Gmail **Andrew Lyjak <andrew.lyjak@gmail.com>**

Permaculture Simulator

9 messages

Henry Coulson <h.coulson@outlook.com> Mon, Jan 14, 2019 at 12:04 AM
To: "andrew.lyjak@gmail.com" <andrew.lyjak@gmail.com>

Hello Andrew,

Henry here, I will launch straight into it

Yes, the back end may well end up being an almighty piece of engineering. I have been reading quite a few research papers on some fundamentals, like fertilizer effects on crop yields, soils science etc. There are a few good models out there, and some good pieces of data, but the scene as a whole is sketchy at best.
The approach I am thinking of taking is just to have some simple models of things like plant growth, nutrient loss etc. and run it more as a game for the first iteration. This I think will suffice for an MVP, and when the ball gets rolling somewhat, maybe look at improving the model, and adding more data. But we can talk about this more in detail later.

I have been thinking a 3D desktop application might be better to run with, (specifically, using Unity) as things like terrain height are rather instrumental in Permaculture design, and also it it easier for the user to interact with and visualize if it were on a pc, than on a small touch screen. However, I am not wedded to the idea, so I am willing to be persuaded.

I am keen to hear your thoughts on how best to proceed, either with the front end or back end.

Cheers,

Henry

Andrew Lyjak <andrew.lyjak@gmail.com> Mon, Jan 14, 2019 at 9:42 AM
To: Henry Coulson <h.coulson@outlook.com>

Hi Henry,

Thanks for the reply. Here's my thoughts:

First, I'm skeptical that packaging such a piece of work as a game is effective, as I think the audience is going to be pretty small. What I have been looking at is developing a user interface for changing how people manage their yards -- so the product is a platform for better managing urban and suburban landscapes. I think you guys in New Zealand are a little more civilized than us out here in the USA, but I'm looking for a way to encourage people to reduce or remove their lawns and replace them with more of a permaculture type arrangement. The amount of wasted time, space, and fossil fuels currently devoted to maintaining grass lawns in the US is mind boggling. If we can convince people that replacing their lawns is an effort that's worthwhile in terms of the cost vs reward that they put in, then I think there's a compelling case that such an app would be downloaded by quite a lot of people. The app is there to show people what they can achieve, and make it easy for them to execute a positive transformation. The simulator is important in order to do two things: 1) provide estimates on biomass, required inputs, edible outputs for a yard in its baseline state versus after permaculture modifications, and 2) to help suggest modifications that are tailored to a person's landscape (their macro and micro climates). With such capabilities, permaculture principles can be sold to a much wider audience than there is currently because we can make a pragmatic argument rather than one based just on beliefs and interests.

If such a user base can be established, I have a couple ideas on monetization:

- At first, this would be supported by a freemium service -- mainly ad revenue, plus people can buy the add-less version with some extra features.
- If a user base can be established, we can also introduce an 'uber for yards' platform: in this scenario we have gardeners and land owners. The gardeners maintain properties for the land owners. Since we have actual crops, the revenue between gardeners and land owners may be an exchange of produce rather than currency in some situations, this way the gardeners can actually become "neighborhood farmers" by caring for a neighborhood's worth of yards. As with uber, the platform would take a small cut of each exchange.
- There may be ways that people can gather credits from their governments by using the app too -- water retention and carbon sequestration are two areas that I know some areas offer tax credits/offsets for
- Another monetization idea that's a little more far out is getting an equipment rental service integrated in the app such that folks can share big equipment

I recently realized that you don't need the full-blown simulation to release a minimum viable product for the application -- to start off, you can use heuristics to predict metrics and recommend guilds/planting strategies. These heuristics can be informed by simulation, but they can also incorporate the existing body of knowledge that places like permies.com and other permaculture resources have gathered over the years.

Another thing I would like to do is increase the quality of data associated with a permaculture-centric ecological simulation. I believe this app could facilitate that. What I would like to do is have much of the data that the app feeds on come from an ecological and agricultural wikipedia-style server. Users would be encouraged to use the app to submit data on the productivity of their efforts, and this data can then better inform the simulation capabilities -- thereby creating a virtuous cycle of improvements!

