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After the HGP and development of the first direct-to-consumer genetic tests (e.g., AncestryDNA, 23andMe, FamilyTreeDNA and so forth) the market for consumer genetic testing has increased and is likely to continue becoming more popular due to expanding commercial interest. According to a Global Market Insight report, the direct-to-consumer genetic testing market exceeded 1 billion (USD) in 2019 with projections of valuing 3.48 billion (USD) in 2028 (Ugalmugle & Swain, 2020)⁷. This study is at the forefront of exploring potential implications of these tests on people's identities and overall sense of self.

As DNA testing has become more lucrative and continues to expand, other projects to find more information about people's origins and histories are being completed (e.g., National Geographic Research), having potential implications for people's identities and their outlook on life. This study examines participants' self-perceptions of the effects on their identities, contributing to knowledge about identities and highlighting possible future implications. Furthermore, this study is significant as the implications of DNA tests to notions of identity have not been explored in-depth.

1.4 Thesis Structure

This thesis comprises six chapters. [Chapter 1](#) provides context and introduces the research question and aims of the research, along with the scope, and the significance of this research. The literature review presented in [Chapter 2](#) consists of relevant literature that has informed and provided vital context to this research. This comprises literature on identity, genetics and DNA testing, and the relationship between DNA test results influencing identity.

[Chapter 3](#) details the methodology and research design, discussing qualitative research, the use of interviews, sampling, along with thematic analysis. The findings are presented in [Chapter 4](#), whereas [Chapter 5](#) discusses these findings and their significance to the research question⁸. [Chapter 6](#) concludes the thesis, answering

⁷ As of 17 October 2020, these figures approximately correlate to NZD 1.5 billion, and projections to NZD 5.27 billion (XE, 2020).

⁸ The research question is: How do DNA test results affect individuals' perceptions of their identity/identities?

Chapter 2: Literature Review

2.1 Introduction

In order to understand identity and its wider implications for DNA testing, this literature review focuses on [identity](#), including the historical background and conceptualisations, the post 2000's perception of identity: personal and individual and collective and group identity while briefly touching on intergroup dynamics and Social Identity Theory. Further to this, [genetics and DNA testing](#) are discussed with particular focus on aspects relevant to this research. These aspects include genetic testing types, the types of DNA tests, and challenges of DNA testing for one's identity. Lastly, it will review [DNA test results and identity influence](#), focusing on the spectrum of DNA test results influencing identity. As this research is about how DNA testing affects individuals' perceptions of their identities, relevant literature from various disciplines are drawn upon to contextualise this research.

2.2 Identity

Identity is a multifaceted concept with varied conceptualisations from western and eastern perspectives. Western conceptualisations of identity have primarily been focused regarding 'what one is' and the way individuals categorise the world around them, whereas Buddhist principles think of identity as a state of mind (Coulmas, 2019). The German sociolinguist, Coulmas (2019, p. 130), stated that,

[i]ndividual identities are complex structures combining inherited features with various group memberships, loyalties, values, belief systems, and fashions. These structures adjust to changing circumstances and so does the concept of identity itself.

More simply, the Cambridge Dictionary (n.d.) defined 'Identity' as "who a person is, or the qualities of a person or group that make them different from others" (para. 1) or alternatively with the legal definition, "who a person is, or the information that proves who a person is, for example, their name and date of birth" (para. 5).

To understand how these differences in understanding identity came about and how they may influence the current research, a broad overview of the historical background and development of the concept is provided. Further to this, the development of the concept post 2000's in a personal/individual and collective/group understanding provides additional context.

2.2.1 Historical Background and Conceptualisations

Although the concept of identity has been explored by numerous philosophers since Socrates, the term 'identity' was not coined until Locke and further developed in the 19th and 20th centuries (Coulmas, 2019). Coulmas (2019) and Izenberg (2016) agreed that identity as a concept was first discussed when British philosopher John Locke (1632-1704) raised the issue of personal identity. Locke conceptualised personal identity as "the self's continuity or sameness in relation to the ever-changing stream of our sense impressions" (Izenberg, 2016, p. 10). He emphasised that necessary conditions of individual identity included rationality, self-knowledge and personal memory (Coulmas, 2019). According to Izenberg (2016), American newspapers and periodicals from the 19th and early 20th century showed that 'identity' was used in everyday and bureaucratic purposes to define name, gender, age, address, occupations, parentage for minors and physical appearance.

It was during the early 20th century that Sigmund Freud (1856-1939) advanced his psychosexual theory of personality development, making a substantial contribution to psychology by conceptualising the human psyche through the development of a dependant new-born to an autonomous adult (Coulmas, 2019). Freud's model detailed three parts of personal identity and how they interacted during different stages of human development with the idea that 'moral agency' would regulate people's behaviours (Coulmas, 2019). Jay (2020) stated, "[d]espite repeated criticisms, attempted refutations, and qualifications of Freud's work, its spell remained powerful well after his death and in fields far removed from psychology as it is narrowly defined" (para. 2).

Freud's student, psychoanalyst Erik Erikson (1902-1994), continued developing Freud's personal identity theory and included the synergy between internal drives and cultural demands, whereby personal identity would emerge as a balance

between the two (Coulmas, 2019). Coulmas (2019) stated that Erikson deviated from the traditional Freudian psychosexual theory of human development, as he believed that people's personalities continued to develop past the age of five. According to the Erikson Institute (n.d.), Erikson was the first to "propose that children are not simply biological organisms but also products of society's expectations, prejudices, and prohibitions" (para. 2). Erikson then developed the eight stages of personality development⁹, where characteristics from this theory stemmed into identity crisis (Harvard University, n.d.).

The term 'identity' was popularised to describe different forms of identities by Erikson in the 1950s, when he coined the terms 'ego identity' (the psychic structure fundamental to psychological equilibrium in mature adults) and 'identity crisis' (the disturbances that disrupt the self while it is being established in the adolescent) (Coulmas, 2019; Fearon, 1999; Harvard University, n.d.; Izenberg, 2016). According to Coulmas (2019), Erikson's identification of the concept of 'identity crisis' as well as the stages of personality development were pivotal moments in western literature of identity development.

In the 1960s, political activists, social theorists and historians began to widen Erikson's psychological concept to include markers of identities such as gender, sexual orientation, ethnicity and nations (Izenberg, 2016). Political scientist James D. Fearon (1999) wrote that the concept of 'identity' was a fairly recent and complicated concept, adding that although people used the word properly in everyday discourse, it was difficult to provide a short and simple summary statement to capture its full meaning.

2.2.3 Post 2000's Perception of Identity: Personal and Individual

Izenberg (2016) claimed that contemporary identity is different from the concept of 'personal identity'. Coulmas (2019) described personal identity as something people are, have and act on, whereby people "perform acts of identity following culture-

⁹ Erikson's eight stages of psychosocial personality development over the course of one's life: (1) Trust vs. Mistrust, (2) Autonomy vs. Shame and Doubt, (3) Initiative vs. Guilt, (4) Industry vs. Inferiority, (5) Identity vs. Role Confusion, (6) Intimacy vs. Isolation, (7) Generativity vs. Stagnation, and (8) Ego Integrity vs. Despair (McLeod, 2018). These stages are associated with particular psychological struggles during one's life which shape one's identity (The Erikson Institute, n.d.).

specific stage directions that leave room for individual expressivity” (p. 100). The development of identity is also an ongoing process, whereby a person adapts to their mutable environmental conditions (Coulmas, 2019). Therefore, identity may be seen as not what it professes to be but rather, it displays different characteristics depending on the environment. This results in a continuous process of negotiation and re-negotiation of personal identity. Throughout history, the question of how consciousness and self-awareness connected with personal identity had been pervasive and had been put forward with elaborate answers, showing “that self-awareness is more than just being consciousness” (Coulmas, 2019, p. 7).

