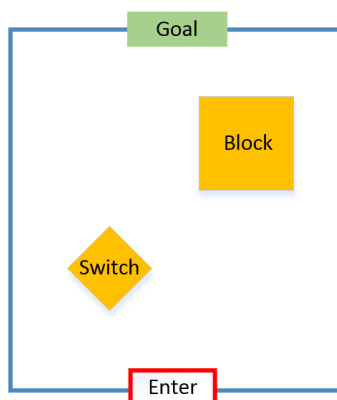
The following blog post, unless otherwise noted, was written by a member of Gamasutra's community. The thoughts and opinions expressed are those of the writer and not Gamasutra or its parent company.

Good puzzle design gives a player that moment of epiphany, where suddenly all is clear, and the following satisfaction when your put your solution in place, and it works!

During my time working on Disney Infinity, I began to see that a lot of game puzzles, including many of our own, missed this mark. Even puzzles in some of my favourite games often left me feeling unsatisfied. The reason was simple - I kept finding myself solving puzzles through experimentation or trial and error without fully understanding either the objective or the true nature of the puzzle itself.

Consider this extremely simple and often seen game puzzle:

You walk into a room and see a heavy box and a weighted switch. You move the box onto the switch. A cutscene plays showing a door opening you haven't really registered before. You solved the puzzle before you even knew there was one. You feel cheated because if you had realised, you would have been capable of solving it. Even in a situation as simple as this, there is a better way.



Because of this I developed four steps to deal with this problem, they may seem obvious at first but it's amazing how many puzzles, simple and complicated, fail this simple test.

Step one - the player understands the objective clearly.

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You'd think this would be an obvious one, but time and time again we encounter design that skips this basic step, leaving players unsure why they've been presented with the elements of a puzzle in the first place. As gamers, we know when we encounter a puzzle we are meant to solve it, and so as a designer it's easy to lean on that fact and overlook this fundamental step. Clearly communicate the problem FIRST. Example: There is a locked door you need to get through.

Step two - the player discovers the pieces of the puzzle needed to solve it.

Basic things like switches and levers. Note though that it is OK if these objects need to be experimented with in order to discover their true function. Note too the emphasis on this ordering. You discover a problem that needs a solution AND THEN you notice the puzzle that needs solving.

Step three - the player notices the association between the components and works out a solution in their head.

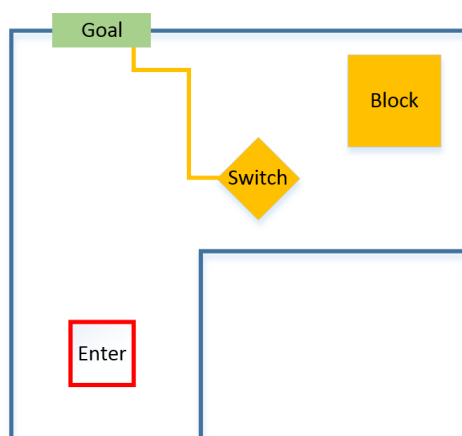
This is an important one, though there are a few caveats I'll discuss later. The player must be able to think of a solution before implementing it. What this essentially means is that they are not forced to solve the puzzle with simple trial and error. It may be POSSIBLE to solve with experimentation, but the key point is that it is not necessary. The puzzle is readable.

Step four - the player implements the solution and solves the puzzle

Again, obvious, but it exists as a reminder that working out a solution and implementing it are two separate stages.

Now consider this reworking of the same simple puzzle:

You drop into a room and observe a locked door which seems to be the only way out (step 1). After exploring more you then find a heavy box and a weighted switch that weren't immediately visible from where you entered the room (Step 2). You see a line from the switch to the door and deduce their association. After standing on the switch and observing no movement you guess the heavy crate might do the trick (Step 3). You move the box onto the switch and the door opens (Step 4). You feel a small amount of satisfaction that you were presented with a challenge, solved the problem and are now able to progress.



Note too the readability of the connecting line linking the switch and the door, and the fact that we drop in to this room, ensuring that the player cannot mistake the entrance for the goal.

Now we can see that the original room had us noticing the puzzle elements first (Step 2), solving it (Step 4) and only then realising what our objective was all along (Step 1) and finally gaining a true understanding of what the puzzle had been and why your solution worked (Step 3).

There are a couple more things it's important to keep in mind.

First of all it's important to remember that experimentation can be a fun mechanic. These steps do not mean that everything has to be immediately obvious. It's fine to create a room in which each puzzle component, each switch and lever has to be experimented with to see what it does. The important part is that once the true functionality is discovered, the player can work out a solution.