What do you think?

Cheers,

Andrew

[Quoted text hidden]

Andrew Lyjak <andrew.lyjak@gmail.com> Mon, Jan 14, 2019 at 9:51 AM
To: Henry Coulson <h.coulson@outlook.com>

Regarding user interface, I've been focusing on a 2D interface to start. I agree that contours and topology are vital for permaculture, but my thinking is that, at least to start, its important to get a workable representation of a user's property. Also, contours can be represented in 2D maps. For the application I describe in my earlier email, getting a map together is going to involve significant work from the user, and I think getting them to get a viable 2D map is going to be easier than having them try and wrangle a 3D representation. Of course later versions, given infinite time and money could incorporate a whiz bang feature that allows them to use their phone sensors to walk their property and acquire a map that way, but that's a product unto itself... (that I've looked into developing!)

I've been working with web canvas (I'm not decided between svg or html5 as of yet), as developing for web technologies allows me to simultaneously create applications for Android, web, and iOS. Right now I'm using Ionic as

the development framework, and integrating many of the capabilities of the d3.js library.

[Quoted text hidden]

Henry Coulson <h.coulson@outlook.com> Tue, Jan 15, 2019 at 12:38 AM
To: Andrew Lyjak <andrew.lyjak@gmail.com>

Hi Andrew,

Yes, some interesting thoughts here, I am a bit behind the curve when it comes to technology usage. I only use my iPhone rarely, as I don't like the small screen, but apparently I am in the minority, according to my friends.
So you might well be right in that it might be better to release it as a phone app. To be honest, once I have made a bit more progress on the back end (I have spent most of my time so far doing research) I will share it with you, and you can see what you think. I don't really have any strong ideas about how it is eventually presented to the user, so I am happy to go with the flow on this one.

Having said that, I might have to respectfully disagree that the audience will be small. A lot of folks I have talked to about this have thought that it would be a good idea, and a $10 - $20 program won't break the budget. I am aiming this more towards the people who are interested in permaculture, but don't have the time, energy, land or money to devote to exploring it. Not sure about the US, but in NZ, there are tons of people who like the idea of going off grid, but can't for whatever reason. The thing about a "game" vs a "simulation" thing is that a game might be more approachable/ marketable. Accuracy need not be compromised just because it is a game. (Maybe also see my response to Bernetta on this post: https://permies.com/t/100306/permaculture-projects/Front-Programmer-Permaculture-Game-Required#827142)

I would agree also that Permaculture really needs some good data and science behind it. (That said, the concepts are sound and proven, but we can't easily quantify the effects of certain measures) So I would agree that a good simulation would help facilitate that.

My questions regarding what you have said:

Are you sure that a mobile device would have enough processing power to simulate the natural systems? Or would you send the input off to a server to run the calculations (Unless I am mistaking the complexity you mean to embed in the software)
I think that there are a few apps already out there that offer generic gardening advice. Do you think that you will be able to differentiate the app you are making from those others?
Also, once you have a working backend, which could run through the calculations, it would seem a shame to limit it only to back lawns. I was thinking you might as well go whole hog, and let it be used by people who want to design entire sections.

As I think about it, 2-D might be the way to go. But I am curious as to how you plan to addess the above. Maybe we can end up helping each other in some way,

Cheers,

Henry

De: Andrew Lyjak <andrew.lyjak@gmail.com>
Enviado: martes, 15 de enero de 2019 3:42 a. m.
Para: Henry Coulson
Asunto: Re: Permaculture Simulator

[Quoted text hidden]

Andrew Lyjak <andrew.lyjak@gmail.com> Tue, Jan 15, 2019 at 1:09 PM
To: Henry Coulson <h.coulson@outlook.com>

Responses below!

Hi Andrew,

Yes, some interesting thoughts here, I am a bit behind the curve when it comes to technology usage. I only use my iPhone rarely, as I don't like the small screen, but apparently I am in the minority, according to my friends. So you might well be right in that it might be better to release it as a phone app.