According to The University of Pennsylvania Press’s website, Izenberg (2020) argued that to live effectively and interact comfortably with others, one must have a stable sense of who one is, adding that,

while it is a mistake to believe that our identities are givens that we passively discover about ourselves, decreed by God, destiny, or nature, our most important identities have an objective foundation in our existential situation as bodies, social beings, and creatures who aspire to meaning and transcendence, as well as in the legitimacy of our historical particularity. (para. 2)

Comparing the western concept with the eastern concept on personal identity, Coulmas (2019, p. 15) stated that,

The postmodern self is different in that it constructs itself, at least in part, and recognizes this fact. It is inherently fluid, constantly reinventing itself. In this, it is akin to Eastern concepts of personal identity. To mention but one rich tradition, in contrast to European dualism, the holistic view of humanity that Confucianism represents treats the self as an ethical concept predicated on a ceaseless process of self-cultivation and moral improvement.

Therefore, personal identity seems to be fluid, ever-changing and influenced by the environment.

According to Izenberg (2016), the American historian Jerrold Seigel described the western concept of ‘self’ to be closely related to identity. The term ‘self’ is what distinguishes each person, draws together parts of one’s existence, one’s development or opening the way of becoming who one could or should be (Izenberg, 2016; Seigel, 2005).

Collective and group identities are often used interchangeably and include other forms of shared identities (i.e., familial and cultural). Scholars such as Chu et al. (2017) reinforced this idea by stating that in a world of globalisation and international migrations, cultural identities are becoming more complex. Ten years earlier, Samovar et al. (2007) identified globalisation as a key driver for the importance of identity. Callister and Didham (2009) wrote that the “intermixing of people across various boundaries, suggest that personal definitions of identity are likely to become more important than ‘scientific’ definitions imposed by external authorities” (p. 73). Thus, they illuminated that although globalisation and mixing of identities have become more prevalent, one’s personal definition of who they are and how they collectively identify, is likely to be more important.

Samovar et al. (2007) claimed that “identities are largely a product of group membership” (p. 119). They added that identity development was the result of a process of familial and cultural socialisation, which affected one’s personal development. Similarly, Coulmas (2019) described people at a collective level as being part of ambiguous sets “rather than clearly delineated groups” (p. 128). Their writing suggests that there seems to be a strong impact on one’s self and the way various identities are constructed with individuals integrating multiple and distinct social identities, and where both national and ethnic identities can be important to one’s sense of self (Sablonnière et al., 2007, as cited in Chu et al., 2017). This idea ties in closely with collective and group identity where people who share common features such as ethnicity, religion and nation will strive for a shared sense of identity (Coulmas, 2019). Jasper et al. (2015) explained the vastness of collective identities, including identities such as national, political and gender identities (Jasper et al., 2015).

According to Samovar et al. (2007), the first exposure to one’s identity is through family, where one learns culturally appropriate beliefs, values and social roles; this is also when one “first begins to inculcate the concept of an individual- or group-based identity” (p. 119). Coulmas (2019) claimed that sociologists had argued that a cohesive society is “impossible without a collective sense of belonging to a bigger whole as a source of security, pride, and self-esteem” (p. 94), alluding to feeling part of a collective group as part of something bigger. He believed that group

identities were relational (focused through relationships to other members within and outside the group), resulting from the inclusion of peers and the exclusion of others, and that having a collective sense of belonging is what constitutes satisfactory group identification. In this context, identification seems to be in line with how one constitutes their identity and, for the purpose of this research, will abide by how one professes their own collective identity/identities.

2.2.5 Intergroup Dynamics and Social Identity Theory

In the early 1970s, British social psychologist Henri Tajfel and his colleagues conducted 'minimal-group' studies, which showed that people identified as members of a group simply by being categorised into that group (Ellemers, 2019). Tajfel and Turner (1979) focused on outlining a theory (social identity theory) to observe intergroup behaviour and intergroup conflict, specifically applying the theory to individual prejudice and discrimination through interpersonal behaviour. For instance, Tajfel and Turner (1979, p. 33) detailed,

[o]pposed group interests in obtaining scarce resources promote competition, and positively interdependent (superordinate) goals facilitate cooperation. Conflicting interests develop through competition into overt social conflict. It appears, too, that intergroup competition enhances intragroup morale, cohesiveness, and cooperation.

Therefore, their study elucidated that intergroup conflict or competition facilitated more intragroup morale and so forth, which is linked to interpersonal behaviour (Tajfel & Turner, 1979). For this research, the theory's principles are relevant in that varied DNA test results allow for DNA matches to biological relatives. These relatives could be construed as family groups, where each family has its own intragroup dynamics and different families could have intergroup behaviours, thus differentiating families. This study focuses on how participants' perceptions were affected by DNA test results which may affect group identities.

Tajfel and Turner (1979) explained that during their study, the subjects were "randomly classified as members of two nonoverlapping groups" (p. 38). Ellemers (2019) explained that the minimal group studies involved participants being assigned to groups that were described as being as 'arbitrary' and 'meaningless' as

possible. Subjects then made 'decisions' where they awarded money to pairs of other subjects in booklets designed for the study (Tajfel & Turner, 1979). Tajfel and Turner (1979) described these aspects as making the groups "purely cognitive, and can be referred to as minimal" (p. 39), hence the term 'minimal studies'. Despite being assigned to arbitrary and 'meaningless' groups, when asked to assign points to other participants in the research, subjects "systematically awarded more points to in-group members than to out-group members" (Ellemers, 2019, para. 2). This highlighted the relationship between belonging to a group and the perception of an 'out-group' where one does not have membership to.

These studies allowed for the development of social identity theory. Proposed by Tajfel and Turner (1979), scholars have applied the aforementioned theory across disciplines. Leaper (2011) stated that this theory addressed the ways in which social identities affected individuals' attitudes and behaviours regarding their ingroup and outgroup membership. This theory has three main dimensions which include social categorisation, social identification, and social comparison (Tajfel & Turner, 1979). Social categorisation allows individuals to categorise objects to understand their meaning and identify them, helping understand the context and social environment (McLeod, 2019; Tajfel & Turner, 1979). Social identification occurs when individuals adopt the identity of the group that they have categorised themselves as belonging to, meaning they conform to the norms of that group and attach emotional significance to their identification with that group (McLeod, 2019). This provides a "system of orientation for self-reference" whereby "they create and define the individual's place in society" (Tajfel & Turner, 1979, p. 40). The final dimension of social identity theory is social comparison, which refers to categorising and identifying with a group and comparing their group with other groups (McLeod, 2019). Tajfel and Turner (1979) described social comparison as relational and comparative, defining individuals as 'better' or 'worse' than members of other groups. These dimensions strongly link to social identity, and may be applicable to participants' perceptions of their identities.

Social identity refers to people's self-concepts based on their membership in social groups and how they categorise themselves to social groups (Leaper, 2011; Tajfel & Turner, 1979). Jenkins (2014) argued that the 'social' part of 'social identity' was

redundant and described (social) identity as how individuals identify themselves, depending on the context of the situation and involving interaction through communication and negotiation (of one's identity). For this reason, this research uses identity as being socially constructed, dependent on a person's perspective and interactions and how they perceive their own identities. Identities are most important when individuals feel like they have strong emotional ties to a group and have membership with that group, thereby reinforcing their self-esteem that sustains their social identity (Leaper, 2011). In this study, DNA test results may affect one's social or group identities, which makes social identity theory valuable in this research.

2.3 Genetics and DNA Testing

This study investigates participants' self-perceptions of their identity as a result of DNA testing, and so, in order to give further context, this section illuminates the types of genetic testing, the types of DNA tests and the challenges of DNA testing for one's identity. In [2.3.2 Types of DNA Tests](#), there is a focus on available direct-to-consumer tests, how the testing is done and what is presented in these DNA test results in order to help contextualise participants' perspectives on the effects of these results on their identities. Although technical in nature, knowledge about genetic testing types provides relevant context for the different types of DNA testing available. In order to fully contextualise participants' perceptions of the effects of DNA test results on their identities, some understanding of the technical aspects of the types of tests is required.

