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Housing in Silicon Valley

A survey on the status quo and a solution proposal

April 2016

'I do what I have to do, I have a family to take care of. It is my responsibility to take care of them. If that means sacrificing a few spare hours a day to give them a better life, I'll do it.'
He works for Stanford University Dining. Every day he needs a six-hour round trip commute on bus, bike and train from his home in Stockton.
Ronnie Thomas, Stanford University employee, KQED News, March 28, 2015

'Silicon Valley's affordability crisis: A push for new housing ideas'
San Jose Mercury News, July 6, 2015

'Developer sees homes at site. Voters rejected low-income complex at location.'
San Jose Mercury News, July 12, 2015

'In Palo Alto, one of the Bay Area's wealthiest cities, a frantic effort aims to prevent a tiny enclave of the city's poorest residents from losing their homes.'
San Jose Mercury News, July 19, 2015

'As rents rise, tenants sink. Even professionals struggle to keep a roof overhead as job growth fuels dizzying increases that far outstrip wages.'
San Jose Mercury News, August 5, 2015

'Working people are going hungry due to high rents: The high cost of housing is forcing too many families to choose between paying rent or buying food. That is an unconscionable choice.'
San Jose Mercury News, November 22, 2015

'Room to grow? 27,900 new Apple employees could be added given the building and property deals.'
San Jose Mercury News, November 4, 2015

'Feeling crowded now? Expect to feel more so. Looking ahead, one high-growth projection is that by 2040, jobs will grow 32%, population is projected to rise 30%, Report by the Bay Area Council Economic Institute.'
San Jose Mercury News, November 11, 2015

'Housing shortage claims Stanford oasis: Escondido Village – home to generations of grad students with families – to be replaced with units for singles'
San Jose Mercury News, December 12, 2015

'Steady increase, $2,436 average monthly rent in San Jose, up 9.4% from one year ago.'
San Jose Mercury News, January 20, 2016

'Priced out of valley homes, millennial generation facing prospect of leaving Bay Area to find affordable housing.'
San Jose Mercury News, February 10, 2016

'Affordability crisis hits home, attorneys for woman, 97, say she is facing eviction.'
San Jose Mercury News, February 27, 2016

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1. SUMMARY

Silicon Valley's well-established high tech companies and its numerous startups lead to a constant increase of jobs. This results in a strong influx of new workers. Unfortunately the construction of new residential units is not keeping pace with the increased demand, wherefore real estate prices and rents are at an all-time high. In 2014, the San Francisco Bay Area and San Jose held the number one and two spots on a list of the highest rent increases in the United States. [1]

Residents most lower and mid-income levels can no longer afford housing close to their workplace. In this context affordability is defined as the ratio of yearly housing expense to yearly household income based on all data available in a certain geographic region. If this ratio exceeds 30%, some low- and some mid-income levels are priced out of the region and are marginalized. This leads to a high level of commuting traffic, homelessness and a lack of societal diversity.

This paper digs into the root causes of Silicon Valley's housing challenge referred to the global phenomenon of urbanization. The procedure is determined by the use of statistical indicators to create meaningful characteristic values. It describes the root causes of the housing shortage by relating to the growth of two big companies and their hometowns – Google in Mountain View and Apple in Cupertino. At the end it suggests an idea to reduce the tension in housing in the region Silicon Valley.

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[1] Zillow Data

2. URBANIZATION – A GLOBAL PHENOMENON

Cities are booming. At the best, they are vibrant places to live with enormous social and economic value. To achieve this status or to maintain it, cities need to not only thrive economically, function legally, and work politically, but also a liveable environment and affordable housing. But it is precisely the latter that is becoming increasingly difficult to find due to the urbanization trend.

The definition of urbanization refers to the increasing number of people that live in urban areas. According to the United Nations, urban population will increase more than 2.5 billion between 2010 and 2050 in less developed regions, compared to less than 150 million in its more developed regions. By 2050, more than 85 percent of the world's urbanization is expected to be in today's less developed regions. [2]
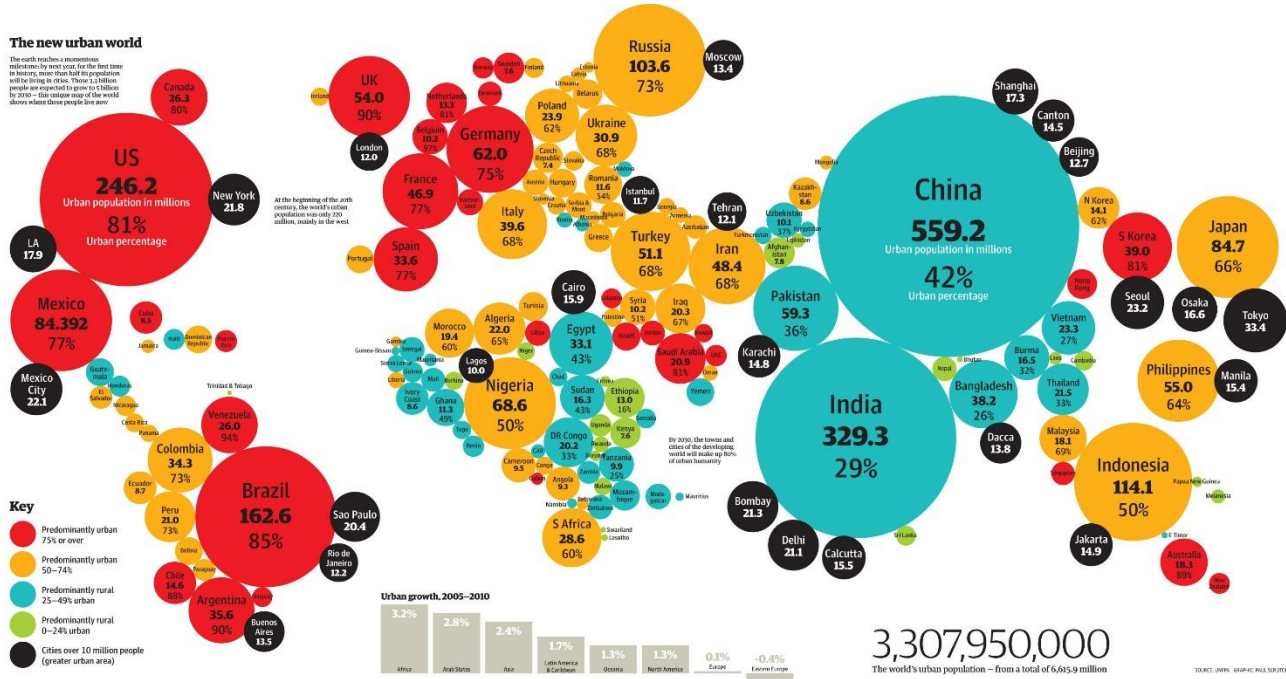