> Actually what I'm trying to do is release it as a cross-platform app using web technologies. Ionic allows me to create an app that can be used in the browser, on a PC via Element (similar to software like the Spotify app, or Gitter to name two examples), or for Android or iphone as well.

To be honest, once I have made a bit more progress on the back end (I have spent most of my time so far doing research) I will share it with you, and you can see what you think. I don't really have any strong ideas about how it is eventually presented to the user, so I am happy to go with the flow on this one.

> cool! Let me know if you need a sounding board for any of your design decisions or need any help programming. I have experience with Python, Matlab, C, C++, Rust, and web technologies (html, css, js, etc.), as well as a mathematical background (Aerospace engineering degree).

Having said that, I might have to respectfully disagree that the audience will be small. A lot of folks I have talked to about this have thought that it would be a good idea, and a $10 - $20 program won't break the budget.

> That's good to know, but be careful forming business decisions just based on testimony by people you know. Also, forming a fully formed game that can be sold for that price point may be too big a risk for me to help with. The benefits of something that can be put on an app store are that incremental improvements can be released, which lowers time to market. Also it allows the features to be adapted based on gathering information on what people like and don't like in the early

versions of the game/simulation/app, rather than just guessing.

I am aiming this more towards the people who are interested in permaculture, but don't have the time, energy, land or money to devote to exploring it. Not sure about the US, but in NZ, there are tons of people who like the idea of going off grid, but can't for whatever reason.

> I don't see the game aspect as divergent from what I've described actually. I'm going try and put together some user stories today, but the way I see it if you focus on providing an app that allows you to plan and helps you maintain your property, that same experience can be applied to the property you wish or imagined you have. So basically there's two ways to 'play' you can play just in in app, or you can have what's essentially an augmented reality experience -- where you use your 'play' in the app to influence your 'play' in the real world.

The thing about a "game" vs a "simulation" thing is that a game might be more approachable/ marketable.

> So I see the simulation as an engine. An engine usually isn't a product unto itself, it just powers the product. What needs to occur is finding a product that garners enough interest to allow continuous development and improvement of the the simulation engine. Also, there's many products this engine can be integrated in. For example, I think you ran into this as well -- there seems to be a lack of wholistic ecological modeling software available. I know that when I was researching this, I was pretty disappointed by what I could find. Here's a list of the most promising things I came across:

Many of the research here is from crawling this list: https://soil-modeling.org/resources-links/model-portal

* Regional Climate

  * Just need farmers almanac type stuff I think
  * Need to also apply global changes: see Asymtotic Environmentally Determined Trajectory https://journals.plos.org/plosbiology/article/file?id=10.1371/journal.pbio.2002634&type=printable

* Water/Soil/Nutrient Movement

  * https://epicapex.tamu.edu/apex/
  * https://github.com/MarcelVanOijen/BASFOR/tree/master/
  * https://daisy.ku.dk/
  * https://www.pc-progress.com/en/Default.aspx?H1D-description#k8
  * https://github.com/zalf-rpm/monica/wiki
  * datasets: https://soil-modeling.org/resources-links/data-portal

* Soil moisture model should be pretty important. The soil should be treated as an organism most likely, not as something inanimate.

  * https://www.rothamsted.ac.uk/models-and-analytical-tools

* Microclimate

  * NicheMapR – an R package for biophysical modelling https://onlinelibrary.wiley.com/doi/abs/10.1111/ecog.02360
  * https://www.researchgate.net/post/What_is_the_most_practical_micro-climate_model_for_examining_the_relationship_between_urban_design_parameters_and_outdoor_thermal_comfort

* Ecological databases

  Many of these are pulled from an integrated plant database a friend of mine is developing: https://github.com/christabor/plantstuff. Others are pulled from the Resources section of Gaia's Garden, second edition by Toby Hemenway

