An Experiment Delving Into The Formation of Highly Innovative Regions Like Silicon Valley
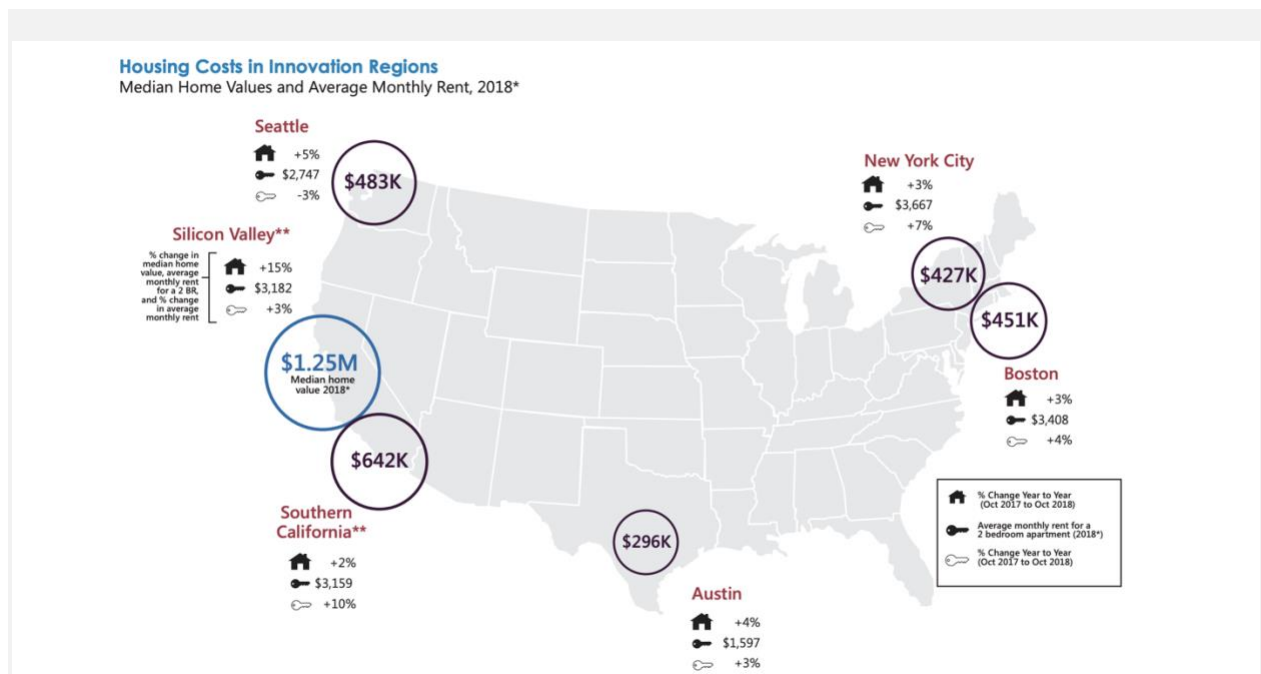
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Much like the peppered moth during the Industrial Revolution, regions in Northern California (especially around the Bay Area) have undergone a metamorphosis as a result of the technological and economic boom in the last half-century. Primarily, we can attribute this to the record number of technological advances that Silicon Valley has sustained ever since its beginnings as a hub for semiconductor technologies. However, this is only part of the picture.

This area has become a sort of pop culture phenomenon, considering its presence in the media: news, film, and especially television — but what makes it so appealing? In a report done by the Silicon Valley Competitiveness and Innovation Project, authors John Melville, Janine Kaiser, and Audra Keefe delineate the growth patterns of this region, among other factors.

Housing Costs in Innovation Regions
Median Home Values and Average Monthly Rent, 2018*

Seattle
+5%
$2,747
-3%
$483K

New York City
+3%
$3,667
+7%
$427K

Silicon Valley**
% change in median home value, average monthly rent for a 2 BR, and % change in average monthly rent
+15%
$3,182
+3%
$1.25M
Median home value 2018*

$451K

Boston
+3%
$3,408
+4%

$642K

Southern California**
+2%
$3,159
+10%

$296K

Austin
+4%
$1,597
+3%

% Change Year to Year (Oct 2017 to Oct 2018)
Average monthly rent for a 2 bedroom apartment (2018*)
% Change Year to Year (Oct 2017 to Oct 2018)

"Housing Costs in Innovation Regions"—SCVIP

Above is a map of the various median home prices across the nation. This map tells me two things: there is an increase in the median home price in Silicon Valley, reiterating this region's burgeoning standard of living, and that I may need to set up shop in a cardboard home if the cost of living gets any higher. Pair nice homes with a preexisting appeal to live in relatively close proximity to corporations in major cities (San Francisco, Palo Alto, Mountainview, Santa Clara, etc.) and it invokes the population in any area to skyrocket.

The Idea

In recent years, it's become more evident that hubs like Silicon Valley are growing at rapid rates — and it's not just because of the abundance of boba shops. More and more, tech-related startups move into these places and fill their staff to the brim with skilled labor. It's done a lot for the community: increased wages, a higher standard of living, but also inflation and overcrowding.