Figure 1 The new urban world, Source: United Nations Population Fund (UNFPA) Graphic: Paul Scruton, 2010

The urbanization process and its challenges aren't new. However, many urban areas face big problems handling the increase in population and the great demand in housing. Therefore housing and especially its

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[2] United Nations 2014, 118

affordability - ratio between housing expenses to household income - becomes one of the biggest challenges, as can be seen in many metropolitan areas with a high population influx like Silicon Valley.

It predominantly results in the physical growth of urban areas, be it horizontal or vertical but the demand seems to be never met. [3]

According to the United Nations, the urban areas of the U.S. are defined by 50.000 or more inhabitants. [4]

Based on this definition 81% of U.S. areas already urbanized.

Silicon Valley, one of the U.S.'s urban areas, also belongs to the Primary Metropolitan Statistical Area Subareas. They are defined by having a population of one million or more. [5]

Consequently it is advised to have a look at the already urbanized areas, like Silicon Valley, in order to identify risks that cause housing problems and possible solutions.

3. HOUSING SITUATION IN SILICON VALLEY

Sixty years ago, the rural area south of San Francisco was filled with fruit orchards. Since then it has been transformed into a vibrant business world. As the epicenter of *digital*, Silicon Valley is a magnet for people all over the world who want to be employed or create a startup in electronics, software and the technology industry. And of course these people wish to settle close to their workplace. Therefore Silicon Valley's population is growing rapidly, primarily driven by foreign immigration and natural change despite declining birth rates.[6]

For the purpose of this investigation, the Silicon Valley region is defined according to the annual publication *Silicon Valley Index*, published by Joint Venture Silicon Valley. The area includes all of San Mateo County, Santa Clara County, Scotts Valley in Santa Cruz County, and the cities of Fremont, Newark and Union City in southern Alameda County. [7]

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[3] Reviews 2015
[4] United Nations 2014, 118
[5] U.S. Department of Commerce
[6] Hancock 2016, 10
[7] *ibid.*, 6

Figure 2 Geographical boundaries of Silicon Valley, Source: Openstreetmap supplemented with own drawing

The land area of Silicon Valley is 1.854mi² (4.801 km²) with a population of 3.000.000 inhabitants. This results in a population density of 1.618 persons/mi² (625 persons/km²).

In comparison the metropolitan area of Vienna/Austria amounts to 10.869 persons/mi² (4.196 persons/km²).

According to the growth of workplaces in Silicon Valley's high tech companies it is relatively easy to get hired, compared to finding a place to live. As a worldwide rule of thumb up to 30% of a household income is needed to afford housing. In Silicon Valley 39% of its renters have to spend more than 35% of their income to satisfy their housing needs. Overall the number of people in California that are burdened with such high housing costs is even higher: 45%.
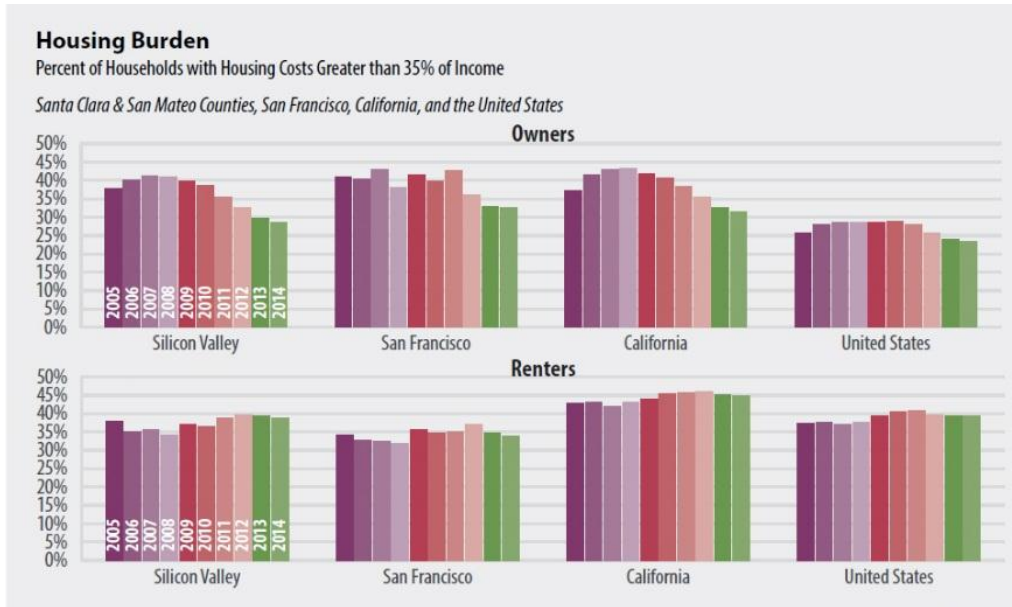
Figure 3 The share of Silicon Valley owners and renters burdened by housing costs, Source: Hancock 2016, Silicon Valley Index, 66.

