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COULD GENETICS BE THE FUTURE OF MARKETING?

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Declaro que el trabajo titulado “Could Genetics be the future of Marketing?” lo he realizado de forma individual, y que su redacción es personal. No es el resultado de “cortar y pegar”. Es una redacción propia. Cuando se ha estimado oportuno copiar párrafos de forma literal, se han marcado con claridad (comillas o cursiva) y, todas las fuentes utilizadas están siempre debidamente indicadas, en el apartado de bibliografía del propio trabajo.

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INTRODUCTION

This project's aim is based on exploring and opening the door to new possibilities and ways of using marketing, taking advantage of genetics. To be exact, this paper is all about Genomarketing, the application of biological data (belonging to genetics science) which determines if the genetic nature of different consumers makes them more susceptible to distinct stimuli of publicity, more prone to buy certain brands or products, etc.

The success of a marketing campaign is directly related to a perfectly executed marketing segmentation, which allows brands to deliver a personalised customer experience, stretching the bond between the customer and the brand. As marketers, segmentation allows us to divide our customer base into subgroups which share specific characteristics among them, helping us with capturing the right clients' attention.

At present, there are four main segmentation types to segment audiences, those are demographic, psychographic, geographic and behavioural. All of them have advantages and drawbacks which will be covered in this paper but, What about adding a new way of segmenting and targeting based on genetic data?

According to the American Marketing Association, it is estimated that "more than 30 million customers have already taken a DNA test". This information obtained with the tests has an easy-access thanks to genetic data collection efforts funded publicly resulting in vast datasets containing genetic private information. The use that marketers can develop thanks to genetic data is using personalised advertising, tailoring messages and offers with the specific genetic preferences and predispositions of individuals.

Additionally, it has to be considered the implementation of strict regulations to ensure the necessary protection of an individual's privacy and also avoid misuse of that information. Privacy and consent policies should be applied.

OBJECTIVES

Among the objectives this paper will cover, it is found:

1. Explain how genomarketing has innovatively affected marketing and why it is a productive form of segmenting consumers, studying also the drawbacks it has compared to traditional segmentation methods.

2. Investigate if a correlation exists between an individual's genetic data and his consumer behaviour. Specifically this paper seeks to determine whether having certain genes pushes up the likelihood of consuming particular brands or products; as well as if it increases the likelihood to acquire credit card debts and impulsivity.

3. Study the ethical issues of genomarketing which is correlated with the level of exposure of the personal information people have due to this practice. Hence, also investigating possible solutions to those issues and misuse companies could undertake, establishing the limits of this new way of segmenting.

MARKETING SEGMENTATION

Marketing segmentation is a well-known concept because of its relevance towards the achievement of a company's goals. Segmenting the market is the process by which a company divides a broad target market into smaller groups sharing similar characteristics, behaviours or preferences. These smaller groups with shared needs and preferences are used by marketers to adapt their strategies and efforts to fulfil those specific necessities each segment has.

The benefits of dividing the market into subsets are the following;

- **Achieving the greatest targeted marketing possible**, which allows a better understanding of customer segments by analysing their common characteristics to apply personalised marketing actions (such as offers, messages and advertisements). These marketing actions could improve Inbound marketing (the process which consumers go through until they become recurrent clients) raising the chances not only to attract but also to retain customers.

- **Getting to know customers on a deeper level** by analysing their desires, behaviours and needs. Examining those traits helps build different prototypes, resulting in more accurate promotional activities, pricing strategies, product launching, etc. Customer understanding is one of the most important qualities that stand out in companies since it enhances their value proposition, seeing it goes hand in hand with the specific needs of a certain target segment.

- **Optimising resources.** Where to allocate a company's marketing budget and resources is a difficult task, lessened with the identification of the most suitable target segments for that company (who provide the highest return on investment for the company).

- **Gaining a competitive advantage.** By establishing an effective segmentation, marketers can differentiate their products in the market, creating a unique and personalised value proposition for each segment, which will increase their customers' loyalty and therefore, the brands' market share.

- **Customer retention.** Customers who identify a product as unique, because it accomplishes their needs and desires, are high-value customers needing specifically tailored marketing actions to reinforce their thoughts and retain them.

As seen previously in this paper, segmenting brings to the table valuable benefits for a company but only if it is well executed. Aspects like the potentiality and effectiveness of the target segment must be analysed before targeting a specific one. Then, how to implement and make an effective segmentation is going to be covered next.

According to Kotler (2010), the requirements for an effective segmentation to occur rely on certain aspects that segments must have, such as:

- **Measurability.** A segment must be measurable and quantifiable in terms of size and growth over time.
- **Accessibility.** The ease to access, target and reach a segment determines this aspect, that directly affects the viability of reaching via marketing communications a subset of the population.
- **Suitability.** A segment is worth it if it has a minimum spending power for the company to sustain.
- **Actionability.** A company needs to have sufficient communication resources to reach a segment targeted. If not, it is useless to target a segment that the company can't reach.

But segmenting is not an independent and alone process, companies need to think about, to make proper use of their resources and, moreover, increase the chances of their success in the market. Segmentation is only one of the three steps covered in the STP, necessary process companies develop.

STP stands for "segmentation, targeting and positioning", three steps covering the task of effectively looking for and appealing to specific target markets:

1) **Segmentation** serves as a guide covering the areas where the company must focus (taking into account geographic, demographic, social and other aspects)
2) **Targeting** accounts for the specific necessities in need to be covered and fulfilled.
3) **Positioning** involves the consumers' perception of a specific brand or product.

I. TRADITIONAL MARKET SEGMENTATION VARIABLES

According to Schiffman and Kanuk (2004), there are three vital conditions to successfully segment a market into measurable segments according to geography, demographic, behavioural and psychological variables; those are "large population, sufficient disposable income and diversity to partition".

Then, these four universal factors considered to segment, involve analysing details such as age, gender, income, purchasing habits, lifestyle, attitudes, etc.
Furthermore, this subtitle has aim to define and analyse the main 4 segmenting factors considered to create targeted marketing approaches depending on the segments analysed:

1. Geographic segmentation

This type of segmentation divides the market into groups in the function of geographic units such as nations, countries, cities, regions, etc (Kotler et al 2005). According to Haley (1968), the first segmentation method used was the geographic one, since it was thought that a geographical region will share the same cultural influences and values among citizens.