  * Dr Duke's Phytochemical and Ethnobotanical Databases: https://phytochem.nal.usda.gov/phytochem/search
  * Plants for a future https://pfaf.org/user/Default.aspx
  * USDA Plants Database https://plants.usda.gov/java/factSheet
  * Dave's garden plant files: https://davesgarden.com/guides/pf/
  * Monrovia Plant Catalog: https://www.monrovia.com/plant-catalog/

* Perrenials plant catalog: http://www.perennials.com/results_alphabet.html?letter=A
* Spring Hill Nursery Plant Finder: https://www.springhillnursery.com/category/plant_finder
* UConn plant database: http://hort.uconn.edu/
* wikipedia: https://en.wikipedia.org/wiki/Category:Lists_of_plant_species

* Competition/Dynamic Stability, Dynamical Processes in Networks

* http://allison.bio.uci.edu/

Accuracy need not be compromised just because it is a game. (Maybe also see my response to Bernetta on this post: https://permies.com/t/100306/permaculture-projects/Front-Programmer-Permaculture-Game-Required#827142)

> Agreed, but its hard to rationalize the additional verification and development work for an application that doesn't _need_ to be accurate.

I would agree also that Permaculture really needs some good data and science behind it. (That said, the concepts are sound and proven, but we can't easily quantify the effects of certain measures) So I would agree that a good simulation would help facilitate that.

> Agreed that the principles are sound, but even on the permies.com forum, there's quite a few complaints on how many testimonials, rather than quantitative improvements are recorded.

* https://permies.com/t/16557/permaculture
* https://permies.com/t/99768/ways-money-homestead

My questions regarding what you have said:

Are you sure that a mobile device would have enough processing power to simulate the natural systems? Or would you send the input off to a server to run the calculations (Unless I am mistaking the complexity you mean to embed in the software)

> I'm not concerned about processing power for a couple of reasons:

#. Each run of the simulation may be processing intensive, but it doesn't need to run at real time like a first person video game for example. The processing just needs to occur whenever the user makes a change.
#. Many of the simulation results can be pre-calculated. For many things this doesn't even need a cloud server. Similar to machine learning, many of the calculations may be intensive to calculate at first, but then using their results is not intensive, and their results can be used many times over.

I think that there are a few apps already out there that offer generic gardening advice. Do you think that you will be able to differentiate the app you are making from those others?

* True, I have collected a few lists of them but I wasn't satisfied with them. Most of the apps just wrap around an existing plant database and essentially offer you bookmarks to those database pages. Either that or they are glorified note taking apps that you can keep lists of your plants on. A couple features that I want:

- I want the app itself to offer recommendations on what I should plant, where i should plant it, and why.
- I want the app to pre-schedule checkups, recommend I take pictures and measurements, and also help me if with recommendations if the planting isn't healthy.
- This is a later feature that I want to develop once the app is stable: I want the app to provide a messaging and market place such that I can work with my neighbors to share resources, harvests, and other activities.

Also, once you have a working backend, which could run through the calculations, it would seem a shame to limit it only to back lawns. I was thinking you might as well go whole hog, and let it be

used by people who want to design entire sections.

> Agreed, there's no need to artificially restrict usage like this. I was principally referring who
I would like to market the product to. See my comment on the game above

As I think about it, 2-D might be the way to go. But I am curious as to how you plan to addess the above. Maybe we can end up helping each other in some way,

> I hope my responses helped clarify my positiion! Thanks for talking with me!

[Quoted text hidden]

Henry Coulson <h.coulson@outlook.com> Tue, Jan 15, 2019 at 5:09 PM
To: Andrew Lyjak <andrew.lyjak@gmail.com>

Hi Andrew,

Wow, it seems as if you have looked into this quite thoroughly. I would definitely be keen to help out where possible.

> "cool! Let me know if you need a sounding board for any of your design decisions or need any help
> programming. I have experience with Python, Matlab, C, C++, Rust, and web technologies (html, css,
> js, etc.), as well as a mathematical background (Aerospace engineering degree)."