The housing burden is climbing only among the renters. A slight home reduction between 2012- 2014 could be explained by the fact that there was increased commuting traffic (see section 6.2) by people that moved out of Silicon Valley to find more affordable homes.

The table below states current figures about Silicon Valley and 4 of its self-organized cities to provide a differentiated overview of the actual situation in comparison to Vienna/Austria:

City	Housing unit density [units/km²]	Median household income [€]	Median monthly rent [€]	Affordability
Mountain View	1.090	89.035	3.855	52%
San Jose	685	74.849	3.149	50%
Sunnyvale	980	91.509	3.450	45%
Cupertino	721	118.889	4.133	42%
Vienna/Austria	2.371	21.143	486	28%

Figure 4 housing facts, Source: U.S. Department of Commerce, Statistik Austria, own analysis

All of the mentioned cities experience an influx of population into their boundaries. Vienna's housing unit density shows that it expanded not only horizontally but also vertically in the past. However, in Silicon Valley 2-3 story buildings for housing purposes are the norm, whereas the increasing demand for additional housing is hardly met by horizontal expansion.

"As employment growth accelerates and the region's population continues to grow rapidly, housing remains a critical issue. Low housing inventory and increasing demand are driving up median sale prices – which reached $830.000 in 2015 (6% higher than the previous year) [...] rental rates have gone up 8% year-over-year. Income gains were not nearly enough to accommodate home price and rental rate increases between 2013 and 2014, and new housing development has fallen far short of meeting the needs of a growing population. As such, household size and the share of multigenerational households have been increasing as residents try to minimize their housing costs." [8]

Housing Inventory
Average Monthly For-Sale Inventory

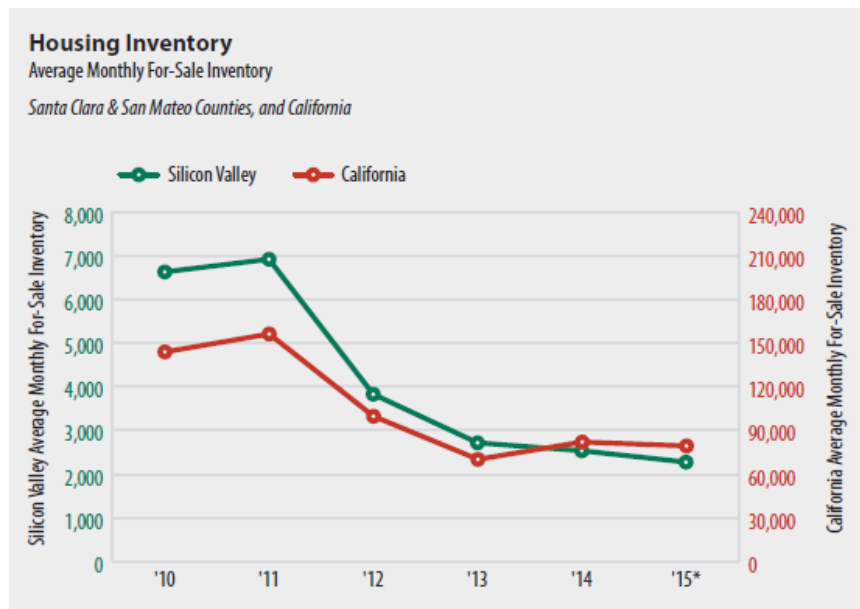*Santa Clara & San Mateo Counties, and California*

Figure 5 Housing Inventory, Source: Hancock 2016, Silicon Valley Index, 59.

The inventory of Silicon Valley houses listed for sale each month has declined by 10% since 2014. [9]

Comparing the number of units being developed (units in building permits issued) with the number of units that are actually needed to accommodate the region's growing population provides an estimate of the housing shortage. The data suggests a shortage of nearly 25.000 units in Silicon Valley (Santa Clara and San Mateo Counties) since 2007, taking into consideration rising household sizes.[10]

A home is considered "affordable" if it costs no more than 30% of a household's annual income. Affordable homes are required to limit their rents and mortgages for a period between 15 to 55 years. Such properties are

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[8] *ibid.*
[9] *ibid.*, 59
[10] *ibid.*

built by private and nonprofit developers for middle and low income households. These are households making not more than 80 percent of their area's median income level, which in the Bay Area varies according to the city/county, but is an average of $62.000 per year. [11]

4. ROOT CAUSES OF THE HOUSING SHORTAGE

The causes for the housing shortage in Silicon Valley can be found in two main facts:

  1. Silicon Valley's attractiveness as a workplace with a wide range of technology companies.
  2. Local growth of well-established high tech companies

In the following section these two facts are described and highlighted by examples of the two tech companies: Google and Apple.

4.1. Silicon Valley's attractiveness as a workplace

The pace to get new software related products to market gets faster and faster. Therefore technology companies in Silicon Valley aim for a very short reaction time with regard to product development highly efficient teamwork. This leads to the requirement of workplaces that are close-by to Stanford University campus and partners. Venture capitalists especially want to have a very short commute to companies in which they invest. As a consequence lots of innovative ideas are being worked on right in Silicon Valley instead in other areas of the US or the world. Innovators are somewhat "forced" to move to Silicon Valley to get funded. This leads to a steadily increasing workplace density between San Francisco and San Jose, because the geographic boundaries of Silicon Valley remain unchanged.