Geographic segmentation can be used based on population density, segmenting the market according to the number of inhabitants, but taking into account the different needs and preferences of consumers in the same regions.
Focusing on the advantages this segmentation method provides, we find the consideration it does of the cultural differences of the different regions appealed. It is a useful method when the company is small and with limited resources, helping it to operate in a determined and concrete small geographic area, generating greater efficiency in the actions taken.

Some of the inconveniences regarding these segments are assuming that all the consumers in the same geographic area are similar, without taking into account their different needs. For that reason, it is a drawback that this segmentation needs to be used combined with another segmentation base.

2. Demographic segmentation

Demographic segmentation divides the market under characteristics such as age, education level, income, occupation, family life cycle, race, nationality and other demographic data. These mentioned variables are easy-to-measure and helpful for companies when they are deciding and segmenting the subgroups they want to target, they provide information necessary to understand which types of products the brand may deliver to achieve the best value proposition for each specific segment appealed.

Some favourable reasons why to use this way of segmenting the market are the easy, cheap and quick access to the information needed (already available in the government statistical data) and how it can be not hard to apply in an internal marketing plan, since everyone understands and manages these criteria.

On the contrary, this strategy has similar limitations to the geographic one because it assumes that each demographic group has the same needs. To put this in context, an example would be grouping in the same segment María Patiño (Spanish journalist of Mediaset group) and Najwa Nimri (Spanish actress) both born in 1972, quite wealthy but with absolutely different lifestyles, needs and purchasing decisions. With this, we can conclude that one of the main drawbacks of using the demographic segmentation method is the tiny understanding of the consumers this method provides.

3. Psychographic segmentation

Psychographic segmentation takes into account the psychological aspects of consumers' behaviour; dividing the market depending on personality traits, social class, values, opinions, interests, etc. An insight into psychographic segmentation is, according to Beane and Ennis (1987), how it looks at the inner person instead of the outward expression (trying to understand the market based on personalities and lifestyles).

Opposite to behavioural segmentation, the psychographic method tries to understand the insights of a consumer. It gets to know and identifies the basis of their needs and motives, which may help brands carry out effective marketing programs. However, smaller organisations will have it harder to segment according to psychographic characteristics, because access to detailed consumer data is more suitable and easy for a larger company.

4. Behavioural segmentation

As Kotler stands (et al 2005), behavioural segmentation entails segmenting the market according to knowledge, attitude and/or the use or response to a product.
Then, the groups a company chooses to target will share the same patterns of purchasing behaviour, price sensitivity, purchase frequency, use of products, etc. This way, the market is segmented according to the priorities of purchases between people, for example when younger consumers prefer liquid soup instead of bar soap as elderly ones do.

A positive aspect of segmenting with behavioural criteria, is how it segments understanding the complexity of consumers' behaviours. This type of method is helpful when organisations in mature markets aim to understand how to activate a non-user, or how to convert a medium user into a heavy one, etc.

On the contrary, it does not really explain why the consumer is buying the product (his reasons, needs, etc) but the purchasing decisions he makes.

To sum up, it is possible to distinguish different purposes for which segmentation is done, as for example identifying new customers, improving the cost of sale per customer, finding new opportunities to enter new markets, etc. But, even though the criteria chosen to segment markets depends on the characteristics of a specific sector in the market; it is more intelligent to combine different segmentation methods and variables because it allows a better understanding and a bigger capacity to reach consumers.

II. NEW WAYS OF SEGMENTING - GENOMARKETING

First of all, this paper is providing a definition of Genomarketing to understand what it is talked about.

To define Genomarketing, it must be said that it is a new marketing discipline. According to Taveras (2022), genomarketing involves how genetic techniques are applied to marketing; its purpose is to analyse and understand the different behaviours of individuals that those genetic variants have produced towards an advertisement or product.
It is applied to measure the effectiveness of campaigns or advertisements persuading consumers; to investigate consumers' desires and impulsivity to buy; to understand what provokes consumers to buy products from an advertisement or campaign, etc.

In this society, information is one of the most powerful tools a brand has in order to have an impact on the segmented group wanted to be targeted, therefore personal data is a key factor since it lets information within everyone's reach.

Taking a look over the traditional segmentation methods, are based on personal data and information of individuals which helps marketers divide the market into subgroups with similar preferences, lifestyles, etc. depending on the type of segmentation implemented.

But, what about if companies started implementing genomic sequences in their databases, to segment more effectively consumers? This is not a difficult task because "the days of genomic anonymity" do not exist anymore according to Robert González from iO9 allegations (WebProNews 2013). Various researchers from the Massachusetts Institute of Technology (MIT), exhibited in a paper published by Science Magazine, how the genetic information of people who volunteered to donate their genome sequence data could be easily found by searching for public information available.

This evidence shows that personal data is currently effortlessly available online. Because of that, humans should be aware of that and think about what could happen depending on who possesses and uses that information. To be more precise and give examples, genetic information in the hands of a scientist or doctor could be used to study diseases and help with investigations improving our health but, in other hands such as Google or Facebook (or even a criminal), it can be used to create strong new search tools or use someone's data against him.

The process needed to find and cross genetic data with personal data and find from whom that genomic sequence belongs already exists, but is covered below in a different chapter. The main focus of these paragraphs is to demonstrate how obtaining this data procedure already exists and how it could be used as a segmentation method.

Legally, policies and legislation should be quickly adapted to the speed of technology, which is not always possible, appealing to humans' rights, and ownership of their information.

THE HUMAN GENOME / DNA

Thinking about Genomarketing leads to genes and how genetic information conditions affect human behaviour. This chapter covers a brief explanation of what the human genome is formed by, as well as its relevance on human beings, covering why genes make every human different and how that affects our behaviour and our willingness to have certain diseases, among other aspects.

The human genome comprises the whole genetic information (DNA or deoxyribonucleic acid) an individual has. This DNA is also called "The Blueprint of Life" because it contains all the information an organism needs in order to grow, develop, survive and reproduce. But, why does our DNA make humans different from each other?

Humans' unique hereditary material, DNA, contains and deposits coded information composed of four chemical bases: adenine (A), guanine (G), cytosine (C) and thymine (T). This Blueprint is composed of an organisation of 23 pairs of chromosomes, which contain around 3 billion base pairs of DNA firmly curled around "histones" (which are the proteins providing structure). 99% of those bases are identical in all humans so that 1% left is what makes humans different thanks to the variations in the previously mentioned nucleotide bases (A, G, C and T). Check Appendix A.