After examining this metamorphosis, I began tying this to the Schumpeterian theory of *Creative Destruction*. In crude terms, this involves the changing of the marketplace, *destroying* incumbent innovations by replacing them with newer innovations. With this idea in mind, it became clear how preexisting industries would be transplanted by newer ones, reshaping the landscape for potential careers and subsequently bolstering consumer spending.

Now considering the initial goal, this theory was crucial toward uncovering the crux of Silicon Valley's success in sustaining its growth while answering the question: what makes this place so successful?

I also solely focused on the relationship between startup-companies and investors, as this was the seed of these companies' growth. Essentially, my logic was that an innovator would develop an idea and present it to wealthy investors, allowing for an eventual growth in staff. (I utilized staff growth as a response variable because a company that can support a larger staff indicates monetary success.)

Moreover, I referenced a research paper entitled *Blade Runner Economics: Will Innovation Lead the Economic Recovery?*, written by Daniele Archibugi, in which the author discusses the effects of innovation on economic development. This paper discussed a macroeconomic view of Schumpeterian theories, providing a basis for my model.

Using NetLogo, an agent-based modeling simulation tool developed by researchers at Northwestern University, I replicated this peculiar system. The attributes of each agent were split between wealth and inventiveness. As a whole, the aim was to see if wealth and ingenuity placed in close proximity could form clusters similar to that of Silicon Valley.

The Experiment

I began by distinguishing 4 types of agents: *workers*, *innovators*, *investors*, and *wealthy innovators* (both an innovator and investor). I first identified the *worker* turtle (the Netlogo name for an agent) as the base classification, which would be the majority of the population. Next, I assigned a smaller subset as the *innovators* who were likely to develop a successful company. The *investors*, the turtles funding the innovators' companies, were similar in proportion. Finally, I considered the *wealthy innovators* (based off of Silicon Valley CEO's that could fund their own projects), which were incredibly rare and low in frequency.

I set the proportion of the inventive turtles at 1.89%, as this figure was calculated from the number of successful start-up companies that withstood a [10 year growth period](), among the reported number of self-employed workers from the [Bureau of Labor Statistics](). I then set the wealthy population at 1%, based on the mean estimate from *The New York Times* article, "The Millionaire Next Door: The Surprising Secrets of American's Wealthy", written by Thomas J. Stanley, Ph.D. and William D. Danko, Ph.D.

With these figures, I was able to assign percentage values to each type of turtle. After programming the model, which can be found on my [GitHub](), I ran it through several instances.
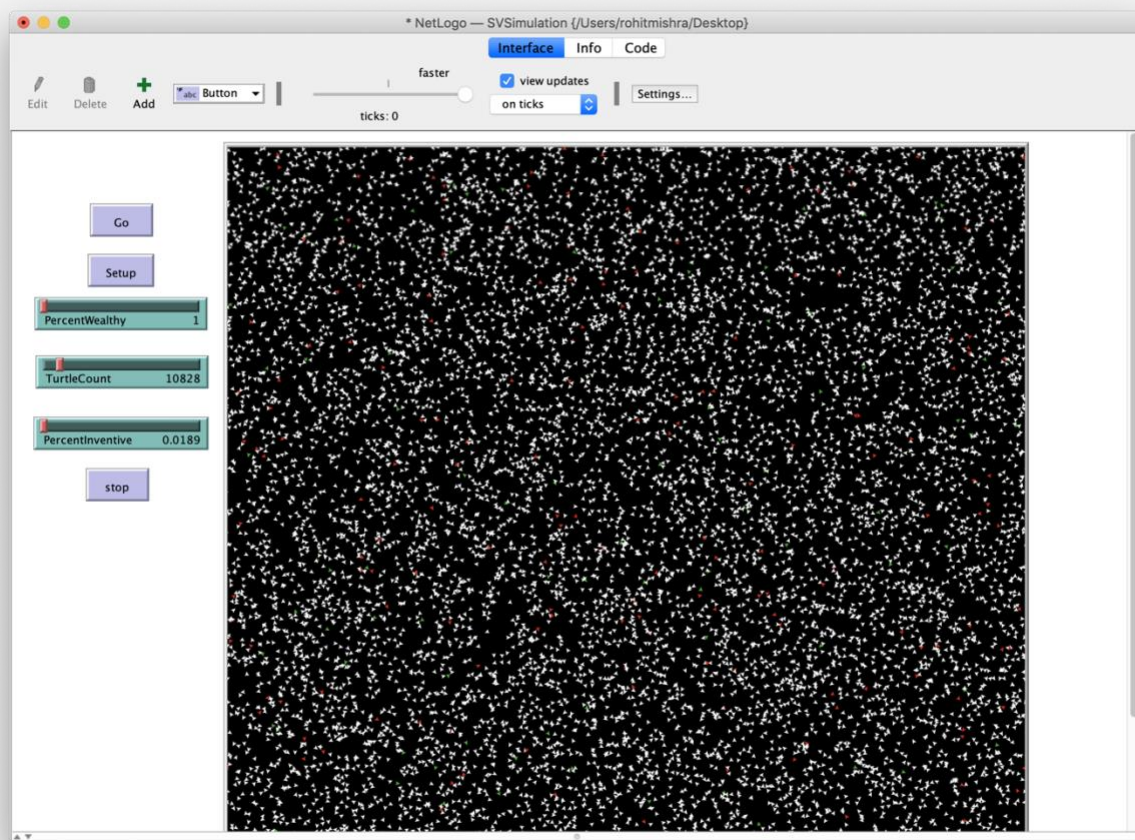
Interface at 0 ticks (runs)