Between Q2 2014 and Q2 2015, the San Francisco Bay Area created 134.318 additional jobs (rising to a total of 3.67 million jobs). Job growth in Silicon has been accelerating since 2010, with the most rapid growth occurring between Q2 2014 and Q2 2015 at 4.3% (+64.363 jobs) – a rate higher than any other year since 2000.[12]

Silicon Valley's job growth rate remained extraordinarily high in 2015 [13]

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[11] Association of Bay Area Governments 2014, 9
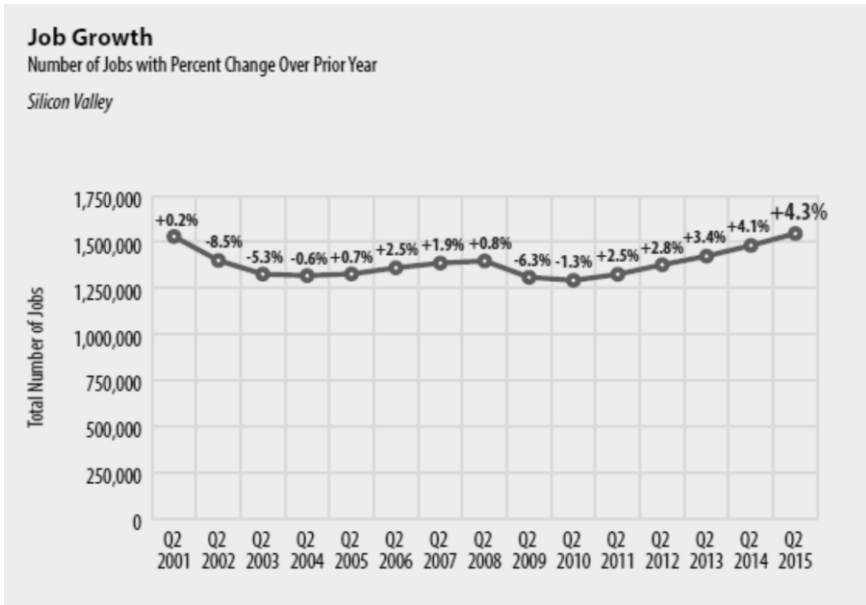[12] Hancock 2016, 16f
[13] *ibid.*, 16

Figure 6 Job Growth, Source: Hancock 2016, Silicon Valley Index, 66.

4.2. Local growth of well-established high tech companies
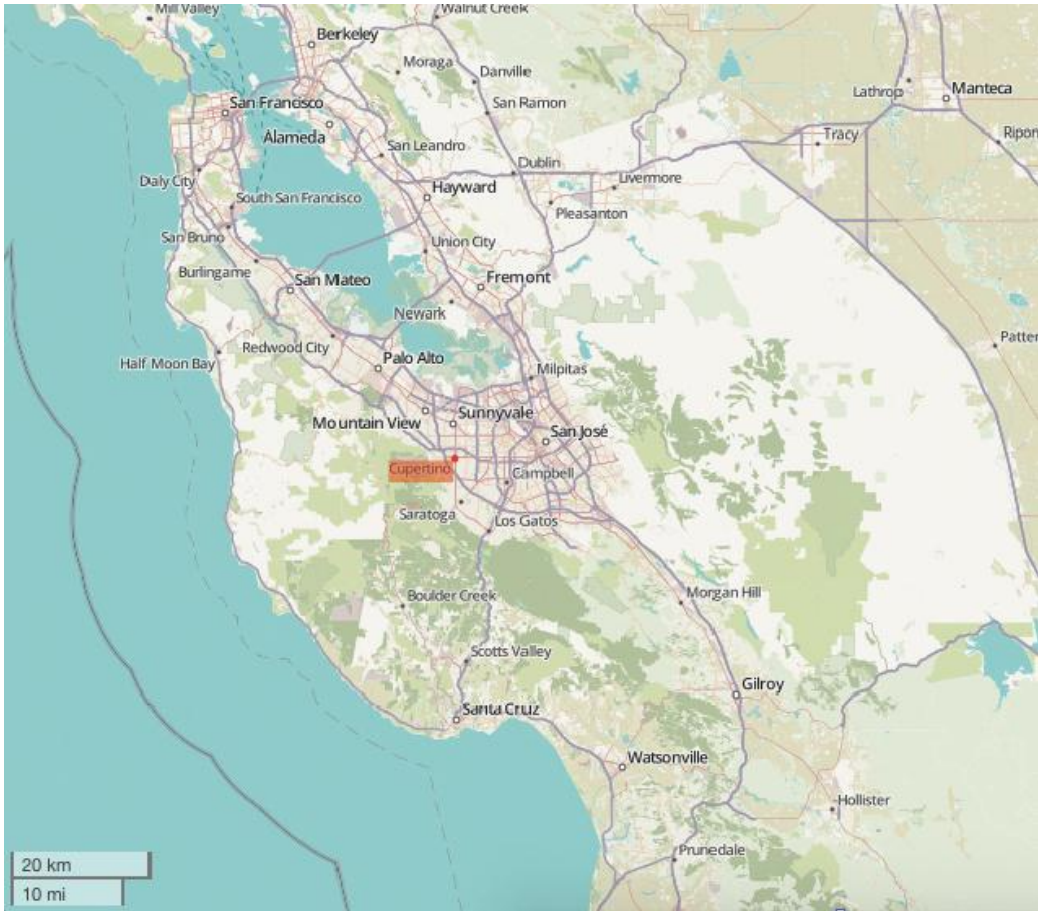
4.2.1. Apple in Cupertino