Specifically, genes (segments of DNA) are in charge of transmitting to cells the information related to the production of a particular protein. Each human being has around 21.000 genes that determine certain aspects of that person. However, it doesn't determine all of them, since how each human lives influences the operation of our genome (see chapter Epigenetics).

I. HUMAN GENOME PROJECT

The Human Genome Project was a reference point and a global scientific effort whose intention was to generate the first sequence of the human genome. Its origins can be traced back to the 1980s, but it wasn't launched until 1990.
The leader of this project was the American geneticist Francis Collins, who received backup from the U.S. Department of Energy and the NIH (National Institutes of Health).

The final projects' findings were published in 2003, revealing a sequence that covered around 90% of all DNA base pairs within the human genome, a discovery resulting from hard work mapping DNA (coming from a diverse group of donors). Thanks to this investigation carried out, a typical human genome sequence was created.

This project was complex, ambitious and held great importance because studying the human genome helped us to define our identity and discover who we are. The Human Genome Project aimed to map the whole genome, identifying both the position and sequence of every gene's base pairs.

II. FUTURE OF GENOMICS

At the beginning of this new century, the uses of genomics have been more focused and related to health and diseases. There is a whole business created around genetic data where people can take a test at their homes and send it to be analyzed.
The intention of this necessity of knowledge about an individual's personal health is to help identify their probability to have certain diseases, as well as getting to know more about their ancestors, family heritage, etc.

But, since this market is growing day by day, in the future there could be some applications that we cannot even imagine now. Scientists have already gained a huge knowledge regarding the human genome which could be applied in the following sectors:

- Genetic information obtained could be used in the **employment sector,** applying it to selection processes where the personality and health of candidates are examined. Also, this evaluation could be implemented in professional sports.

  The viability of these processes exists, but it depends on the country it is applied to. A law established in the United States, called GINA (Genetic Information Nondiscrimination Act) prohibits the application of genetic data to selection processes, decisions to promote, etc. But, in other countries such as the UK, there is not any specific legislation that prevents the use of this data in employment situations.

- People with an insurance contract could be affected if the **insurance market** starts to look for information related to behavioural and physiological aspects (such as sensitivity to injury, or risk-taking behaviour, etc.)
  Individuals would have to face the impacts produced by their home or car insurance contracts.

- Behaviours can be predetermined thanks to genes like MAOA (associated with impulsivity and aggressive behaviour) and used in **criminal justice**. Also, according to Francesca Ducci and David Goldman in the study "The Genetic Basis of Addictive Disorders", the likelihood to express addictive behaviours is determined in some part by genetics. Then, reports could be built and taken into account to know who has a real possibility to abuse substances.

According to what was said in this same subtitle, reactions to these emerging and growing applications of genomic data should be happening. Policies must be developed to cover the ethical issues and privacy problems that may occur.

For example, a policy that could be applied may be one covering the necessities and support that customers and businesses entering the market need to have a positive exploration and navigation through the genomic marketplace.

GENOMIC VARIATIONS

The human genome is identical in all humans in 99 per cent; however, that 1 per cent left previously mentioned makes a difference.

Between individual human genomes, a little amount of DNA letters (which represents 1 per cent of the total DNA) varies. These variations produce differences in humans such as health aspects, tendency to diseases, physical features, etc. but those distinct aspects between humans are positive and matter.

I. RELEVANCE OF GENOME VARIATION

Genomic variation is in charge of the existent diversity in populations, representing the scope of genetic differences between individuals. The reason why variations in the genome are positive is that human survival and adaptation directly depend on those differential aspects between individuals, which can offer advantages in fluctuating environments, as well as increase the chance of individuals to survive and reproduce thrivingly. Subsequently, the human genome leads to the gradual evolution of populations over time, thanks to the protection against certain medical conditions which variations offer.

According to the National Institute of General Medical Sciences, the identical percentage of DNA two humans have in common is 99,6%; meaning that the 0.4 per cent left accounts for 12 million different base pairs which establishes the genomic variants.

These distinctions in human genomes contribute to a person's uniqueness, but other factors such as diet, lifestyle, social context, environment and more, also play a role. (Explained in epigenetics subtitle)

Some of the genomic variations we can find are the following:

- **Single-nucleotide variants (SNVs)** are the most common and the smallest ones. SNVs appear at a specific location in the genome, in a single nucleotide or letter (with a particular relative frequency). See Appendix B for a more detailed overview on this type of variation.

- **Insertions and Deletions** are another type of small genomic variants where missing or added nucleotides of DNA are present in the genome.

  These genomic variants usually involve no more than 50 nucleotides; in particular, tandem repeats are the most common variants. Tandem repeats have helped create maps of the human genome across history, that's because they are short repeated stretches of nucleotides which can be replicated fewer or more than a hundred times, depending on the different chromosomes they are forming. See Appendix B for a more detailed overview on this type of variation.

- **Structural variants**, which are larger-scale genomic variants, can involve thousands of nucleotides moved, deleted, inserted or inverted to different parts of the genome to others.

Consciously, investigators have used these variations to study and get to understand Human history, using that acquired knowledge to explain our origins, human evolution, dynamics of the population, cultural exchanges, etc.
This information and even more affecting other disciplines such as genetics, medicine, biology and anthropology have been useful by contributing to the learning of other fields such as heritage, willingness to certain diseases, response to treatments, etc.

From a scientific perspective, genetic variation is not only positive but negative if it doesn't exist because populations need a variety of alleles for genes to increase the possibility of adaptation to environmental changes.

But, how have scientists studied that 0,4 non-common percentage in humans? Science has studied these possible variations of the human genome thanks to a developed "reference", of the human genome sequence, that has been built. This reference point is used to compare an individual's genome to it, observing and detecting the differences between both and concluding which variations have the most significance biologically and in the end, are relevant to the study. Developing the capacity to analyse genetics can be useful when implementing and studying different genomic applications to different branches.

Defining a reference genome sequence is a meticulously studied representation of the human genome which has the intention to be a reference point for genetic research and to help decode individual genome variants. It has been built after investigating and taking into account a diversity and representative variety of individual genomes which represent the genetic diversity humans encompass. This reference guide contains not only humans' 23 pairs of chromosomes included in their genome but non-coding regions, regulatory elements and others.