2.3.1 Genetic Testing Types

Genetic testing identifies changes in chromosomes, genes or proteins (Genetic Home Reference, 2020b). Depending on the purpose of the genetic testing, different tests yield different results. These tests are conducted through analysing a sample of blood or body tissue (Hirsch, 2019). Since the Human Genome Project¹⁰,

¹⁰ After successful discoveries in the programme, including international researchers unravelling the genetic code of an entire human chromosome in 1999 and a two billion of the three billion 'letters' (also referred to as 'bases') which constitute the 'genetic instruction book of humans', the project was completed two years ahead of schedule in 2003 (National Human Genome Research Institute, 2018).

tests have become cheaper and easier to access, resulting in numerous types of DNA tests relevant to this study which will be discussed in this section.

According to Elliot and Brodwin (2002), in the early 2000s there were two main techniques, which were “mapping polymorphisms on the Y chromosome to trace paternal ancestry and on mitochondrial DNA to trace maternal lines” (p. 1469). Since then, a third technique, autosomal testing, has been used to provide ethnicity estimates. Schneider et al. (2019) stated that the “farther apart the geographic regions of origin of two persons lie, the greater the genetic differences between them” (p. 877). This is due to migrations and certain DNA markers seen in particular population groups in specific regions, or ones in common within certain regions (Schneider et al., 2019).

Schneider et al. (2019) added that these markers were called ancestry-informative DNA markers, which could be passed from one generation to the next, and which could display biogeographic ancestry in three different ways: autosomal, Y chromosomes, and mitochondrial. The USA government site, Medline Plus (2020) explained that there are three main types of genetic testing: Y chromosome testing, mitochondrial DNA testing and single nucleotide polymorphism testing (also known as autosomal testing). These forms of testing can be used for direct-to-consumer tests, where individuals can do a test to gain more information about their ancestry (Best tests, 2014). This is done through the use of “maternal mitochondrial DNA and Y chromosome DNA to provide continental and regional information about ancestors” (Best tests, 2014, p. 17). As a result, the test either helps identify the individual’s specific lineage, or looks at a wider estimate from both lineages (autosomal). Y chromosome testing only focuses on the paternal line whereas mitochondrial DNA testing looks at the maternal line (Medline Plus, 2020; Schneider et al., 2019). This is important as the user receives specific information that could affect how they perceived themselves.

Schneider et al. (2019) explained that markers located on the Y-chromosome were only passed from father to son, which reflected the geographical origin of a male’s ancestors in his paternal lineage. Mitochondrial DNA, however, is passed down from mothers to both genders, allowing any gender to take the test (Medline Plus,

2020). This, while the research focus is on DNA tests' effect on identities, the type of test may influence the resultant effect.

The third test, the single nucleotide polymorphism (SNP) test, evaluates variations across an individual's entire genome and the results are compared with others who have also tested in order to create an estimate of an individual's ethnic background¹¹ (Medline Plus, 2020). Medline Plus (2020) added that this type of testing was often used by genealogists to provide ethnic background from both lines rather than a singular line, as was the case with Y chromosome and mitochondrial testing. According to Schneider et al. (2019), the markers located on the autosomes are inherited from both parents and therefore reflect the geographic¹² origins of both. They explained that autosomal DNA is reassorted in each generation so that "only half of autosomal DNA markers are still present in each off-spring" (Schneider et al., 2019, p. 877). When biological ancestors come from different regions, autosomal DNA markers can be used to make 'quantitative inferences' about a person's mixed biological ancestry (Schneider et al., 2019). Medline Plus (2020) outlined that due to most human populations having migrated many times throughout history, thereby mixing with nearby groups, the "ethnicity estimates based on genetic testing may differ from an individual's expectations" (para. 5).

These types of DNA tests are becoming more readily available and are a development from [Mendel's](#) original conception of genetics. Mendel's conclusions from his study with pea plants led him to create the 'laws of segregation' and the 'law of independent assortment of characters', which are elements recognised in the fundamental laws of heredity (Haas, 1998; Slack, 2014). Mendel "postulated that there were invisible hereditary 'factors' causing each variable character, and showed that there were predictable rules for their inheritance", which explains why dominant genes are likely to be passed down from parents and are a combination dependent on factors inherited from each parent (Slack, 2014, p. 5). Thus, the

¹¹ An approximation or estimate is based on the database of who has tested and may vary between providers (Medline Plus, 2020).

¹² Geographic origins may reflect one's ethnicity estimate (as they are based on the geographic population, which may be associated with ethnicity), as commonly displayed in DNA test results.

potential combinations of DNA may be passed down from parent to child and DNA test results may vary between family members.

2.3.2 Types of DNA Tests

The quantitative inferences are displayed as ethnicity estimates in direct-to-consumer DNA tests, which are also referred to as 'home kits'. These readily available kits provide the user with an ethnicity estimate as a percentage breakdown of their ancestral background, reflecting their ancestors' origins with a list of regions and percentages of DNA that comes from each region (MyHeritage, n.d.a). Ancestry platforms also generate a measurement of shared centimorgans (cM) between two individuals' test results. These are used to measure the probability of how closely related people are, and therefore, the more centimorgans two people share, the closer their relation is likely to be (AncestryDNA, n.d.).

Besides ethnicity estimates and the use of cM to determine closeness of biological relationship (AncestryDNA, n.d.), some direct-to-consumer DNA kits also identify health information as well as haplogroups, which are direct paternal and maternal lineages derived from Y-DNA and mtDNA analysis. Table 1 is an adaptation of genealogist McDermott's (2020) compilation and comparisons of the five key commercial companies who offer a range of testing, including AncestryDNA, MyHeritage, FamilyTree DNA, 23andMe and LivingDNA, thus outlining the likely tests participants in this research may have taken.

Each test has its benefits. Some are better for genealogy, ethnicity estimates or YDNA (paternal lineage testing) and mtDNA (maternal lineage testing) whereas others are better for health or distant ancestry (beyond six to eight generations) (McDermott, 2020). McDermott (2020) also compiled the size of each database, as evident in Table 1, thus showing specific regions with more data or broader population bases that are likely to influence one's results. All five of these companies are known to be compatible with GEDmatch¹³ (Takano, 2020).

¹³ GEDmatch is popular free service where people have uploaded their raw genetic data in order to connect with family members and to better understand their genetic heritage. It is also one of the

Table 1*Comparison of Important Features From the Five Main DNA Testing Companies*

	AncestryDNA	MyHeritage	FamilyTree DNA	23andMe	Living DNA
Best for	Genealogy, matches, ethnicity regions	Global matches, tools for advanced genetic genealogy	Distant ancestry, YDNA, mtDNA	Genetic health testing	British Isles ancestry
Ethnicity Results	Yes	Yes	Yes	Yes	Yes
Ethnic Regions	500+	42	24	1,000+	80 (in depth for UK)
Family Matching	Yes	Yes	Yes	Yes	Limited
Database Size (People)	15 million	3.8 million	1 million	10 million	None
Y-DNA Test	No	No	Yes	Broad haplogroup, no matching	Broad haplogroup, no matching
mtDNA Test	No	No	Yes	Broad haplogroup, no matching	Broad haplogroup, no matching
Collection Method	Saliva	Cheek swab	Cheek swab	Salvia	Cheek swab
Health Information	No	For extra fee	No	For extra fee	No

Note. Adapted from McDermott's (2020) comparison table.

Companies tend to share similar processes for testing, whereby a kit is ordered and an individual places their saliva sample or cheek swab in a prepaid envelope to be analysed in laboratories (Ancestry, n.d.; Family Tree DNA¹⁴, n.d.; MyHeritage, n.d.b). Results are then emailed to the consumer approximately four to eight weeks later, depending on the company (Ancestry, n.d.; MyHeritage, n.d.b). For Ancestry

first DNA databases to be used by police to identify criminals (which is now one of its primary purposes after Verogen purchased the company). (Takano, 2020)

¹⁴ Family Tree DNA's overarching company is Gene by Gene, Ltd.