Above is the original environment, with the various agents scattered across the patches. There are different sliders to manipulate the percent of the population that is considered inventive, wealthy, and also to change the size of the population.
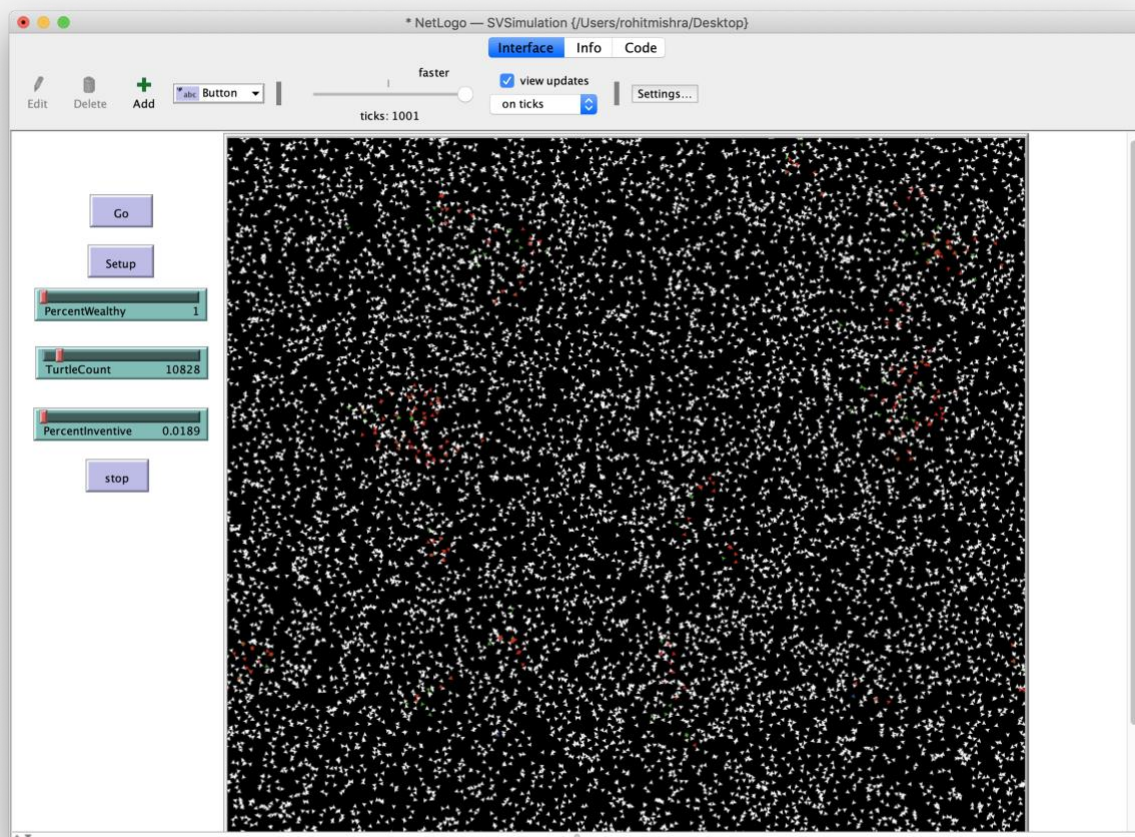
Interface after 1000 ticks (runs)

After running the model through 1000c instances, the results are pictured above. Immediately, there are visible cluster formations of red and green agents. There are also distinct clusters around the map that resemble the placement of cities in Silicon Valley.

We can conclude that when innovation and wealth are in close proximity, it not only affects the wealth and capital of each respective company, but it more so propagates the coexisting of these entities, allowing for large industrial hubs to form. This is why cities such as New York and San Francisco have a distinct industry attached to their central economy—finance and technology, respectively.

Then What?

This simulation, in its entirety, reiterates the unique composition of Silicon Valley, geographically and economically. This system emphasizes the importance of innovativeness' proximity wealth and it also displays that it is essential for a region like the one we see today to actually take shape.

Although this was a fairly simplified overview of the underlying factors present in this region, there is definitely more research that needs to be done in order to uncover the after-effects of such region formation. Considering the effects that the increased wealth in this area have had on the population, including gentrification and overcrowding, it is important to note that although the economy benefits, there are still downsides to rapid development.