II. PARTICULAR STUDIES OF GENETICS AFFECTING MARKETING: MAOA GENE

According to an article by "De Neve and Fowler (2009)" it is reported how some people are significantly more likely to have credit card debt if, studying their genes, a specific low-efficiency variant in the "monoamine oxidase A" gene is observed.

"De Neve and Fowler" run an experiment taking into account data obtained from the "National Longitudinal Study of Adolescent Health", using a sample of people between 18 to 26 years old. The experiment found out how possessing one or both MAOA alleles (of low-efficiency type) increased the average likelihood of having credit card debts by 7.8% and 15.9% respectively.

Approximately, half of the US population has one or both MAOA low-efficiency type alleles. Prior investigations have related this genetic variation to addictive behaviour, impulsivity and lack of conscientiousness.

What is Monoamine oxidase A?: Monoamine oxidase A (also called MAO-A) is a gene that provides the instructions needed to make the enzyme called monoamine oxidase A, which is in charge of breaking down monoamine neurotransmitters such as serotonin, dopamine, epinephrine and norepinephrine). Scientists believe that an excess of neurotransmitters (in particular serotonin and norepinephrine) reduces someone's ability to control their impulses and therefore, more aggressive behaviours are produced.

Could this be the portent of unethical marketing practices? Taking it further, Could complete marketing campaigns be adapted to specific markers in an individual's genome?
This practice may come in the future but not yet since there are, for example, different limitations in "De Neve and Fowler" findings (2009). One of these limitations mentioned was that the only question asked to the sample as if they had any credit card debt, without asking how much or anything else.

The investigation of the report draws some conclusions according to the results:
Before reading about the results it's important to understand that in the sample (which contained ages between 18 and 26), 41% belonged to low grouping allele frequency and the 59% left belonged to high grouping allele frequency.
The answers to the question "Do you have any credit card debt?" around 41% answered in the affirmative.

How could these conclusions be used in marketing terms? If there are no legislation barriers in the banking sector, bank companies could personalise and approach individuals with a low-yield variant in the MAOA gene, since that individual's genome predisposes consumers to spend more money on credit cards.

GENETICS APPLIED TO MARKETING

I. RELEVANCE OF GENOMARKETING

One of the issues that, to this day, society continues to do is trying to understand and predict the behaviour of others. Applying this question unknown to the business world, we could say that businesses try to exploit and understand it to the maximum.
The key to the matter lies in the behaviour of humans which, by studying their genomes, helps to gain knowledge related to our patterns of behaviour and the probability of developing certain reactions or behaviours.

According to the author Turkheimer (2000), behaviour arises from complex and non-linear development processes. That is why it is difficult to understand human behaviour patterns; also adding that ethics help by preventing us from controlling most of the processes Turkheimer talks about.

Scientists claim to be able to study whether genetic variations in genes are capable of affecting human behaviour; also predicting the percentage probability that a certain behaviour will happen. That is why this new type of marketing, called genomarketing, exists. In genomarketing, studies of social sciences and genetics are combined to help segment and improve processes, based on human behaviour.

As seen before, the Human Genome Project brought important discoveries related to human genetic structure; contributing to the determination of the approximate number of genes, their location in the genome, structure, etc. Likewise, it has been appreciated how the environment also plays a role in the expression of genes (this paper will cover at the end more about this science called epigenetics).

Anyways, even though the environment affects genetics, it is easier to understand the relationship between genes and health than genes and behaviour since it is a more complex relationship.

In 2000, intending to develop a better understanding of behavioural influences on humans, Turkheimer mentioned concrete 3 laws regarding genetics affecting behaviour, those were:

1. Human behavioural characteristics have a genetic component inherited.
2. Genetic influence on human behaviour has a greater impact than growing up in the same family.
3. A relevant part of the variations in human behaviour cannot be only explained through genetics or parental factors.

II. HOW COULD MARKETING TEAMS USE GENETIC DATA?

After the use of Neuromarketing, Genomarketing claims that there is no doubt that some of the differences in brain activity are caused due to genes (taking into account, as explained before in 3 Turkheimer's laws, that environmental and developmental factors also play a role).

Companies then, can implement genetic techniques in marketing, to analyze how a specific gene can influence the behaviour of an individual towards a product or advertisement. Another use of genomarketing in businesses, in concrete towards advertisements, could be using it to measure the effectiveness in persuading a consumer, campaigns produce. Moreover, brands can also measure, through research, the percentage of impulse and desire of consumers to buy, after watching an advertisement. Advertisements also produce a first impression and reaction on consumers which can be studied thanks to genomarketing too.

There is no doubt about the exploitation private companies are doing of genetic testing; an example of it, that has already happened, is the alliance between Spotify and AncestryDNA..

In 2018, Spotify (allied with AncestryDNA) requested genetic data to its more than 217 million users, to be uploaded to the mobile application. The way the company decided to justify this call was, by relating it to the possibility individuals will have to create playlists that align with their genetic ancestry. Therefore, consumers' data will be used to create personalised and unique playlists. The idea was advertised by asking consumers "If you could listen to your DNA, what would it sound like?"

A second example of a company using and asking for genetic information from their clients is Mexico's national airline, Aeroméxico. This company decided to launch a campaign called "DNA discounts", offering discounts to the consumers who shared their genome information and checked out whether they had "Mexican DNA" at the end of the test (Vora, 2019). The company was able to collect genetic data from its customers.

These different actions have defined the beginning of a new period where consumers and companies have access to information that previously couldn't have been accessible.

GENETIC TESTING

The genetic testing term refers to the study and examination of an individual's DNA. This examination involves analysing variations of the DNA, chromosomes, specific genes, etc. Its purpose is to increase insights into the human genome of an individual; identifying potential genetic disorders, attributes or propensity to certain diseases.

Therefore, genetic testing can provide potential and useful information about a person, getting to know more about his individual health, heritage, etc.

Taking a close look at genetic information, some features of its characteristics are:

- Through genetic data obtained, an individual can be identified since each human has a unique genomic sequence. Moreover, an individual's relatives can be also identified thanks to heritage. Therefore, once a full genomic sequence is analysed, a link between that individual and its DNA sequence is established; so anonymity is lost because it is impossible to unlink the sample containing genomic data with his data.
- Knowing and establishing a diagnosis of around 3000 genetic diseases (by sequencing DNA), all of them caused by mutations in a single or more gene.
- Anticipating predispositions. Some aspects of an individual such as his behaviour, personality, etc. have a genetic component. By sequencing DNA, scientists can state if an individual has a certain probability to develop that prediction observed thanks to genes.
- Genetic information is available to all because each human cell contains it (a sample can be obtained from hair roots, skin, blood, saliva, etc.). Therefore, the analysis of genetic information without someone's consent can be done.
- DNA can be available for long periods if it is stored properly. Moreover, it can be amplified, so several analyses may be carried out.