Further to home kits, there over 1,000 genetic tests currently in use with more being developed (Genetic Home Reference, 2020b). For instance, other than their ancestry testing through FamilyTreeDNA, Gene by Gene (n.d.) offers a range of other testing, such as clinical testing, carrier screening (helping potential and expecting parents with future comprehensive screening tests), forensics, research genetics, COVID-19 testing, and relationship testing (for paternity, maternity, and immigration DNA testing services) (Gene by Gene, n.d.). There are also other specialised and expensive tests available, where according to Ito (2019), a blood test can identify health conditions and sequence 97.9% of a person's genome, in comparison with other direct-to-consumer tests such as 23andme which only details 0.01% of one's genome and can assess the potential risk of only thirteen conditions.

More expensive specialised testing include African Ancestry (n.d.), which traces the country of origin and the tribe one belongs to (if one shares African ancestry over the past 500-2,000 years), and FullGenomes DNA Sequencing, who can do advanced testing with the most expensive test looking at the 'Long Read Whole Genome' (Full Genomes DNA Sequencing, n.d.). Full Genomes DNA Sequencing (n.d.) claimed their test to be the most comprehensive genetic analysis at the time of writing with 1,000 times more data than other commercial tests.

Since the completion of the Human Genome Project, other testing and projects have investigated human genetic variation and specific population groups. Terry et al. (2012) stated that researching human genetic variation was the 'current phase' of Human Genome Project, which allowed for an improved understanding of haplotypes (genetic markers present on one of the chromosomes that tended to be inherited together), better identified disease susceptibility in genes and facilitated more development in tools and further treatments. Some of the new DNA testing research included The African Genome Variation Project (Gurdasani et al., 2015), studies on evolutionary history and local adaptations in African genetic diversity (Choudhury et al., 2018) and National Geographic's¹⁹ Genographic Project looking at 'The Human Story' about migration and adaptation (National Geographic, n.d.a;

¹⁹ In 2016 they partnered with the company Helix, allowing those who took the test to look deeper in their DNA results (National Geographic, n.d.b).

n.d.b). These projects demonstrate the vast nature of DNA testing and other applications for these tests, providing context to tests that participants may have taken. Thus, while the research considers the effect of DNA tests on self-perceptions of identity, the effect is far more nuanced than it may appear on the surface.

2.3.3 Challenges of DNA Testing for One's Identity

Nucleotide polymorphism testing, which is often referred to as autosomal testing, assumes that genetic material is passed down half from each parent (Elliott & Brodwin, 2002). Dooney (2017) wrote that DNA specialist Brad Argent detailed that as genetic material is passed down from person to person it can become diluted, especially in a world where people are increasingly diverse. Elliott and Brodwin (2002) believed that the biggest issue of DNA testing was that it was based on the assumption that genetic material was passed unchanged from parent to child, and that certain DNA procedures only followed one chromosome, tracing only two genetic lines in a family tree, which then doubled for every preceding generation. As these trees branched out, the genetic testing would connect them to only one ancestor 14 generations back, not to the other 16,383 ancestors in that generation, even though they were related to these ancestors in equal measure (Elliott & Brodwin, 2002). Argent also claimed that due to genetic material being diluted, siblings may have different results (Dooney, 2017). Essentially, with the recombination of DNA from each biological parent, siblings may inherit a mixture of genetic material from each parent and have varied combinations (i.e., they may not have 50% of each parent's DNA).

Elliott and Brodwin (2002) highlighted the controversy around genetic testing, stating that genetic information was given too much authority in deciding questions about identity; one's genetic ancestry might not reflect one's identity. However, Elliott and Brodwin (2002) also pointed out that even though genetic testing could disrupt identity claims, it could corroborate these claims and confirm origin stories, family history or rights to group membership. In Dooney's (2017) article, Argent added, "[w]e are shaped by the stories of our ancestors, and not necessarily by our genes" (para. 19). In a similar vein, Lawton and Foeman (2017) stated that Ancestry

DNA was pushing people to the edge of their racial classifications, giving additional information to how they identified themselves and included a range of factors such as “phenotype, social class, languages spoken, family narratives, and peer relations” (p. 80). Nevertheless, while consumers might be pushed to the edge of racial classification, a weakness in DNA testing remains in regions such as Africa, Asia and the Pacific that are still under-represented (Dooney, 2017). However, this may change. As more people take the tests, data sets are becoming larger and seemingly more accurate.

2.4 DNA Test Results and Identity Influence

Before molecular genetics, ancestry played a crucial role in political identity and still does today with citizenships, memberships and the right to return to countries after displacement (Elliot & Brodwin, 2002). Genetics can also influence one’s ethnic, religious or family identity, for example whether someone is of Jewish, Māori or Cherokee descent, or whether they are related to a famous or politically important figure (Elliot & Brodwin, 2002).

However, the extent to which DNA plays a role in forming one’s identity – including legal, societal or constructed identity – has been disputed. Coulmas (2019), for instance, wrote that the “variables that go into identity formation are not the same everywhere” (p. 99). He added that culture occupied a place in personal identity theory, and that one was born as a biological being, but whether they were called ‘a white woman’ or ‘a black man’ was socially constructed (Coulmas, 2019). Elliot and Brodwin (2002) claimed that “clearly confusion looms when genetic markets conflict with other kinds of markets of group membership, such as a shared culture of historical narrative” (p. 1469). For example, historically, a single genetic line could disqualify a person from a social group or provide them membership of that group, such as connecting a single line to the British Royal Family, getting a German passport, or qualifying as a member of the Jewish Cohanim (Elliot & Brodwin, 2002).

2.4.1 Spectrum of DNA Tests Results Influencing Identity

A study conducted by Lawton and Foeman (2017) examined how genotype information affected the identification narrative of multiracial individuals. They

Another study detailed a personal story of a man²⁰ who was evacuated as a young boy in 1939 and decided to find his identity based on his genetic information (Puig et al., 2019). He was one of the many children, mostly children of Spanish Republican families, that were being persecuted by the rebel army of General Franco and evacuated to Belgium during the Spanish Civil War (1936-1939). Puig et al. (2019) detailed this personal story, showing how genetic data from the man's blood samples connected him to his mitochondrial cousin (through common ancestry of their maternal grandmother). As a result of this connection, after having been apart for over seven decades, the man was able to reconnect with his biological family in Spain (Puig et al., 2019), enabling him to redefine his identity.

Individuals align their identity in different ways through genetics, and disruption claims to this identity can also happen when one receives unexpected results. There have been an increasing number of articles and videos where people were doing a DNA test because they were curious about what the results might bring. But there is an emotional fallout when receiving confusing or life-changing test results, and where "[i]dentities that have been cherished by families for generations can be dismantled overnight" (Lawton, 2018, para. 6).

One of these instances of unexpected results was documented by BBC News (2019). Several individuals took DNA tests; each had a different response. One individual expected to be half Polish but found out she was 47% Italian, which resulted in her learning that her biological father was actually someone she knew as a 'close family friend'. Another individual learned that she had another whole family of half siblings. In the video, Kenyatta D. Berry (a genealogist and author) said that DNA may result in more questions that may lead one to wonder how they are related to someone.

In a news article, DNA expert Brad Argent from Ancestry.com was quoted as saying that people wanted connection to something bigger than themselves and many younger people were doing DNA tests in search of their identity (Huffadine, 2018).

²⁰ According to Puig et al. (2019) the man had left his aunt and cousins in Spain and his name was changed after being adopted by the 'D.' family. He was unable to remember his childhood before the adoption – likely amnesia due to a head contusion. DNA allowed him to reconnect with this family.