Now that's not to say that confusing situations, games of chance or trial and error as a game mechanic don't have their place, but they are not puzzles. There is a difference between a maze and a labyrinth. Simply be aware of what experience you are trying to give the player and mould the gameplay to that goal.

The other caveat to this system are complex puzzles that are too large for the solution to be calculated and held in the player's mind at once. There are many examples of these we've all come across before - a Rubik's cube or a Sudoku puzzle for example.

But here we can see that each stage in the greater puzzle is in itself a small 4 step loop. Every number written on the page in a Sudoku solution is a tiny calculation and solution that can be put in place and saves the progress of the puzzle and brings the overall solution closer.

This concept of incremental progress in more complex puzzles is an import at one, otherwise the player can feel lost and frustrated in the face of seemingly endless combinations. Most of us will have at some point fallen back to brute-force trial-and-error in a point-and-click adventure when the puzzle's true goal has eluded us, and this is always very tiresome.

Playtesting

Finally, a note on testing. Just because someone can get through a puzzle does not mean it's a successful one. The joy of a puzzle is in solving a problem, if the problem is only understood in retrospect the puzzle is not successful. Time and time again I have seen confusing game design make it into a final product simply because the player is, after some time, able to solve the puzzle by mistake.

There are thankfully many solutions, asking the player to explain what they did after they've finished the puzzle and why they did it can be incredibly valuable. Also having them do this while watching a replay of themselves will often prompt their memory/

Another good technique is to sit with a player and ask them to think aloud while they attempt the puzzle.

So those steps again:

Step one - the player understands the objective.

Step two - the player discovers the puzzle.

Step three - the player works out a solution in their head.

Step four - the player implements the solution and solves the puzzle.

Attempting a puzzle is essentially an attempt to find a solution for a problem, so make sure the problem is clear. No one would attempt to solve a Rubik's cube if it wasn't for the coloured stickers on each piece.

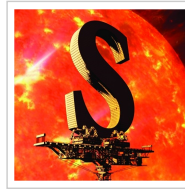
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Kenneth Blaney

28 May 2015 at 10:42 pm PST



If you look at the original Myst you will, perhaps unsurprisingly, see that they more or less followed this advice in every Age except Channelwood (which many argue is the weakest age puzzle-wise). This starts right from the beginning on Myst where you have to turn on switches near the "locks" in order to get the clues to unlock them and continues in each Age which have you pass by the exit on your way to the rest of the area. This pushes the exploration aspect and also primes the player's brain for what to look out for.

Also, I think what you are talking about is a really good piece of advice for point-and-click adventure games. Often people will complain that adventure game characters are weird pack rats who just sort of randomly pickup often weird items even if they seem to have no need for it. If the need for the item is established before the ability to pick up the item arises, this pack rat behavior appears less weird.

So what I'm saying is that I think the intended effect here is probably more broadly applicable to solving a number of different problems than you may have originally thought.

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Asher Einhorn

29 May 2015 at 2:08 am PST

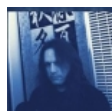


I agree, I think it's actually a loop that we now apply to almost all aspects of game design. What it's essentially outlining is that a component in a game should be readable before you are expected to deal with it, and that if you have to deal with it, you should have a motive. This seems to be applied quite well to most aspects of game design in my experience, except puzzles, where I often witness these steps get confused. Ironically this is mostly due to the pursuit of making a 'innovative' and 'clever' puzzle design.

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Chris Oates

31 May 2015 at 5:24 pm PST



While It's definitely been a while since I played the original Myst, I remember it differently, in that the answers to every puzzle (at least for the overworld) were more or less in plain sight, and often seen before one encountered the puzzle itself (I think it was an observatory or something that if you turned the telescope to a "wrong" spot, it would give you the exact answer for one of the puzzles on the wall)

Similarly, I remember many of the worlds being similarly obvious in that there was minimal effort spent in steps 2 and 3, with much of it being "oh, here's the puzzle and the solution all together, the only challenge is in

making sure I click on the right spot"

The one exception I remember was an underground maze with no light. I read later that there were sounds that were supposed to guide the player to the exit, but for me it completely failed to make the association clear while playing, so I remember just whipping out my old infocom skills and mapping out the entire maze by hand.

In any case, I distinctly remember (as a player and an adventure game enthusiast) the original Myst failing this very good set of guidelines almost universally, and being graphically pretty, but one of the least challenging games I had ever played. It really soured me on adventure games for a while, since so many have modeled themselves after its pattern.

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Adam Bishop

1 Jun 2015 at 6:40 am PST



I agree with Kenneth, I think Myst has fantastic puzzle design.