Figure 7 Silicon Valley, highlighted: City of Cupertino, Source: Openstreetmap supplemented with own drawing

The city of Cupertino is located 45 miles south of San Francisco and showed a steady population growth rate over the past decades. In 2013 Cupertino had an estimated population of 60.189 people on a total area of 11.257mi² (29.156 km²). That results in a density of 5.200 persons/mi² (2.000 persons/km²). [14]

Census	Population	%±
1960	3.664	—
1970	17.895	388.4%
1980	34.297	91.7%
1990	40.263	17.4%
2000	50.546	25.5%
2010	58.302	15.3%
Est. 2014	60.668	4.1%

Figure 8 Historical population Cupertino, Source: http://www.census.gov/prod/www/decennial.html

Cupertino has been Apple's headquarters since 1977. Since that time the number of employees has risen to 16.000 in 2013, which makes Apple Cupertino's largest single employer.[15]

Apple is still growing and currently finalizing its construction of Apples' Campus 2 in Cupertino.

Figure 9 Rendering Apple Campus 2, Source: https://upload.wikimedia.org/wikipedia/commons/0/0d/Apple_Campus_2_rendering.jpg

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[14] U.S. Department of Commerce
[15] Keyser Marston Associates 2013, 4

This will enable Apple to add an estimated 7.400 additional jobs in Cupertino.[16] Those internal jobs also create service-related jobs. Apple estimates an increase of 12.000 additional jobs just due to its expansion.
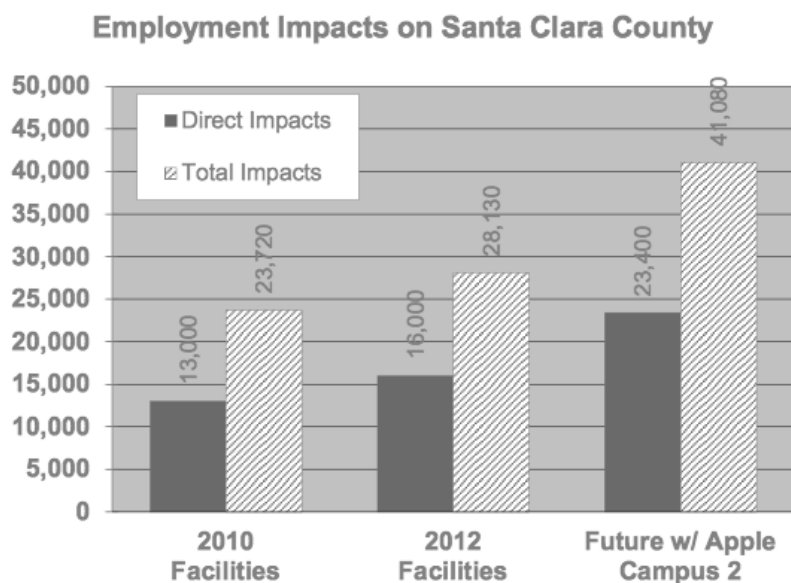

Figure 10 Direct and Indirect employment impact of Apple's Campus 2, Source: Economic and Fiscal Impacts Generated by Apple in Cupertino – Current Facilities and Apple Campus 2

This means that 1 additional Apple tech job creates around 1.6 (12.000 jobs/7.400 jobs) additional jobs in the surrounding economic environment. Other sources find an even factor correlation: For each job created in the local high-tech sector, approximately 4.3 jobs are created in the local non-tradable sector in the long run. [17]

However, all of these new employees aim for a short commute. Apple's Cupertino-based employees with higher income than in other service-related jobs reside throughout the San Francisco Bay Area, but 64% of them is living in communities within Santa Clara County. Key concentrations in the Bay Area include the following cities:

San Jose	**25%**
San Francisco	14%
Cupertino	8%
Sunnyvale	8%
Santa Clara	6%

Figure 11 key concentrations of Apple employees in the Bay Area, Source: Economic and Fiscal Impacts Generated by Apple in Cupertino – Current Facilities and Apple Campus 2

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[16] *ibid.*
[17] Hathaway 2012, 25

Logically it can be expected that the creation of the new Apple Campus 2 quite close to its current
headquarters will exacerbate the housing shortage for low- and mid-income levels in the Bay Area. Apple's
expansion is a double-sided sword: On the one hand it is great for the economy to provide additional jobs, but
on the other hand those jobs are created right in the center of an already booming region with an existing
housing shortage.

The land use of 3.420.000 sqft for Apple Campus 2 does not help but further increase the housing shortage.
So it follows that low- and mid-income residents have to make room for those additional tech employees that
can afford the ever-rising housing costs. Apple's planned contribution of $2.5mio for additional affordable
housing as part of their investment in their new campus does help but appears a drop in the bucket.

Public Improvements and Community Benefits to be Funded by Apple ($ Millions)	One-Time Investments	Annual Investment
Roadway, Utility and Public Safety Improvements	$50.2	
Bicycle and Pedestrian Facilities	$10.0	
Additional Affordable Housing Contribution	$2.5	
Park Land	$3.7	
Traffic Demand Management Program		$35.0
Total	**$66.4**	**$35.0**