The previous features of genetic information are applied not only to the individuals' genome analysed but to their families and people who have common ancestry. This happens due to heritage and how genetic information moves between generations.

I. TYPES OF GENETIC TESTING

There are many types of genetic tests on the market, all of them with different purposes:

a. **Predictive testing**, as its expression says, helps to assess someone's likelihood of developing a particular genetic disorder that is already expressed in one of their family members but the individual has no symptoms related to it yet.
b. **Diagnostic testing** is different to predictive since the individual wants to confirm or eliminate a suspicion related to a genetic disorder.
c. **Pharmacogenomic testing** is used by healthcare providers to know which response certain medications will produce in an individual, avoiding those unwanted side effects.
d. **Reproductive testing** is used by healthcare providers and parents too. Its objective is to examine the possible variants when growing a family, kids could carry. It is used before, after and during pregnancy by experts to help them make better decisions.
e. **Forensic testing** comes hand in hand with legal purposes, helping for example to identify the biological family of victims and suspects of crimes or others.
f. **Direct-to-consumer testing** is a genetic test that can be carried out at home by individuals (without medical intervention). It collects a DNA sample that is sent to a company in charge of analysing it to give information related to an individual's ancestry, lifestyle factors, potential risks of certain diseases, etc.

Thereafter the progress in genomics, led by the Human Genome Project, the amount of direct-to-consumer testing at home has grown. Nowadays many companies are offering this type of service where humans can know more about themselves and their families (via DNA testing) by buying a simple DNA test in their closest pharmacy or purchasing it online.

According to the National Human Genome Research Institute (NIH), the direct-to-consumer genomic testing market value was $ 117 million in 2017.
This figure has been increasing since then, because his growth of at-home genetic testing has been produced by diverse factors, such as:

- A study carried out by Accenture, showed the increase in personalised products, demonstrating that 63% of worldwide consumers have a growing preference for personalised and customised products. Genetic testing provides this personalization since, as explained in other chapters, the human genome is unique and particular to each individual.

- The awareness society has around direct-to-consumer genetic tests is increasing because, throughout the last years, new companies have started to provide these services and there is also a bigger diffusion (thanks in part to social media and platforms).

- The actual consumer profile is another factor. Consumers have changed in the past years, now they are more encouraged to take decisions and not passive towards brands. This way, genetic testing companies have appealed to customers by making them want to know their ancestors, health and other factors expressed in the DNA, to cover that created necessity of knowing more information about them.
  Early adopters are playing an important role here because they are enthusiastic to know more about their genomic information; being curious to find out their willingness to develop a disease (to improve their health).

Focusing on the necessity consumers have now of getting to know more about them, they need to evaluate some aspects such as if they are ready to have information about their health, ancestors, etc. and how would they handle any difficult or hard-to-face information that may arise.

II. COMPANIES USING DIRECT TO CONSUMER TESTING

Following, two main companies focused on selling direct-to-consumer genetic tests are going to be analysed. The information that is going to be explained comes from their official web pages, but then, some discoveries close to unethical behaviours from these companies are going to be explained.

1. 23 and me

23andMe is one of the leading companies in the emerging genetic testing market. The company announces itself as being about “real science”, “real data” and “genetic insights that positively impact customers” (23andMe official website); doing so by selling accurate personalised reports which offer: family trees, ancestry timelines, physical features, personal tastes and smells, unique personal characteristics, and even possible future diseases (See Appendix C and D for further information related to their genetic tests offer).

Their products are shipped worldwide to: Albania, Armenia, Australia, Austria, Croatia, Hong Kong, Hungary, Iceland, Norway, Poland, New Zealand, Romani, Spain among others; but only countries like Denmark, Ireland, Canada, Netherlands, Sweden, United Kingdom, etc. are able to receive health reports.

23andMe strongly declares itself as private and secure. In its privacy template, the company claims it won’t supply any enterprise or 3rd party marketer with their customer’s data. Moreover, it's stated on their website that the language used is comprehensible for all customers, as well as that their identity is encrypted throughout the genetic process. It is repeatedly alleged that no data will be shared or commercialised without the customer’s explicit consent. All in all, the firm tries to be perceived as secure and trustworthy.

However, once the customers send their DNA and it gets analysed, they receive the information that had been paid for. And unless the consent is revoked, all this data will also be stored by 23andMe, who could make lucrative use of it. An example of this is the $300 million deal that 23andMe had with the pharmaceutical company GlaxoSmithKline, exchanging access to the data of its customers (Brodwin, 2018).

Of course, this knowledge is, at the very least, appealing to insurance or pharmaceutical corporations, who may use it to develop new products according to society's necessities, achieve a better value proposition in their products, etc. One example of this is the case that relates the Spanish Pharmaceutical company Almirall (which owns Almax, Skilarence and Tesavel) to 23andme. According to "El Español" spanish' newspaper, the scandal happened because 23andme used the personal and genome data of their customers to produce a drug which treats Psoriasis among others; and it was sold to Almirall for an unknown and not public amount of money.

2. Myheritage

Another leading company in the genetic testing market is MyHeritage, which is quite similar to 23andMe. This firm offers genetic tests focused on the origin of the customer's ancestors and the discovery of possible new relatives. Sending a simple saliva sample, the clients will receive their data after approximately 4 weeks.

Their products are expanded all across Europe thanks to their distribution centre in the Netherlands, Tilburg. Myheritage then ships to all European countries except Poland. Nowadays it is the genetic testing company available in most languages, and the one with the highest competitive advantage in Europe since, thanks to their data, it is easier to identify someone's relatives across Europe.

Almost identical to 23anMe, their privacy policy declares the need for explicit consent to use personal data for investigative or lucrative means. Despite this statement, a publication in January 2022 of the AEPD (Spanish data protection authority) revealed a 16.000€ fine imposed on Myheritage Ltd.

The reason why Myheritage was penalised was related to the little and not enough information this company provided about its website's cookie policy. This lack of information violated "Article 22.2 of Law No. 34/2002 on Information Society Services and Electronic Commerce (LSSI)". Also, the fine was a warning for violating "Article 13 of General Data Protection Regulation (Regulation (EU) 2016/679)".