This includes people searching for their history, especially in New Zealand where many are descendants from immigrants, or even finding their biological family, traits or health (Huffadine, 2018). Walters and Kenny (2018) wrote about Oriini Kaipara, a television presenter who took a DNA test that showed that she was 100% Māori. They reported that, technically, her DNA reflected that she was 98% Māori, 1% Scandinavian and 1% Caucasus, but Argent (the DNA expert from Ancestry.com) stated that the other 2% was likely 'noise'²¹. Kaipara was quoted saying,

The DNA test did not define who I am, nor did it change my perspective or outlook on who I am as a Tūhoe descendant, or a Ngāti Awa descendant, or a Ngāti Tūwharetoa person; I'm still the same person. (Walters & Kenny, 2018, para. 22)

She also discussed what it meant to her to be Māori, the language, culture and heritage. Other articles about the test results were also published, with one mentioning Kaipara saying she had two Pākehā ancestors, one on her mum's side and another on her father's (Dooney, 2017). Thus, the 2% could be 'noise' or DNA passed down from these ancestors.

There have been numerous articles relaying the stories of people who took DNA tests with different results. In one of these, Lawton (2018) recounted her own experiences with DNA tests. She took a MyHeritage test wanting to receive peace of mind about her biological father whom she did not know. Being raised by an Irish mother, she wrote, "I'd always longed for a country to attribute my blackness to, or for help answering the ubiquitous 'Where are you from?' question" (Lawton, 2018, para. 1). After receiving her ethnicity estimate she found she was 43% Nigerian, 1% Kenyan, 55% British and Irish as well as 1% Eastern European. Lawton wrote that she felt more confused than ever and wondered: even though she had no cultural knowledge of Nigeria, could she claim it as her own?

In comparison, Letzter (2018) completed nine different commercial DNA tests and said he had received six different results. He wrote that he knew that his ancestors

²¹ Noise can refer to statistical noise, which implies test results have an unexplained variation or randomness (Thelwell, 2013). Lower percentages are sometimes referred to as 'noise' as it shows a small biogeographic connection to people in a particular area, which may not be accurate to their actual ancestry.

were Jewish who lived in the shtetls²² in Eastern Europe. Although his DNA test results corroborated this, the different companies provided different ethnicity estimates of how Jewish he was. Depending on the test, it would include small percentages from other regions such as the Iberian Peninsula, Middle East or Italy and Southern Europe (Letzter, 2018). Evidently, although results were similar, they depended on the database. These underlying differences could potentially impact one's perception of their identity.

2.5 Summary

This chapter reviewed various conceptualisation of identity. It first provided background to the concept of identity with philosopher John Locke having raised the idea of personal identity in the 1600s. After Erikson's popularisation of the term 'identity' in the 1950s to describe different identities (coining the term 'ego identity' and 'identity crisis'), there have been further discussions about the complexity of the concept, including the varied types of identities. The post 2000s conceptualisations of identity, primarily personal and individual identities, along with varied forms of collective and group identities, were examined in this chapter. For the purpose of this study, identity is focused on 'what one is' and the way participants' identify the world around them, focusing on their self-perceptions of their identities.

In this chapter, identity was detailed as something people are and how they act, and an ongoing process of adaptation to changeable environmental conditions. With multiple constructions of one's identities, individuals can integrate multiple and distinct identities with equal importance to their sense of self. Those with common features may also have a shared sense of identity, being part of a group professing a collective identity. These group dynamics have been highlighted through Tajfel and Turner's (1979) social identity theory, looking at intergroup behaviour and dynamics.

This study centres on participants' perceptions of their identities as a result from their DNA tests, and therefore, this chapter discussed the types of genetic testing

²² A shtetl refers to "small Jewish town or village formerly found in Eastern Europe" (Merriam-Webster, n.d., para. 1).

relevant to this research. This discussion included the three main types of tests including: Y chromosome testing (paternal lineage), mtDNA/mitochondrial testing (maternal lineage), and autosomal/single nucleotide polymorphism (SNP) testing (used for ethnicity estimates and broader ancestral lines). Key DNA testing companies and their tests relevant to this study were outlined, along with other relevant DNA tests and the challenges and assumptions of DNA test results in conjunction with one's identity. The chapter concluded with scholarly material, articles and videos that reported on identity claims influenced by DNA test results.

Chapter 3: Methodology and Research Design

3.1 Introduction

This research focuses on how DNA test results affect individuals' perceptions of their identities, and provides qualitative insights from interviews conducted with individuals who have received their DNA test results. Participants were identified through purposive and snowball sampling methods, being interviewed in-person (where convenient) or through video calling.

In this chapter, the methodology and research design of this study are introduced. The qualitative research approach, specifying participants' recruitment (sampling), how semi-structured in-depth interviews are used as a data collection tool and the use of thematic analysis are explained.

3.2 Qualitative Research

Vaismoradi and Snelgrove (2019) described qualitative research as broadly "encompassing different data collection and analytical approaches with the aim of providing cultural and contextual description and interpretation of social phenomenon" (p. 1). As this research focuses on participants' perceptions of their identities, a qualitative approach is best suited to contextualise descriptions and interpret results. It also makes use of quotes from interview data. This is in line with Krippendorff's (2004) explanation of qualitative approaches using quotes and examples as data.

Scholl (2015, p. 510) summarised qualitative methodology as characterised by

its openness towards the research object in order to reconstruct its attributes authentically and to gain a deeper insight into these attributes. As a consequence, the research process includes an interactive and close relationship between the researcher and the researched persons or material rather than an objective, detached, or neutral relationship.

like Galletta (2013) and Cavana et al.'s (2001) emphasis on the idea of the 'researcher as an instrument' in qualitative research. They described the researcher as an instrument that can prompt a participant, rephrase questions and make changes to the questions depending on the interview situation. In the case of this research, it is important to gain insight from and clarification of participants' answers, thereby enabling interactive and authentic interviews through modification and rearrangement of questions during the interview. This allows for better communication and relationship building, which provides opportunities for participants to express their perspectives of how DNA test results affected their identities.

A researcher needs to be able to pay attention to the participant's narrative as it unfolds, making well-informed judgements, such as when and when not to interrupt the participant as they answer the questions (Galletta, 2013). By following a semi-structured interview approach, interview questions are centred around the research question, allowing participants to have some direction and focus while discussing what they feel is applicable to their own perceptions of their identity and their DNA test results' effect. Galletta (2013) elucidated that as part of the interview process, the interviewer needs to keep in mind points, which may be returned to for elaboration or to ask the participant to critically reflect on. Questions in this research are open-ended, allowing for flexibility in responses. These questions are available in [Appendix A](#).

Schlütz and Möhring (2015) described in-depth interviews as open-ended interviews. They detailed that these types of interviews "reconstruct social events as first-hand experience via storytelling" (p. 302). In this research, a combination of in-depth and semi-structured interviews are used. Semi-structure allows for focused direction, while the in-depth element allows participants to reconstruct their lived experience in relation to DNA testing, involving storytelling as they discuss what they feel to be relevant to answer questions.

Interviews are devised as face-to-face when possible, and video calling for those unable to be interviewed in person. Cavana et al. (2001) described face-to-face interviews as information gathering, where the interviewer and interviewee meet

the most relevant sampling criteria (Schlütz & Möhring, 2015), and therefore is a consideration in this research.

Fugard and Potts (2015) referred to sampling for thematic analysis as dependent on what is a “useful sample size for their particular context when investigating patterns across participants” (p. 669). For this research, the sample size includes those who met the inclusion criteria (such as having completed a DNA test and having received their results) and who expressed their interest in participating in the research. The indicative sample size was originally planned to be about ten people, but was extended to sixteen due to greater than expected interest. All sixteen people were interviewed.

Scholl (2015) claimed that sampling procedures in qualitative studies are mostly deliberate or purposive and are usually “coherent and consistent with the research questions and the theoretical aim of the study” (p. 512). For this reason, purposive sampling is important in order to recruit participants who fit the criteria of the research. Ideally, participants are located in New Zealand for ease of data collection. However, with video calling available, this is no longer a necessity. The key inclusion criteria are that participants had to have completed a DNA test and had either already received their results or would receive their results before their interview²⁴.