That is good to know. I come from a similar sort of background, although perhaps I have a bit less experience than yourself. I studied maths and physics, and have worked as a research assistant and software developer for a number of years. I first learned to program in Matlab, actually. I am most familiar with Java, but have worked with C++, Python, C#, Matlab, and dabbled in Django.

> "That's good to know, but be careful forming business decisions just based on testimony by people
> you know. Also, forming a fully formed game that can be sold for that price point may be too big a
> risk for me to help with. The benefits of something that can be put on an app store are that
> incremental improvements can be released, which lowers time to market. Also it allows the features
> to be adapted based on gathering information on what people like and don't like in the early
> versions of the game/simulation/app, rather than just guessing."

Sound advice there. I got into this more because I was looking for a permaculture simulation myself, and noticed that people I had met both in person, and also on forums like permies, had wanted something similar. It was a bit of a lightbulb moment.

I was thinking more of releasing an alpha, which is incomplete for a lesser price, and then keep releasing updates. For example, I used to play an indie game called Kenshi which when released, only had half the features, and has been steadily adding more and more to the game, and the price has been increasing on Steam. $10-20 I was thinking would be the final price range. I agree with you that trying to jump straight to a product worth that amount might be a bit rash.

Thanks for the links by the way, most of them look really useful.

I would like to know what you think of my approach to the back-end:

I have seen out there, (as have you) that there is a lot of research into agricultural science and modelling. Whilst I haven't looked at all of the links you sent me in great detail, I would imagine that there would be license restrictions on how you could use some of the models which are already out there. Given that this is a large wheel to (possibly) re-invent, I have been focusing on trying to design a backend which is:

1. easy to alter and update when better mathematical models come along.
2. simple for the first iteration and will run on crude approximations (for example, just glancing at the notes I have on my desk, I have a very simple model for plant sequestration amount of nutrient based on a product of the sequestation rate for a particular nutrient, the nutrient availability in the soil horizon, and the root volume in the layer)

I am looking at the following systems which need modelling:

1. Nutrient availability in the soil
2. Soil physical composition (aggregates, horizon layers, sand/silt/clay ratios, compaction etc.)
3. Water flow/retention in soil
4. erosion (wind and water)
5. plant growth
6. pest modelling
7. organic matter decay

There are probably others as well which I will need to look at.

My main concern is that such a crude first approximation might not suffice, for any range of parameters, and that great attention to accurate mathematical models might be needed from the beginning.

Anyway, I would be interested to know how long you have been working on your project, or how many hours you have devoted to it.

Cheers,

Henry

De: Andrew Lyjak <andrew.lyjak@gmail.com>
Enviado: miércoles, 16 de enero de 2019 7:09 a. m.
[Quoted text hidden]

[Quoted text hidden]

Andrew Lyjak <andrew.lyjak@gmail.com> Tue, Jan 15, 2019 at 8:22 PM
To: Henry Coulson <h.coulson@outlook.com>

Whilst I haven't looked at all of the links you sent me in great detail, I would imagine that there would be license restrictions on how you could use some of the models which are already out there.

> I imagine you are right, only some of them are going to be open source, and the one's that are may have restrictive licences like the GNU license that doesn't allow development for commercial purposes. iirc the MIT license and the apache license are suitable for modification and integration in a commercial product. Even so, one way to get around this may be to open source the simulator as an engine, and then simply use the simulator in the the game itself as an external library

My main concern is that such a crude first approximation might not suffice, for any range of parameters, and that great attention to accurate mathematical models might be needed from the beginning.

> I would caution you here. You aren't trying to create a chemical level simulation, you are trying to create a permaculture simulation. Permaculture is characterized by exploiting and creating synergies in which each distinct input serves multiple functions. To me, in order to create a viable permaculture simulation you don't need to provide a world class predictive accuracy, what you need to offer is the ability to understand multiple functions and identify when your inputs are behaving multi-functionally -- that's what I think differentiates it from other ecological modeling efforts. So, I believe that using first approximations and heuristics will be fine in most situations. With that being said, if its used for anything other than a game, I do think models should have a validation dataset they are measured against, such that its explicit what level of accuracy and uncertainty is designed into it. BTW, I think your list of modeling areas looks sound!