Figure 12 Public Improvements and Community Benefits to be funded by Apple, Source: Economic and Fiscal Impacts Generated by
Apple in Cupertino – Current Facilities and Apple Campus 2
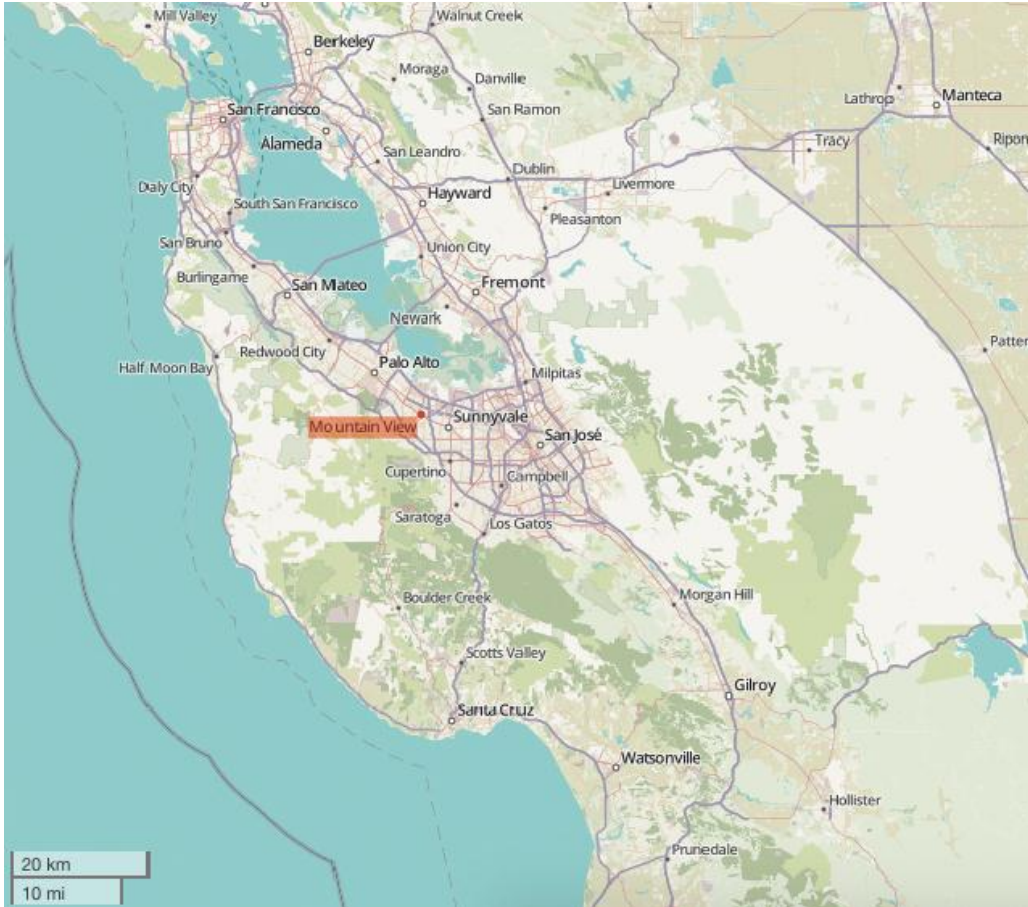
4.2.2. Google in Mountain View

Figure 13 Silicon Valley, highlighted: City of Mountain View, Source: Openstreetmap supplemented with own drawing

The city of Mountain View is located about 40 miles south of San Francisco, right in the middle of Silicon Valley and home of Google's headquarter.

In 2014 the city had an estimated population of 79.378 people [18] that lived on a total area of 12.273mi² (31.788 km²). This results in a density of about 6174,7 people/mi² (2300people/km²). Mountain View also showed a steady population growth with its peak time in the 1950s and 1960s. Most of the housing that was built still forms Mountain View's landscape.

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[18] U.S. Department of Commerce

Census	Population	%±
1880	250	—
1930	3,308	—
1940	3,946	19.3%
1950	6,563	66.3%
1960	30,889	370.7%
1970	54,132	75.2%
1980	58,655	8.4%
1990	67,460	15.0%
2000	70,708	4.8%
2010	74,066	4.7%
Est. 2014	79,378	7.2%

Figure 14 Historical population Mountain View, Source: http://www.census.gov/prod/www/decennial.html

For 15 years Google has been situated on the eastern boundaries of the City – the North Bayshore area. The estimated number of employees in 2014/15 was 16.688 people which makes Google with 14.4% the single largest employer in Mountain View. [19]

In February 2015 Google presented plans for future developments of the company: the Googleplex. The idea is to create an open, flexible and transparent office space for the next decades.[20]

Figure 15 bird's eye view of the Googleplex, right at the Bayshore,
Source: https://plus.google.com/photos/116899029375914044550/album/6120564551779148881/6120564600904301794

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[19] Kong and Zheng 2016, 165
[20] Radcliffe 2015

Figure 16 Rendering of Huff Avenue (main street of the proposed Googleplex),
Source: https://plus.google.com/photos/116899029375914044550/album/6120564551779148881/6120564600904301794

The plans call for 595.000 sqft in total office development.[21] "In general we add 1 workplace for every 250sqft (23,23m^2) of new space added." [22] That means in total 2.380 additional employees will call Mountain View their new working place. The proposal does not include any plans for housing, but the company has told the City Council of Mountain View that it needs lots of it. They want to amend the city's plan to allow at least 5.000 new housing units.[23]

4.2.3. Commuting

An effect in the region is the rising traffic. Most people in Silicon Valley are tech-workers. Single tech workers tended to move to San Francisco because of lifestyle, whereby non-tech workers but also tech workers with family were affected by the increased density in Silicon Valley. They were forced to move to the suburbs of San Jose like Los Banos or to the East Bay Area due to the steadily increasing housing price level. The average commute times to work have risen to 27 minutes, that's 14% over the last decade. [24]

Google and Apple have tried to reduce traffic, for both the city and itself. They transport their employees to work in private buses. In addition, Google was at one point experimenting with bringing some of its San Francisco workers in on boats. They started a free daytime shuttle that is open to the public and they provide its multicolored company bikes for their workers.[25]

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[21] Noack
[22] David Radcliffe. Email, 2 March 2016
[23] Dougherty 2015
[24] Hancock 2016, 9
[25] Dougherty 2015

Also the use of Caltrain eased the heavy traffic on the Bay Area's interstate routes. However, tech companies like Apple and Google expand their campuses in Silicon Valley and numerous startups are still being created right there and in San Francisco. The business land use and further increase of job opportunities will exacerbate the surge of people commuting into Silicon Valley.