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Kenneth Blaney

1 Jun 2015 at 1:40 pm PST



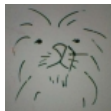
In order to get the clues from the observatory rotation you need to transverse the island and flip on the switches. This requires you to, at least, pass by the puzzles. The exits to the other ages (again, except Channelwood) are located close to the entrances with all of the clues scattered through the rest of the map.

The underground maze part in the Selenitic Age (googled it, I only recalled it being the rocketship one) had audio clues to tell you the direction you should go (that maze was rather easily brute forced). It was locked behind a door that you pass by right at the beginning of the age.

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Paul Speed

30 May 2015 at 12:04 am PST



"After standing on the switch and observing no movement you guess the heavy crate might do the trick (Step 3)."

I recognize that this might be an effect of concept reduction for the article but this might be an example where "no movement" is the most confusing part. If the player tries something really close to what they are supposed to do (put weight on the plate) then there should be some indication that they are close to the solution... but especially so when the alternative is completely illogical. (For example, if I'm not heavy enough to engage the switch then I'm not heavy enough to move the create that would, either.)

Too often I see games accidentally obscure their puzzles this way. The game designer thinks "Ah, the player will eventually think they need the crate." When in fact, they might think "I tried putting weight on it and nothing happened... maybe there is a second switch I need to also engage..." This leads (eventually) to all future puzzles in that game being approached with random trial and error just in case the self-inconsistent logic is misunderstood in one particular case or another.

The alter-examples are games that let the door open when you stand on the switch but then it closes again when you step off. Now there is an "Ahah!" moment: "I need to leave something heavy on the switch." Even my kids are able to figure out those puzzles with a bit of thinking.

Perhaps I'm still just a little war-weary from Broken Age where on a few of the puzzles I was one tiny step away from the right solution but had no indication that I wasn't standing in _exactly the right place_ and resorted to randomly clicking all of my inventory in every place in still accessible. :)

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4

Asher Einhorn

30 May 2015 at 1:55 am PST



Absolutely, in fact we applied this very concept in Infinity. Buttons that require a heavy object or a strong downward force depress ever so slightly when you stand on them to indicate their function and not lead them to believe the object does nothing.

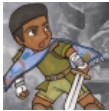
Your point about simply replacing your weight on the button with something else is a great one and not something I'd really given much thought before. Then this subtle feedback isn't even necessary, because the final action

occurs, just not at the right time. Thinking about it this is used a lot in games like Portal.

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rohit crasta

30 May 2015 at 5:40 am PST



I completely agree with this approach, but in practice I'm actually having a lot of trouble making them consistent in my level designs for a mobile puzzle game I am working on. Step 1 is always clear on the macro level (get the characters to the goal), but steps 2-3 can be vague or missed entirely. The problem becomes even worse when there are micro puzzles involved.

Asher: If I sent you a link to my current prototype, could you give me some feedback? I'm not sure if I can message through gamasutra, but you can follow me @rsc390 and I'll PM you there.

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Asher Einhorn

31 May 2015 at 4:28 am PST

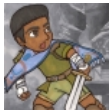


Absolutely, I'd be happy to take a look. I'll follow you back now.

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rohit crasta

1 Jun 2015 at 9:11 am PST



Thanks - I appreciate it! I'm wrapping up a new build for a showcase tomorrow, so I'll send a link after that.

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Eric Schwarz

31 May 2015 at 6:11 am PST



Great article, and I think a really illustrative example in that you picked the exact "same" puzzle - yet rearranging all the elements to be more comprehensive makes all the difference.

I actually recommend that anyone interested in designing puzzles, check out Portal 2's level creator. It's a rather fast way of prototyping ideas, and a good way to test and see what general ideas and concepts work, and what doesn't. Plus, you don't need your own game to do so. ;)

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1

Jason Barlow

1 Jun 2015 at 3:56 am PST



Interesting article and a good example of an issue that can be quite frustrating in games.

For me the key moment of epiphany needs to come from recalling previous collected knowledge and then assessing where they can be applied to the current situation. In this case knowing that weight on a switch will trigger it, and that the door is locked until a switch is triggered. Commonly a player comes frustrated because they are asked to make assumptions and are not able to link the objects they can see or interact with, leading to the trial and error mentality for solutions.

We shouldn't think of puzzle design as isolated to each individual puzzle, but instead as a journey and experience of moments which build up to puzzles, potentially in increasing difficulty or complexity of skills. Eric's example of Portal is a great one I use for teaching puzzle design, not only because each puzzle has interesting skills and outcomes, but because of the build up journey to the puzzle. Introduce a concept such as the liquids which increase bounce height or movement speed and allow the player to experiment with these in a safe environment. Then when they encounter these mechanics later as part of a puzzle they can recall on the understanding they had from their experimenting and apply this to the problem at hand.