However, the company doesn't need to willingly share customers' data for it to become public. This was made clear in 2017 when 92 million users' data was stolen in a breach of the MyHeritage website's security. The emails and passwords of these customers, all of which had signed up in October of 2017, were found on a private server outside the company. The agency helped the affected people as best as they could, but the damage was already done.

Since Myheritage works all over Europe, it was the official partner of Eurovision that accompanied the 20 representatives of Eurovision 2019 in the pre-eurovision party in Madrid. The marketing action was focused on a karaoke-bus where the singers of each country could sing their songs. This action demonstrated Myheritage's presence in Europe, achieving greatest communication and marketing actions to spread their products all over.

GENOME PRIVACY

I. DATA PRIVACY

Genomic research into health and non-health applications has been developed thanks to the created connection between genomic data and personal information. This existing link between both kinds of data has helped scientists keep researching because data is accessible and shareable but; from other points of view, related to other aspects, it is a negative point exposing an individual's data that way. Large data collections are in the spotlight.

Consumers taking direct-to-consumer genetic tests are getting deeper through their traits and health but, at the same time, the privacy risks they are facing increase.

Not always everyone gives consent to take a DNA test, for example, kids whose parents are demanding genetic tests to be done on them; so, for that reason, and taking also into account how these companies badly protect the data (which is often used in scientific researches) some possible risks are attempting to data protection:

- The reveal of personal and genomic data causes problems for individuals. For example, if data privacy is not preserved, insurance companies could take advantage of it by increasing prices and charging higher fees if their customer has a determinate predisposition to certain health issues.

- Data has no way back, once it is revealed, there is no way back to avoid the exposure and possession from others of that information. Therefore, individuals will have to face lifelong privacy risks related to their personal intimate information.

- Family data is also exposed since, in part, studying and analysing personal data reveals information about that individual's relatives. Then, it can be exposed how consent is sometimes inexistent because those family members are not expressing they agree with the release and study of their data.

Lack of privacy entails fewer people wanting to participate in research with scientific purposes, whose aim is learning more about the human genome. But, this lack of confidentiality affects long-term and future investigations since fewer humans are willing to be involved in studies, protecting their data that way.

Another problem is the current legislation regarding global data protection. The legislation makes a distinction between data, there is personal information (which is backed up with laws) and anonymous information (which is backed up but by a minor amount of restrictions on its distribution or sharing).

After knowing a bit more about these two groups in which data is divided according to law let's analyse it within an institution. As GDPR (EU General Data Protection Regulation) considers, there are two kinds of data treated:

- **Anonymous data** refers to personal data which has been protected by de-identification methods, eliminating characteristics such as name, address, insurance number, age, etc. away from it. Therefore, this group of information is personal but, since it has been unlinked from identifiers, it can't be linked back with that information. It encompasses all the information belonging to an individual who can be identified or identifiable.

- **Pseudonymised data** alludes to data which has been treated and where identifiers have been replaced by, for example, a reference number.

Even though pseudonymised data is seen as secure, it is not because the re-identification of individuals from anonymous databases is possible! Connecting data to individuals can be done thanks to data obtained from sources like public transport, medical treatment, etc.

A study carried out by GWAS (Genome-wide association studies) in 2010, discovered how the pseudonymised data could be uncovered via electronic health records, exposing individual and genomic data.

II. SUGGESTED POLICIES

Following, some broad suggestions that will have to be worked on, to be executed and implemented would be:

- Implementing a prohibition that doesn't allow parents to analyse their offspring's DNA information, to avoid lack of consent and not being in control of their personal information (because it won't be taken back, and their privacy lost would be hand in hand with those individuals).

- Database responsibilities could be establishing a limit to multiple queries to prevent phishing attacks and the possession of larger amounts of information.

- As more personal data is stored, easier it is to link and re-identify personal genome information; some data laws should be implemented regarding this case. This should be an upcoming law that puts barriers to access to that connection between the different data, providing society with more privacy and security towards who they are. Therefore, a controlled environment towards databases might be developed to avoid misuse, everyone's access and information stealing

- An approach to protect non-health databases could be an international alliance. A treaty could be established where individuals' security and data privacy may be guaranteed.

  An international alliance, called GA4GH (the Global Alliance for Genomics and Health) is already existing and implemented regarding data privacy in health databases. In this alliance, there are more than 500 organisations belonging to health, academic and commercial research sectors. Therefore, GA4GH could serve as a guide to establish a new treaty taking care of the information in other sectors like education, employment, insurance, etc.

In Spain for example, and according to the Geneva Association, there isn't any regulatory approach to the application of genomic data in the insurance market. So, in the future, this paper claims that authorities should implement legislation that prohibits insurance companies from using data from existing tests, family history or even asking their customers to take a genetic test.

III. ETHICS, WHERE IS THE LIMIT?

Ethics and genomarketing are related because genetic data is used to tailor marketing efforts among other uses that cause ethical issues and deal with moral principles.

Some of the aspects of genomarketing that cause conflict with morality and ethics are related to privacy and the protection of data. Given that genomarketing entails the analysis and collection of genetic data, ethically the possession of that sensitive information can cause harm to individuals or even be spread to others without authorisation.

Other features affect the lack of consent of individuals before collecting and analysing their samples, that is why ethics fights for individuals' rights and security.
Also, ethics is responsible for defending the equality rights of each individual, an aspect that can be infringed by genomarketing when society is segmented and divided into groups with the same predispositions, characteristics, etc

Thinking about the job market and the employment of the genetic chances that an employee could become disabled (where the company has to pay benefits for it) or the probability that the employee could be injured during his work (and the company has to pay compensation); It should be illegal to use that data for job interviews or employee analysis.
According to the GINA law (Genetic Information Non-Discrimination Act) in the US, the use of genomic information to make decisions within the labour framework has been prohibited since 2008.

If we talk about the physical conditions and the interests that exist in the sports environment, we will discover that ethics is at risk. Examples of this can be if genetic analyses were used to evaluate the sports potential of the candidates to belong to a team; also assessing their susceptibility to certain diseases and real physical characteristics.
This would increase existing ethical issues in athlete selection and participation processes. An example of this may be when the famous basketball team, the Chicago Bulls, requested a genetic test from the player Eddy Curry Jr, where they could study his probability of having a heart condition. Finally, he ended up refusing and changing teams.