4.2.4. Outlook

The housing market impacts a region's economy and quality of life. An inadequate supply of new housing negatively affects the diversity of a region. A lack of affordable housing results in longer commutes, diminished productivity, curtailment of family time and increased traffic congestion. It also restricts the ability of crucial service providers—such as teachers, registered nurses and police officers—to live near the communities in which they work. [26]

"Additionally, high housing costs can limit a families' ability to pay for basic needs, such as food, health care, and clothing. As a region's attractiveness increases, home sales, average home prices and rental rates tend to increase. Higher levels of new housing and attention to increasing housing affordability are critical to the economy and quality of life in Silicon Valley." [27]

Comparing the number of units being developed with the number of units that are actually needed to accommodate the region's growing population provides an estimate of the housing shortage. The data suggests a shortage of nearly 25,000 units in Silicon Valley since 2007.[28]

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[26] Hancock 2016, 58
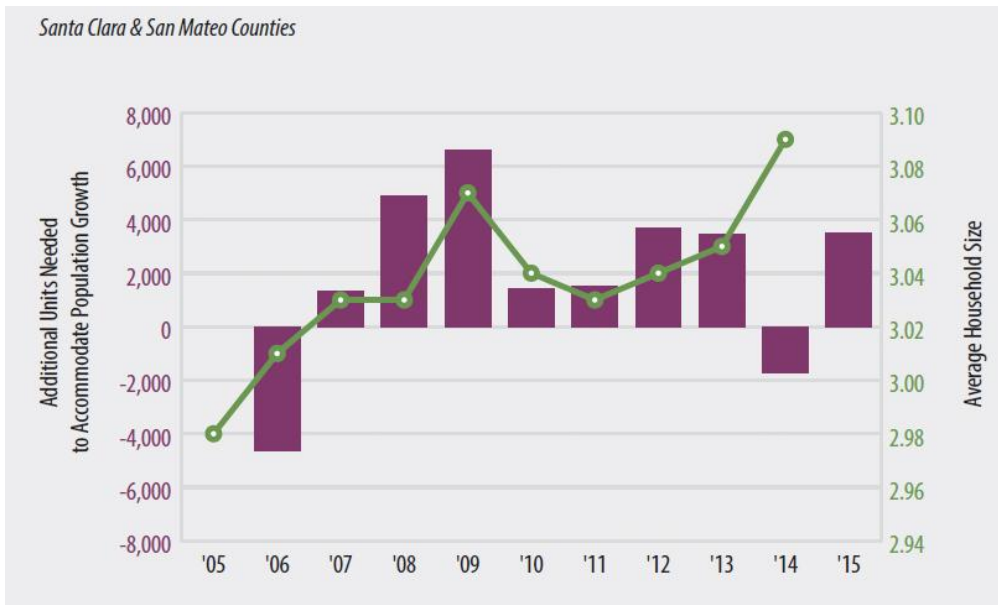[27] *ibid.*
[28] *ibid.*, 59

Figure 17 Average Household Size & Additional Units Needed to Accommodate Population Growth, Source: Source: Hancock 2016, Silicon Valley Index, 62.

The described status quo and the estimated growth of jobs and population isn't just a phenomenon in Silicon Valley. Many urban regions are faced with the same challenge to accommodate the incoming people. (compare section 2, figure 2).

To solve the problem of housing in the Silicon Valley there could be two strategies. The first should be to organize the region of the Silicon Valley in terms of housing as one unit. The decentral attempt to define ways to provide more housing units want be last for the future as a sustainable concept. The 39 cities should arrange as one and define an overall strategy of the Valley.

The second could be defined by the tech companies. To solve the problem of housing, Silicon Valley could be a development leader, as it is for technology. The last section describes an approach which would use the disruptive mind setting of Silicon Valley and the developed technology to create housing which meets the requirements of housing of today's and future residents.

5. APPROACH TO IMPROVE THE SITUATION

There could be different approaches to ease the situation and solve the housing problem. In this paper a way with two different sequelae is shown, wherein a sequence is executed in more detail.

One way to bring the residential demand with supply in coverage could represent obligations of the large corporations in which they also have to provide housing with each new work place. This obligation would have to be pronounced as a demand from politicians. This requirement could have two consequences.

The first may be the failure to meet the demand and thus represent the migration of large corporations. This would create an equalization of jobs. This would result in an exodus of (new) jobs in the surrounded areas. It would lead to the formation of clusters and to redistribute the population. A decentralized labor market situation would arise. Although a price increase would put in the housing estates at these new locations, so the steady growth in Silicon Valley would be stopped.

The second could be the actual performance of the exposure. Thus, the large companies would also set up according to new housing in the immediate vicinity of the new jobs. Conceivable would be a disruptive process the subject living, in line with the basic spirit of the tech companies in Silicon Valley.
Furthermore, it would support the theoretical approach of sociology professor Saskia Sassen:
"The globalization of economic activity entails a new type of organizational structure. To capture this theoretically and empirically requires, correspondingly, a new type of conceptual architecture." [29]

It is clear that the land has to be used effectively. Moreover, the approach of living sufficiency is conceivable. The term sufficiency is used as an adequate offer adapted to the actual needs.