To link this with your example of the door. The player needs to get through a door to continue through the game? But how do we know the player understands this or even can see the door. Yes, we can drop the player directly into an environment in front of a door to say 'hey, notice this door', but sometimes it can also be about building a relationship between design and understanding. If the exit door from every environment or puzzle room is consistent then the player will build up an associated relationship. Through experience they will know that the exit door has a certain appearance and so when they see it they will associate their understanding, they know that is the exit they need to use. This removes the need to always throw a door in the players face, as over time and experience the player will know they need to exit the room and so will actively look for and seek the exit door. Consistency and building relationships here being the best tools a designer has available to them.

Then again with switch or weighted plate, the same theory can be applied. The player shouldn't be dropped into a room and asked to make a connection between a block, a switch and a door. Instead the player should be introduced earlier in their experience to switches. They will know that if they see that style, colour and icon switch in an environment or on the floor, that they can interact with it and see an outcome. In a separate scenario they are introduced to the concept of movable objects. Perhaps they walk into a room, can identify the exit door due to previously mentioned experiences, but there is a block in the way. They can then move the block and exit the room. Build a new relationship that blocks of a certain colour, style or aesthetic appearance will always be moveable and the player can remember this and recall it.

Combining these elements means that the player has, through their journey and experience of the game, learnt to identify and understand the exit door and that it is their way out of this environment, that switches will activate if a weight is put onto them and that blocks of a certain appearance can be moved. These are step 2 of your process, but introduced over a longer period. The player can then make that cognitive jump to step 3 in order to combine to what they know.

Obviously it is not always the case that every player makes the jump to step 3, even after they have built up the relationships between mechanics. This is where Paul's idea is important, have the player step on the switch and the door will open, but if they step off it, it will close again. They can hopefully make the connection that the switch will open the door, but they do not have the time to get through the door before it closes when they walk off. Combine this with other aspects of the design as well to help build the players connections between items. As mentioned using aesthetics and graphical designs can link items and mechanics, a coloured switch leading to a matching coloured door, matching icons or shapes, etc. Dependent on the delivery platform and the game being designed it is also important to consider sounds. Giving the player a reaffirming sound when they perform an action will continue to build the relationship. Every time they step on a switch they will hear the gears grinding and the platform descends, now every time they hear that sound they know they are either triggering a switch or there is one nearby being triggered. Apply this to the door and it can help towards the issue of dropping a player in front of a door to tell them where to go. Build the relationship between the door opening sound happening every time a door opens and then the next time the player walks on a switch and hears the door open sound they will know a door is opening somewhere, even if they cannot see it or aren't looking at it at that moment to notice.

The average player can only understand and digest a certain amount of information and mechanics and so giving them each piece individually allows them to build a relationship. I like to think of it as building with Lego pieces. Each piece or combination of pieces is a mechanic or rule that the designer has established. Looking at the whole puzzle as a giant structure would be a complicated mess of these pieces, but introduce them individually to the player and they can understand that putting certain pieces together can produce expected outcomes.

It is then a very easy building system to keep adding to. The next section of the game might introduce a new mechanic of the game, for example ice on the floors causing the player to slide around. They can experiment and build up relationships with this mechanic and then the next time they have a puzzle they will see the movable block, the door, the switch and the ice. They know how each of them works but they can hopefully jump to step 3 to combine the relationships to get the intended outcome to solve the puzzle.

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Asher Einhorn

1 Jun 2015 at 10:55 am PST



How you design your puzzles to tutorialise each element is indeed important, as is how you increase the complexity of each puzzle as the game goes on, but the way you design them should, in my opinion, always follow these four steps.

It is not possible for players to 'jump' to the third step (at least not with a well designed puzzle). Even if they're so far into the game they can solve the puzzle at hand in a split second, it's still not a jump - they must first recognise the goal and encounter the puzzle that will allow them to achieve it.

If players are jumping to step 3 it means they are not understanding the goal before they happen on the puzzle. If they jump to step 4, then they are solving it before they understood what they were doing. This is what leads to player dissatisfaction, and you should redesign your puzzle.

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Curtiss Murphy

1 Jun 2015 at 6:47 am PST



A strong article with a nice, cohesive take-away. Kudos! Thanks for sharing.

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Matthew Munsinger

1 Jun 2015 at 1:10 pm PST



Great article, with one important caveat: A puzzle that is easily readable is not a puzzle. It's a sequence, a toy, a process... many other things. But to qualify as a puzzle, it has to challenge the player to understand it.