In order to recruit potential participants and therefore ensuring an acceptable sample size, a combination of purposive and snowballing sampling methods are utilised. For ‘purposive’ sampling, the size of the sample depends on the number of factors relevant to the study’s purpose (Merriam & Tisdell, 2016). The researcher posted a short post on her own Facebook, Instagram and LinkedIn profiles. This post briefly explained the research, inviting participants to contact the researcher for further information, then confirming whether they were eligible as per the inclusion criteria.

²⁴ Depending on the DNA test, it may take a few weeks to receive results. Therefore, at the time of sampling, potential participants were given time to receive these results before an interview was to take place.

Although the sampling method is mostly purposive, the recruitment includes snowball sampling to spread the word through further networks. Audemard (2020) stated that snowball sampling involves using a first sample of informants who then refer and help recruit participants. It focuses on using two populations: the individual and their relationships (Coleman, 1958; Audemard, 2020). The researcher uses a similar approach, by posting on her social media channels; then allowing for her networks to share posts, or to pass on information through word-of-mouth to connect with more people. Audemard (2020) wrote that snowball sampling method had been adapted for the use of questionnaire surveys, face-to-face interviews, and ethnographic observation. In this research, it is used to recruit participants for face-to-face interviews (either in-person or through video calling).

As it is ideal for participants to be accessible for interviews in New Zealand (where the researcher is based), the researcher also emailed the New Zealand Society of Genealogists (NZSG) and messaged two Facebook groups to request a post²⁵: 'Genealogy New Zealand and Beyond' and 'Using DNA for Genealogy – Australia & NZ'. These genealogy groups are ideal to find potential participants, as they have a large group of members, many of which complete DNA tests to help in their genealogy research or use the groups to help understand their test results. Contacting these networks is similar to applying the snowball sampling method, where it utilises the networks of a designated person branching out (Audemard, 2020). In this sense, the people sharing the researcher's post; the organisations and Facebook pages can be seen as 'designated persons' who may not be directly involved as participants, but as conduits passing on the information recruiting participants through their networks.

3.5 Thematic Analysis

As described prior, interviews are used to for data collection. Schlütz and Möhring's (2015) stated that analysis of interviews can be through theoretical or thematic coding. For the purpose of this research, a thematic analysis is used to code and

²⁵ The Facebook post was similar to the post to own personal networks. It briefly explained the research and asked for interested potential participants to contact the researcher for more information.

research question and has had engagement with the literature prior to the analysis. In this research, the researcher uses the verbatim transcript in conjunction with handwritten notes to identify common semantic features relating to the research question²⁷. Handwritten notes allow for identification of semantic codes that may develop into themes. Braun and Clarke (2019) explained the differentiation between a code and theme as the code being more specific, capturing a single idea within a segment of data which can be 'building blocks' to create a theme. Although personal beliefs and interpretations may influence the themes that emerge, it is important to identify codes and clear themes from participants' interviews through evidence and examples (Vaismoradi & Snelgrove, 2019).

By using handwritten notes based on the transcript, the coding process looks at frequently used words or ideas within the data to inevitably present themes in the next stages of the thematic analysis. The next three phases include searching for themes, reviewing them and finally, defining and naming these themes (Braun & Clarke, 2006). This type of thematic analysis is commonly a recursive process, moving between each of the six phases; the analytic approach may blend some of these phases together (Braun & Clarke, n.d.), as evident in these three phases. For instance, the reviewing, defining and names of themes may alter as more building blocks (codes) create a larger theme in the analysis process. A theme "captures a common, recurring pattern across a dataset, clustered around a central organising concept" (Braun & Clarke, 2019, p. 2). This process is similar to how Tesch (1990) described data being coded, re-contextualised, and put into a category – which in this case is similar to codes being brought together as a theme. For the purpose of this research, themes are created through a semantic approach. Braun and Clarke (2006) explained this as a process where the researcher identifies themes looking at the explicit or surface meaning of what the participant has said or written – in this case, what the participants have said and what has been transcribed.

Further to the semantic content of the data collected, a latent approach delves into further understanding of the implicit and underlying meaning, looking at the form and meaning of the data (Braun & Clarke, 2006; Lainson et al., 2019). This approach

²⁷ How do DNA test results affect individuals' perceptions of their identity/identities?

allows the researcher to do the interpretative work and discuss how the data is situated within a certain context, as well as how the “social context might shape meaning in the stories being created by participants” (Lainson et al., 2019, p. 91), which is especially important for this research as there may be many possibilities as to how (and if) participants’ identities were affected by DNA test results.

Braun and Clarke (2006) describe the sixth and final phase of a thematic analysis as producing the report. This report is presented in [Chapter 4: Findings](#) where the final themes are presented, followed by exploration and contextualisation in [Chapter 5: Discussion](#). Krippendorff (2004) wrote that qualitative researchers “support their interpretations by weaving quotes from the analysed texts and literature about the contexts of these texts into their conclusions, by constructing parallelisms, by engaging in triangulations, and by elaborating on any metaphors they can identify” (p. 88). This qualitative research will further discuss the findings that resulted from the thematic analysis.

3.6 Summary

This chapter identified the methodology and approach used in this research. Having followed a qualitative approach, this research uses purposive sampling with elements of snowball sampling to recruit participants. To be included in the research, participants need to have completed a DNA test and to have received their results or receive their results by the time of data collection. To collect data, semi-structured in-depth interviews are used, providing some structure to the interview while allowing participants to reconstruct lived experiences they felt was relevant to the research. Most importantly, this research uses a thematic analysis to contextualise the data, identify themes and trends, and to produce a final report.

Chapter 4: Findings

4.1 Introduction

This chapter summarises the findings that emerged from the thematic analysis of the interviews. The chapter starts with a brief summary of each participant. It then leads into the specific themes that emerged from the thematic analysis along with evidence from the interviews (including verbatim quotes and paraphrases of aspects relevant to the research question: “how do DNA test results affect individuals’ perceptions of their identity/identities?”).

While participants detailed their own perceptions of their identity/identities in the interviews, they tended to refer to specific terminology that is often used in consumer DNA tests. This terminology is relevant to understand participants’ perceptions of their results. Notably, participants frequently mentioned ‘ethnicity estimates’ and ‘centimorgans (cM)’, which were discussed in [Chapter 2: Literature Review](#).

Further, a brief summary of their key identifiers (based on the information participants frequently provided or strongly emphasised in relevance to their DNA test results) is included in this section (see Table 2). As mentioned in [Chapter 3](#), each participant’s name has been abbreviated as initials (displayed as P’s initials in Table 2) in order to provide privacy. These initials will be referred to throughout this chapter and [Chapter 5](#) (Discussion).

More detailed summaries to provide further context are available in [Appendix C](#), detailing the reason each participant took the DNA test, the specific company each participant used for the test taken, if the participant was referring to a commercial

Table 3*Summary of Themes*

Theme	Description
<u>Family Belonging</u>	Participants' feelings of belonging to a family, or their feelings of not belonging to their perceived family group and their desire to be a part of their family[ies].
<u>Genealogy and Ancestry</u>	Family background focusing on 'genealogy' and 'ancestry'. Participants felt connected to their family backgrounds. Some received unexpected results that prompted them to reframe their perception of their family background.
<u>Genetic Family Connection</u>	Participants feeling connected to their biological families through their family genetics, specifically their health knowledge, appearance and characteristics through these genetics.
<u>Family Stories</u>	Family stories either being reaffirmed by DNA test results, or results prompting participants to question their historical family narratives.
<u>Place Belonging</u>	Feelings of belonging to a place, either within a country or a specific region/land. Others desiring a connection to specific places, not necessarily corresponding with their DNA test results.
<u>Group Belonging</u>	Feelings of belonging to a group (or a lack thereof), fostering communication and/or the desire to get in touch with other members in the groups. This included groups of DNA matches, close family, religious groups and groups for genealogy, specifically focusing on fostering communication.
<u>National Pride</u>	Having an expressed feeling of national pride.
<u>Unexpected Information</u>	Participants finding unexpected information as a result of their DNA tests, creating further interest to seek answers.
<u>Cultural Affinity</u>	Having a cultural affinity, where participants felt connected to (or questioned) their cultures. Some of these connections were reinforced by DNA, others felt connected regardless of their results.
<u>Seeking Answers</u>	After receiving unexpected information, participants wanted answers and the truth about family members, specifically their close family relationships of their parent(s) and/or grandparent(s).