The idea assumes that the basic needs of the individual [30] have not fundamentally changed and the fulfillments of these needs are essential. However face the social structures of today's society changed completely. Because of rising incomes, increased living standards and declining number of persons per household, there was a continuous increase in living space per capita. [31] However, this arises just out of economic opportunities.

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[29] Sassen 2005
[30] Maslow Abraham 1943
[31] Comparison: Vienna 1961 – 22m²/person, 2014 – 37,8 m²/Person, U.S. 75m²/person, China 30m²/person, Germany 45m²/person

Currently, there is a shortfall in basic, objectified statements about the actual housing requirements. The current generated knowledge base is defined by ideologies, opinions and habits that doesn't meet the future socio-cultural needs of people.

A brief digression to the scientific positioning of access and outlines will explain the invention of the *Frankfurt kitchen*. Through the urban development program *Neues Frankfurt*, 1925-1930, the city realized in a situation of comprehensive housing of 8,000 units of a new type by a systematic basic research. One of today formative innovations of this program represents the functional spatial optimization of the kitchen, and the resulting space configuration of kitchen, living-dining room and their execution. The *Frankfurt kitchen* was a structured analysis and empirical testing by Austrian architect Margarethe Schütte-Lihotzky. She focused on practical processes and their spatial optimization in terms of rationalization. The result had been a key and re-interpretation of the kitchen space, which has become the national and international standards, despite their radicalism within the shortest time.[32]
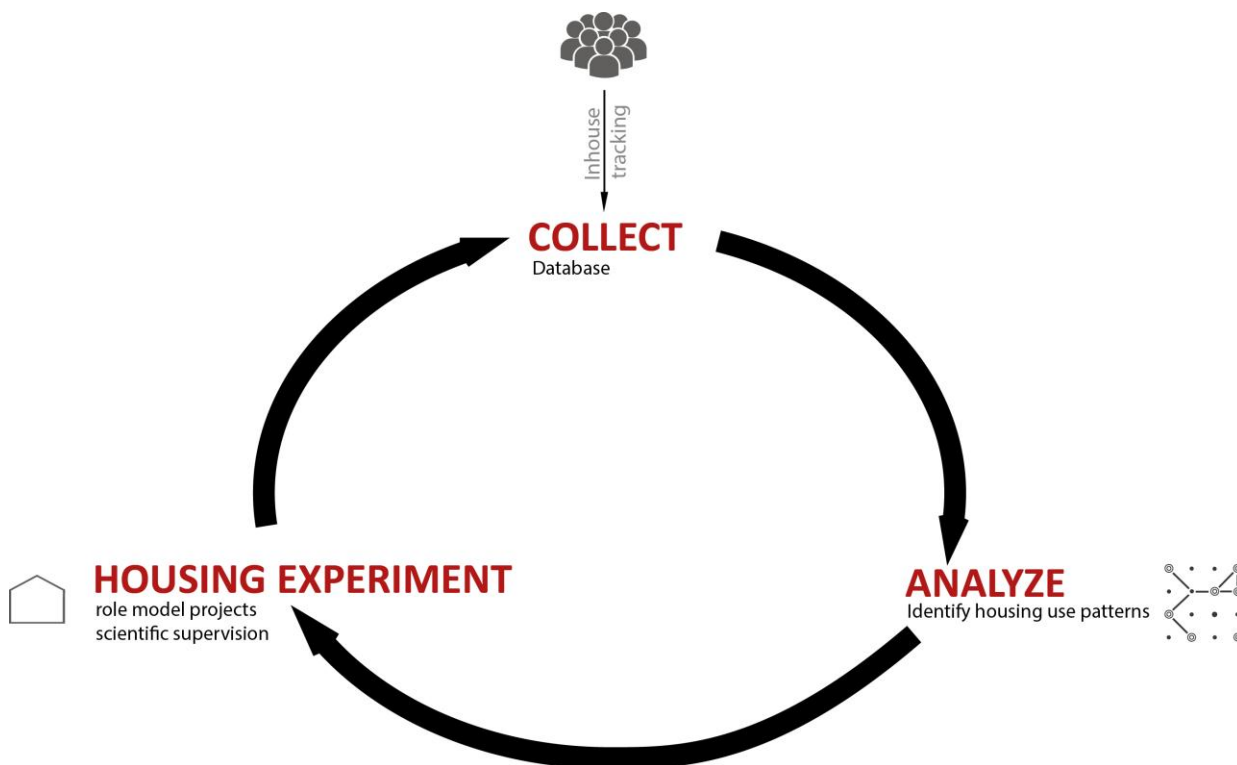

Figure 18 Housing Requirements, own drawing

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[32] Miller Lane 2007, 248ff

Therefore, the first step in the proposed approach would be the creation of a knowledge base on the current housing requirements. The goal is to identify and analyze existing spatial usage patterns in existing residential homes. The main issue here is the current use of the available living space in its functional and temporal dimension. Conceivable would be the creation of space-time protocols. Existing technologies from Silicon Valley would make this digitally captured and analyzed.

In a second step, the analysis of the housing requirements enables the design of a living space that addresses the changed circumstances and diversified ways of society.
It applies to plumb the bandwidth between deficit and surplus in the context of living to a sufficiency.
The tech companies could use the knowledge generated in the analysis for a residential model - implement as a kind of real-time experiment or living lab. The new housing would be exclusively for the new employees of the corporations. Actual use would continuously analyzed to show necessary adaptations or confirmation of the model.

As shown at the beginning, not only Silicon Valley, faces the problem of the influx of people and the associated steadily rising residential prices. It is a global problem that must be solved. In the described approach, Silicon Valley could be a test bed and role model in terms of housing to design livable urban areas of tomorrow.

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