To sum up, ethical thinking should be taken into account in marketing practices (especially when they involve genetic information). The practice of genomarketing would have to follow pre-established legal lines and regulations directed by the government and specialists who can exercise moral control over these practices and methodologies; thus avoiding violating citizens' basic rights and well-being.

EPIGENETICS

Our genome does not entirely define and determine everything about humans because factors such as the environment, lifestyle, daily and long-term decisions, etc. completely impact everyone's growth and well-being. Some examples of this could be smoking habits, physical activity level, dietary preferences, and sleep patterns, all influencing human health and the operation of our genome. Here is where epigenetics take part. Also called epigenomics, it puts the emphasis on how environment or behaviour are able to activate and deactivate genes, without causing changes in DNA letters.

Genes in our DNA are expressed as behaviours once they have been read and transcribed into RNA. Following, the RNA is translated into proteins using ribosomes, and these proteins are the ones that determine the cell's function. Epigenetic changes affect the transcription into RNA (boosting it or, in its stead, interfering with it).

According to the National Human Genome Research Institute, the most common change regarding the gene's expressions is that DNA, or the proteins it's wrapped around, get labelled with chemical tags. This group of chemical tags is known as the "epigenome". The importance of its effect can be explained with the example of a methyl group, which will cause the DNA to squeeze tighter around the protein, making it impossible to access and transcribe the gene. On the other hand, other chemical tags will have the opposite outcome by releasing the grip around the protein, which will result in an easier reading and transcribing of the gene.

Epigenetic changes are, however, a normal part of development. Before being born, the embryo has one master genome; cell division comes with the activation of some cells and the inhibition of others. In the end, the approximately 200 cells in our bodies have the same genome, but their own distinctive epigenome.

According to BioMed Research International (2016), epigenetic marks are in constant change throughout life. Some of these alterations are programmed and take part in significant stages of development. However, the mechanisms involved aren't fully understood yet. In relation to epigenetic variations, the following factors are distinguished:

- **Embryo state**. There are two principal factors: the mother's lifestyle, which entails embryo exposure; and anatomical or phenomenal circumstances, such as the size of the uterus and placenta.

- **Chemical and Physical Environmental Stressors**. Exposure to metals, air pollution and radiation can affect epigenetic marks. Recent studies show that metals like arsenic, mercury, nickel, etc. alter the epigenetic mechanism involved in metal exposure-related diseases. Adding on, air pollutants (especially traffic-related ones) also affect the epigenome.

They have been associated with a reduction in lung function and lung cancer, produced by changes in the DNA methylation of inflammation and immunity genes. Other studies have found epigenetic changes related to ultraviolet radiation exposure, linking it with some modifications associated with the transcriptional silencing of certain tumour suppressor genes, resulting in the stimulation of skin tumour formation.

- **Diet**. Regarding humans, the repercussion of diets causes epigenetic changes related to the emergence of diseases in adulthood.

- **Habits**. Lastly, unhealthy habits such as smoking, drinking a big amount of alcohol or suffering stress from an early age, have shown epigenetic changes in relation to diseases.

However, as BioMed Research International highlighted (2016), scientists are now starting to study and understand how epigenomes function and how epigenetics influence our personality.

CONCLUSIONS

This paper's purpose is to explain in detail what genomarketing is all about and why it is an upcoming method to be applied or used in different sectors, as it is starting to do these days.

First of all, companies need to segment their market in order to achieve accurate marketing campaigns with a high rate of effectiveness.
Knowing that; traditional segmentation methods to segment the market have drawbacks, such as their difficulty to distinguish different needs and desires from consumers when they engage in a geographic or/and demographic area; or how companies notice behaviours towards products or brands without understanding what is behind that pattern of behaviour.

On the contrary, genomarketing uses one of the most important pieces of information when it comes to dividing the market, which is personal and genomic data. Genomarketing wants to apply the scientific research done-to-date, in order to improve targeting and increase the understanding brands have towards consumers.

As seen in this paper, The Human Genome project and other researches carried out, revealed how genes and the environment modified the expression of proteins in individuals differentiating them from others. However, behavioural science is harder to understand because there are many factors influencing it but, for sure, genetics is one of them as stated in researches about MAOA genes.

The discovery, carried out by De Neve and Fowler (2009), linked the possession of the MAOA low efficiency type gene with impulsive behaviour (raising purchasing power by immediacy) and increased ability to carry credit card debt. Therefore, even though this topic is currently being developed and investigated, it can be confirmed how there is a relationship between genes and consumer behaviour.

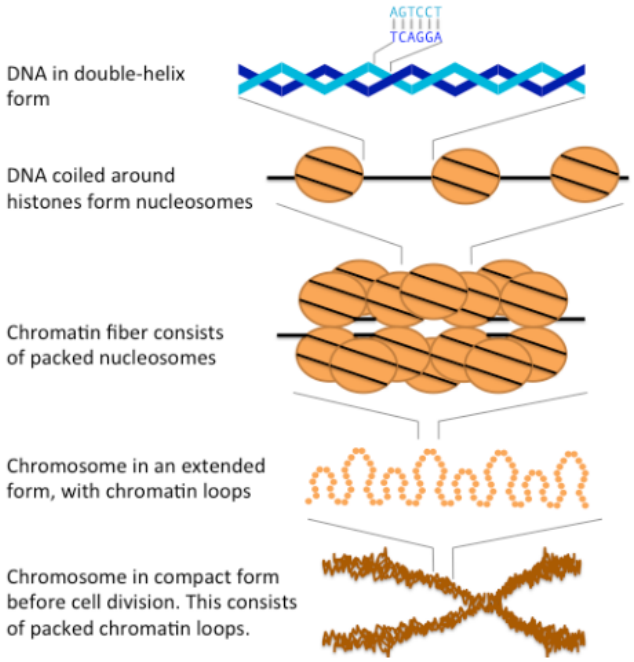
The key of genomarketing is the application it can have in different sectors to improve companies' achieving of its objectives and reaching out consumers in a better way. So that is why some companies have directly asked their consumers about their genetic data (by offering them taking a genetic test in exchange with discounts or personalised offers for them, such as Spotify partnered with AncestryDNA; and AeroMéxico did).