Although some themes were more frequently mentioned than others (e.g., family belonging), other themes were mentioned less frequently but held strong relevance to participants' perceptions of their identities (e.g., national pride). Therefore, frequently mentioned themes and those with strong relevance were included in these findings.

4.2 Family Belonging

'Family' was one of the most prevalent words mentioned by all participants. Participants described they felt belonging (or lack thereof) to their family. DNA test results had made participants feel that they belonged (or not) through a change in who they thought they were (perceived identity), which was usually based on unexpected results. Some of the notable mentions included that of CR, NH, BD, JG and RG.

CR felt she had a significant change in her perceived identity when she found her grandfather was not her biological grandparent. She said that a quarter of who she thought she was, was now unknown. She wondered what that side of her biological family would be like and whether she would like them even though she still loved the family that raised her.

Describing similar feelings of belonging to a family, NH said she grew up with her grandmother who had close connections to her family and remembered asking her grandmother questions about their relations. She mentioned that this prompted her to wonder about the people they were related to and do genealogical research. As she grew up, her curiosity grew, and she took the DNA test with the hope to find out more about her mother's family.

BD also described feeling part of her family, which reinforced who she thought she was while growing up. During this time, her family often mentioned that her grandparents from the one family line had come to New Zealand in 1875. She said, "I identified with the English and that side of the family". It was only until she was nursing someone with haemophilia that her mother was prompted to tell her that she [BD's mother] was adopted. She then described the lack of belonging to her

grandparents: "I was horrified because I love my grandparents. That to me, it was huge. Suddenly they weren't my grandparents".

Other than the descriptions of feeling belonging to a family that was closely associated with their grandparents, participants also mentioned being a parent or having a parent-child relationship. This included CR reflecting on being a parent: "It has certainly made me aware of future decisions and how it's going to change how I raise my son", and BD, who referred to her "childhood identity", elaborating that she had thought about it often and felt "one has many identities".

JG referred to her child-parent relationship in the family, where she learned that the father who had raised her was not her biological father. She said it did not really affect her, because she loved the family she grew up in and was still happy to be in contact with them. She mentioned that she felt "very fortunate" because "they were both so much older". Her mother was 37 and both her biological father (the local gynaecologist) and the father by who she had been raised, were in their 50s when she was born. From this, she said,

I didn't do a lot with my father with, my legal father. I could count on one hand the number of times we actually went and did something together, just us together because he was so much older.

JG did question whether this lack of time with her legal father was due to age "or whether he didn't want to be with me because I really wasn't his". However, she emphasised that people often questioned her relationship with her father:

People just say, and I've heard them say it, 'Oh, but you grew up, you know, he's the father you knew', and I just think, bugger off. It doesn't work like that, and it doesn't work for me.

Family, including uncles, was also mentioned by RG where she expressed that her family thought they were primarily Irish. She recalled one of the stories she liked the best because it showed they had fun:

My uncles would play the fiddle, and all those little things, I don't even know the proper names of everything, and we would have things like barn dances. So that was who I was growing up.

But what I noticed is that this is in my family, my family has a very specific type of self-loathing, which is there. And how this manifests is a desire to be fully and totally British.

AM described what she knew from her genealogy, “I'm of mixed heritage. Some people can tell, and some people can't. [...] My mother's Māori and my father is Pākehā so many people can't tell that I'm part Māori”. She said people sometimes did not believe her, “which is always quite annoying”. She said she knew this was the case, took the DNA test, and “sure enough, it came back 50% Polynesian”³¹. The rest was a mixture of various European ethnicities. AM had found it interesting to do the test and learning these estimates, adding, “it's been quite good for confirming stuff, like to make sure that what you're finding out in your family tree is backed up by the science”.

JG summarised the link between genealogy and family when she said,

It is a very, very special feeling when you find the paper trail is matching your genealogy trail... And, and it's just super seeing all the descendants and the sibling's descendants and we're sharing our DNA.

4.4 Genetic Family Connection

Participants expressed feeling connected (or not) through their family genetics, whether it was finding more health information or seeing similarities (or a lack thereof) through their appearances or characteristics. CH mentioned health information and appearances; KB mentioned health information, appearances, and characteristics. CR, HD, and BD only talked about appearances while characteristics were mentioned by BW, JC and DD.

CH had said she was “more interested in my health information instead of my ancestry origin because I thought I was going to be like 100% Chinese [...] because China is really like, a single monoculture country” and did not expect it to have anything else. KB expressed that after finding out her ethnicity estimates included

³¹ During the time of this interview, Polynesian encompassed Māori. However, in September 2020 (approximately), these results updated to be more specific, showing some people's results as “Māori New Zealand”.

BD had associated her own appearances to the family line that she had grown up in (which was then disproven after the DNA test, when it turned out her grandfather was not who she thought). After learning that her mother was adopted, she looked for a connection partially through appearance:

And I could remember going back and lying on the bed and going well, whose hands have I got? Who do I look like? Who, who is this person that made me?

BD questioned “who is this person that made me?”, while BW wondered what his son, whom he had not seen in twenty years, would be like. He stated that parenthood (as a biological father) had become part of his identity after he had received confirmation from the paternal blood test twenty years ago, which showed they were related: “I’m a father, at that point there was no doubt about it, that I was the father to this bouncing little boy”. He added that he now had a “bouncing little girl” and he saw daily that she had his DNA and wondered, “if he’s anything like what my daughter is, he’s headstrong and basically part of my DNA”.

Similarly, when KB met her biological father, she found that they were “very, very similar” in regard to characteristics, and they had a “very high DNA match”. JC had also said her siblings took the DNA test where,

The sister who looks the most like me and most in nature. I don't know if it's just a coincidence, we share the highest DNA. My younger sister, we're like chalk and cheese and she's had-, the amount of centimorgans she shares is actually shown as possibly a half sibling. But I know she is a full sibling.

DD also associated DNA with potentially seeing “why they might have certain traits”. She added that,

A lot of people are searching for answers [...] it could open many doors about how they feel about themselves, about if they've come from a small family, it might make their family a lot bigger, which might make them feel comfortable.

4.5 Family Stories

In the interview, participants were first asked if they could tell a story that resonated with their identity. Some participants mentioned personal stories (DD and CR), while others recounted historical narratives that their DNA had helped

She compared her feeling of belonging as a New Zealander to her ethnicity estimate origins,

I've always had that strong feeling that I belong here and not somewhere else. We did take a few trips back to England where my forebears came from and yeah, it was nice, but it didn't feel like it was home.

However, her original DNA results (before an earlier Ancestry.com update) displayed 30% Irish, 30% Scottish, and around 20% North Western Europe and 20% Scandinavian. After receiving the Scandinavian results, she was "quite excited about all of it",

This is new, but it actually made sense to me because my mother's family came from Yorkshire and I got this real interest in the Vikings after that [...] And I read up about York and found that York was the biggest Viking capital at one time in the world.

The update shifted her Scandinavian (which she associated with the Vikings) to being mainly British and North Western Europe instead, which she found somewhat disappointing. But she took it with humour, stating that fortunately she had not gotten herself a Viking tattoo like other people had done.

About the 8% Korean in her ethnicity estimates, CH said, "I wouldn't identify myself as Korean though. Like, I would still say I'm fully Chinese, but I'll be like, you know what, I'm actually eight percent Korean". She did not feel as though the DNA results impacted a lot but it did give her a "new perspective" and living in South Korea at the time of the interview, she wondered if it was her "ancestry subconscious" that had brought her there.