Anyway, I would be interested to know how long you have been working on your project, or how many hours you have devoted to it.

> I started thinking about this project in September, and I've been putting some evenings and weekends to it. I'm a newcomer to permaculture, having only really started learning about it this fall. I recently quit my job, so I've had much more time for the past couple weeks to work on this. I'm hoping to get an app out before I find gainful employment again :) ... also, I'm working on a submission for this design contest :https://pina.in/permaculture-design-contest/ I'm using the contest to better understand what the app should do and how it should look and function. Hopefully I can win it and then invest the winnings back into

developing more software as well as improving my yard!
[Quoted text hidden]

Henry Coulson <h.coulson@outlook.com> Wed, Jan 16, 2019 at 10:06 PM
To: Andrew Lyjak <andrew.lyjak@gmail.com>

"I imagine you are right, only some of them are going to be open source, and the one's that are may have restrictive licences like the GNU license that doesn't allow development for commercial purposes. iirc the MIT license and the apache license are suitable for modification and integration in a commercial product. Even so, one way to get around this may be to open source the simulator as an engine, and then simply use the simulator in the the game itself as an external library"

> Yep, you are right there. I am not fluent enough in legalese to know whether or not a GNU license can be used in an open source library, which is then used in a commercial product. I would be surprised if that particular loophole hadn't been closed, but again I am not an expert in that space, so you might know best here.

"You aren't trying to create a chemical level simulation, you are trying to create a permaculture simulation. Permaculture is characterized by exploiting and creating synergies in which each distinct input serves multiple functions. To me, in order to create a viable permaculture simulation you don't need to provide a world class predictive accuracy, what you need to offer is the ability to understand multiple functions and identify when your inputs are behaving multi-functionally -- that's what I think differentiates it from other ecological modeling efforts."

> True, but I think that some modelling of chemical processes is fundamental and necessary. If you are a Permaculture designer, then you should be aware of how your plants become nitrogen deficient, for example. I would guess that a lot of phenomena of Permaculture is emergent from the chemical/biological processes anyway. Nevertheless, I did breathe a sigh of relief when I read your comment, because modelling chemical processes is quite dull, and I was not looking forward to it. I also think that things like plant guilds and inter cropping might have to wait, considering that there is not much info out there at the moment on those fronts, besides rules of thumb, and old time gardeners wisdom. So in the meantime, I am just sticking to what will be easy to work on.

" I started thinking about this project in September, and I've been putting some evenings and weekends to it. I'm a newcomer to permaculture, having only really started learning about it this fall. I recently quit my job, so I've had much more time for the past couple weeks to work on this. I'm hoping to get an app out before I find gainful employment again :) "

> Haha, That is pretty much me, actually. I quit my job for a number of reasons, and this was one of them. Well if you do get something out there or if I can be of any assistance, then do let me know.
I suspect that there might be some significant overlap in what we are doing, so we might be able to help each other out, you never know.

Cheers,

Henry

De: Andrew Lyjak <andrew.lyjak@gmail.com>
Enviado: miércoles, 16 de enero de 2019 2:22 p. m.
[Quoted text hidden]

[Quoted text hidden]

Andrew Lyjak <andrew.lyjak@gmail.com> Wed, Jan 16, 2019 at 10:26 PM
To: Henry Coulson <h.coulson@outlook.com>

Sounds good,

You'll be one of the first to let you know when I've got something worth sharing. I'm going to try and encode the "old time gardner's wisdom" for the time being in order to recommend guilding strategies. But I'll also reach out if/when I'm starting to want something more complicated on the back end. A bit of a tangent, but I recently learned Rust and, although it is a young language, I think it may be perfectly suited for building a performant ecological simulation, and I'm hoping to take a crack at it sometime soon!

Good luck with your endeavors, I really enjoyed this chat!

Cheers,
Andrew Lyjak
[Quoted text hidden]