Other emerging private companies have entered the market offering personalised information about individuals through a DNA sample; making it easier for citizens to take a test (thanks to direct-to-consumer genetic testing) and send it to be analysed. What can be stated is the lack of security companies have, sharing data with others; such as the scandal formed after the exchange of data of 23andme for 300 million dollars with the pharmaceutical company GlaxoSmithKline.

To sum up, genomarketing is a growing field which considers genetic information to enhance marketing strategies and personalise customers' advertisements, experiences and offers. By using individuals' genomic data, the efficiency and effectiveness of marketing efforts are improved; but it can have other uses in sectors like employment or insurances (having a negative impact on consumers, that some countries have regulated but others still need to create laws protecting basic human rights, Spain included). Therefore, privacy and ethical issues must be considered to implement a proper legislation and graduate genomarketing reaches, promoting responsibility.

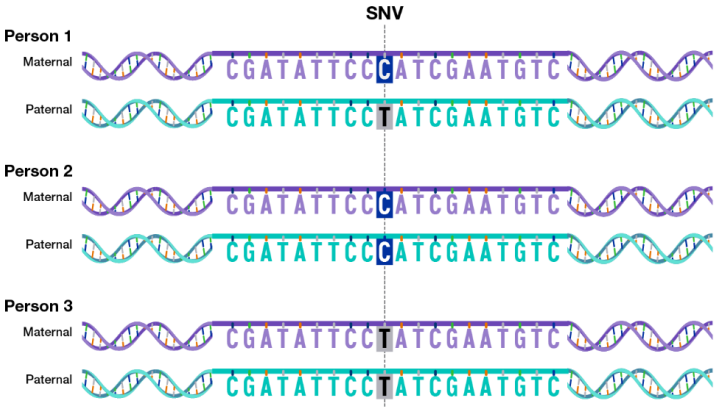
APPENDICES

Appendix A:

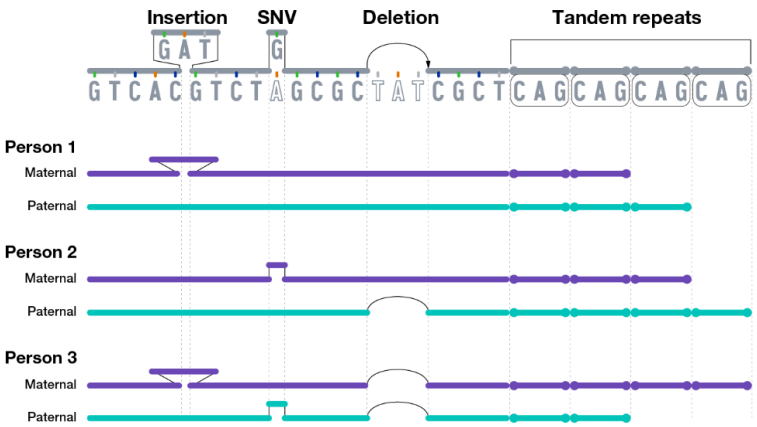


Source: Akalin, A. (2020, september). 1.1. Genes, DNA and central dogma.
The image represents the chromosome structure in animals.

Appendix B:

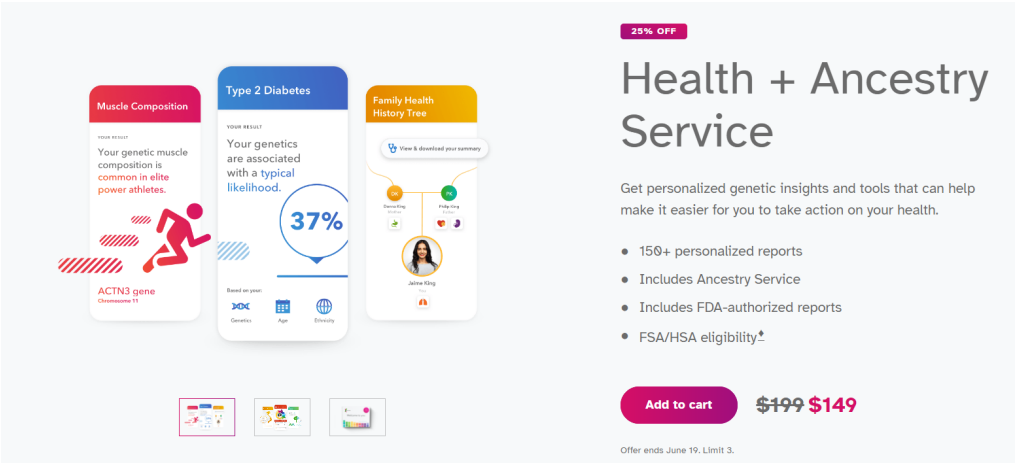


Source: National Human Genome Research Institute
Difference in the genome of 3 different persons (that present a SNV variation).



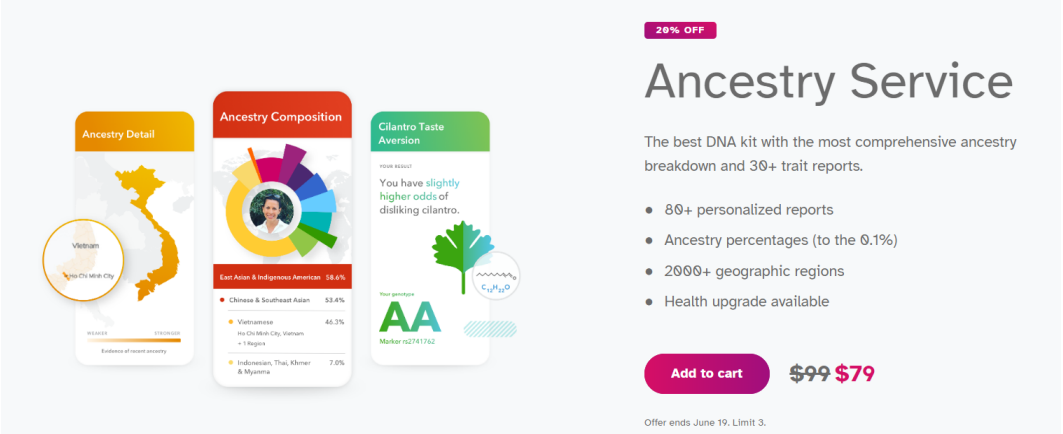
Source: National Human Genome Research Institute
Difference in the genome of 3 different persons (that present a SNV variation, and tandem repeats variations).

Appendix C:



Source: 23andme official website

Appendix D:



Source: 23andme official website

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