The standard definition for a puzzle is this:

"a toy, problem, or other contrivance designed to amuse by presenting difficulties to be solved by ingenuity or patient effort."

Let's look at each of your steps in this light:

1. A clear objective: As a general idea, this isn't bad, but it cuts the legs out from under many of the best puzzles. Often, a puzzle that SEEMS clear can lead to a much more fun and engaging experience by giving you false expectations.

What happens, in your example, if the player walks in, sees the door, rounds the corner and presses the switch but, though they hear a door open, it's not the door in front of them? They push the box onto the switch. SOMETHING is held open, but not the door they have in front of them.

Has the puzzle failed because the objective did not line up with the pieces of the puzzle they were given?

2. The player discovers the pieces of the puzzle. In the turned example, above, before they ever discovered the closed door that bars their way, the player may have discovered pieces of this puzzle: say, another door that they couldn't open, which this particular switch may have activated.

Likewise, there are a number of types of puzzles that defy this idea. Insight puzzles are, when well designed, non-obvious by their very natures. The idea of an insight puzzle is to challenge players to think non-linearly, non-logically, or non-obviously. Any formulaic puzzle will likely fail to produce a moment of insight, which is one of the most rewarding feelings in the world of puzzles.

3. The player works out a solution in their mind. This is a resolute problem: Neuroscience has found that there are dozens of different types of puzzle solvers out there. Close to half of our audience does not solve puzzles, innately, by working them out in their minds. They rely on patience, or intuition. Or, with a large swath of them, through luck and blind chance.

4. The player implements the solution and solves the puzzle. What about parametric puzzles? Tasks or riddles that have degrees of success?

In an ideal world, puzzle design would always call for one solution to each problem, but that's not our world. And creating something that feels both novel and worthwhile generally means creating something that eschews conventions deliberately.

I think that, ultimately, these four steps are still great advice for general puzzles in most situations. And they are CERTAINLY things that the designer should be thinking about from the beginning of each new puzzle, onward.

But I would hesitate, strongly, in calling these steps a "test" that puzzles should strive to pass. After all, if the only puzzles that we felt motivated to solve were puzzles that passed this test, the whole process of scientific discovery would never have taken root for humanity.

We're hardwired to explore things. Exploration - real world exploration, at least - involves the unknown and the irrelevant. These are not traits we should get rid of, but traits we should strive to use effectively. PARTICULARLY the irrelevant.

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1

Asher Einhorn

1 Jun 2015 at 4:18 pm PST



thank you for the praise, and you provide some incredibly interesting thing to think about. I would say though, that all the article is really saying is this:

1 - people need motivation to want to do anything.

2 - you want the player to actually try to solve the puzzle before they succeed.

there may be twists and turns where the real goal turns out to be something else - you step on a switch to open a door but instead the floor falls away. but the point is that the player still has a goal to motivate them, even if it changes half way through.

The example is a simple one, in more complex puzzles this structure can be repeated and nested and obfuscated in many ways, but I still believe the

sequence holds true.

perhaps you're right though, rather than writing 'the objective must be clear' maybe it would be more accurate to say 'the player must have a clear objective' because that includes the possibility that it may shift into something else.

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Eric Ball

1 Jun 2015 at 1:14 pm PST



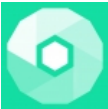
A couple of additional recommendations:

- 1. The solution to the puzzle should not be immediately obvious, unless the purpose of the scenario is not the puzzle. e.g. the first two box & button chambers in Portal
- 2. It should not be possible to simply work backwards (or forwards) from the goal (start) to the solution. A river crossing puzzle is difficult because the solution requires a non-intuitive step.
- 3. While there may only be one correct solution to the puzzle, there should be more than one way to attempt to solve the puzzle. And ideally some of the attempts should not result in immediate failure, but should appear to be potential solutions for as long as possible. e.g. while stepping on the button opens the door, the door closes when stepping off the button. (OTOH, it should be possible for the player to recognize what they did wrong so they don't endlessly reattempt with the same mistake.)

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Daniel McMahon

29 Jul 2015 at 4:12 am PST



I agree that games don't always implement puzzle solving in a way that is this satisfying. I wouldn't underestimate the value of "play" though. I think the trial and error aspect is vital to the feeling of immersion, without enjoyable play mechanics puzzles can feel too complex or too mundane. Braid is a good example in this regard, the puzzles are well thought out and display most of what you suggest but the real hook is the mechanics.

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Adriana Pucciano

31 Jul 2015 at 5:45 am PST



Awesome article! Thanks for sharing :)

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