While talking about a story that resonated with his identity, DJ detailed being accepted into the clan after connecting his DNA to that clan. He said, "it's taken my heart with me and everything that we set out to achieve with the [Family name] clan society and our tartan [...] we're making history in you know, in Scotland the place of history". CR had also mentioned history whilst describing how she would talk to family about the places they had come from, which "created a part of my identity". Knowing where she came from and how her family had come to New Zealand was important:

It's always formed who I am as a person, that ties me to a place that ties me to history in whenever I've visited place overseas that I've heard in the story. It just makes it feel like that I'm home and in, you know, just in other places and other countries that have nothing to do with my heritage, and it still feels like home but certainly places tied into my family tree. It just gives me a sense of belonging and it makes me who I am.

DJ felt connected to his heritage when he visited a cathedral in Scotland. He found the place awe-inspiring; his roots went back to the [Family name] clan about which he said, "you can't take that away".

HD explained that if she were in a place like Bay of Islands (connected to her heritage and reinforced by her Polynesian ethnicity estimates) and saw "certain, like ancestry sort of murals or sculptures or places I'd go and visit; I'd be more encouraged to visit and sort of have a look into the history behind it". When she was asked whether she had expected her results, she said,

Um not really, I thought maybe I'd have a bit of Italian in me because I really love Italian food. I was sort of hoping I had a bit of Italian in me. No Italian; strong ancestors relating back to London. And I was surprised about the amount of like, Polynesian I had in me [due to her appearance].

However, HD said she still wanted to go to Italy.

AV indicated she wanted to see if her interest in Latin and Asian culture was related to her DNA, so when she was asked whether she would have been happy if she found out she was part Brazilian, she said,

It would have been cool to see that perhaps my interest in Asian or Latin culture came from my ancestors and my genetics. But in a way it's cool to see that I'm very European, but that perhaps is the, you know, like it's the environment that's kind of shaped me to have an interest in other cultures. Yeah. So no, I would probably be just as happy.

She did add that it "was very cool to see that I have ancestors from Lithuania", and that it was close to Scandinavia, which she visited during her exchange the year prior to the interview. She felt "not at home, but I felt, very easy and very calm there [in Scandinavia], which was nice".

AD identified with his religious community. In discussing his identity, he stated that the majority of Muslims in his area (of current residence) were of South Asian descent, mostly Indo-Fijians, which is why he thought it was easier for him to integrate when he converted to Islam. The DNA test confirmed his Indian and British ancestry, explaining that he found it “easier because my mother’s family originally come from India”. He believed that although he and his mother were not born there,

I actually believe that ancestry itself has a direct influence on how a person lives, that's my opinion. It's not just something to be interested in, or something simply to identify with.

After confirmation of her Polynesian ethnicity estimate, HD elaborated:

I think it has strengthened the sort of like, assurance and importance of Pasifika and Māori viewpoints. You know, it's given me sort of a different viewpoint when I hear like stories about that stuff on the news.

Similarly, when asked if the DNA test affected her identity in any other ways, RG expressed she would have liked to see more diversity in her ethnicity estimates. She said that she was extremely European and had nothing else in her. She said,

So that kind of also fed into the I'm yeah, like I don't know anything about any other cultures, where they've come from or, you know, struggles that they potentially had, because here's the lady who's totally European.

KB and BD both had unexpected results which caused them to renavigate where they belonged. Both learned that their biological relatives were not who they thought. KB recounted that during her childhood, one story captured her sense of lack of belonging and connection very well. She had noticed growing up that she “didn’t look like anybody in my family”, and she remembered a story of her grandmother on her father’s side (who was later shown not to be the biological father) having had “a few too many drinks” at a party and telling KB her father was “the man who owns the pub in town”. She said, “it scared me” and she talked to her father, who said that it was just because the grandmother did not get along with KB’s mother.

But her feelings of not quite belonging were reiterated much later when KB's partner met her father's side of the family and asked whether she was adopted. The DNA test provided no DNA matches with her father's family. When she was contacted later by a woman writing a family book about their Aboriginal family, the woman explained the results and that she did not match her father's family. KB then looked back on multiple occasions where it seemed odd that she was left out of family gatherings. But after connecting with her biological family, she felt connected to another family and was now in contact with some relatives from that side of the family.

Discussing perceptions of her identity after receiving her DNA test results, KB mentioned she did not feel Jewish although her biological family had Ashkenazi Jewish ethnicity estimates. She had met this "new side" of her family (from her newfound biological father's side), and when they asked whether she was interested in learning more about the Jewish religion, she promptly replied, "No". She mused that "And now we've [she and her newfound biological half-sister] got this whole other Jewish family".

But this communication is not successful for everyone. After the paternity test, BW tried to reconnect with his biological son many times, "I've tried through social media and everything over the years to try to get hold of him, but it hasn't worked out for me". When asked if he would take any further steps, he said,

At this point in time no, I've got a young family now that I'm spending most of my time with. I've always got the door open, waiting for that day to come, but I'm letting him live his life, basically.

BD, who was still looking for her biological grandparents, recounted how she had felt when she was told about her mother's adoption. She was angry when she found her grandparents were not who she thought they were. She explained that she "rejected them" and "was angry with them".

I love my grandparents, and I think that's why I was so broken-hearted when I found out that they weren't really mine.

Once these feelings subsided, she had to “juggle” that they still felt like her grandparents. She explained that after her mother said she [her mother] was adopted, she wanted to know where she belonged and had been doing genealogy research ever since. She now knew her biological grandmother is likely one of two women who lived in the same place and who had almost identical names. Though she had been trying to contact her biological relatives, those with DNA matches had not responded or were unaware of the connection. So, at the time of the interview, she was not able to confirm the facts and find a sense of belonging. She mentioned, however, that she felt she belonged to her genealogist group and that the DNA test had helped facilitate discoveries and discussions within that group,

Now that I’m retired, I belong to two or three groups. And it’s great to be around the same kind of people [genealogist group] and we get all excited if we find something during the week and we can’t wait to tell each other and sometimes you go weeks without anything to say, so yes, it’s fantastic.

4.8 National Pride

SB expressed the DNA test results confirmed her feelings of national pride, whereas DJ’s DNA test results created a new-found national pride by linking his DNA to a Scottish national identity. AV expressed pride in her European ethnicity estimates.

SB had a very strong feeling about her identity as a New Zealander with her forebears having arrived in Nelson, New Zealand, in 1840. Her family had told her they had come from England (specifically Yorkshire), Ireland and Scotland, which was corroborated by her DNA test results.

DJ articulated that after receiving his DNA test results for his Y-DNA (paternal haplogroup) he now identified as a Scotsman (after his paternal lineage and his genealogical research had connected him to Scotland). When asked whether he no longer identified as a New Zealander but rather as a Scotsman, he responded with:

You know what, I do. It's changed my life; it's changed my perception. It's given me my heart; it's given me pride. Look, it was lovely being a Kiwi, but I always knew we came from somewhere else. We’re such a young nation, with young history [...] I've also got one of the oldest clans in Scotland that I can say that I'm part of, so that's really important.

It's impacted me immensely because a quarter of who I thought I was I'm not and it's a very it's an odd sensation; it's an odd feeling in not knowing now.

CR also mentioned that consequently when she sees her mother's maiden name she gets "a different kind of feeling". She was surprised how much it impacted her and who she believed she was. Her whole Manchester, England, family line was no longer what she thought it was.

When KB learned her biological father was someone different, she went to meet him, her biological grandmother and some cousins, whom she described as "really nice". She consequently met her biological father's two children and developed a good relationship with the one. She had been looking to meet more of her paternal family in her local area after a new high DNA match had come up, which she originally thought was a first cousin. But this woman was another half-sister on her paternal side. Her half-sister's parents denied the validity of test and did not acknowledge the results. They told her half-sister to tell the family it was not true. KB was helping her half-sister understand the biological connection and share her own journey.

Similarly, based on a DNA match a couple of years ago and the lack of matches with cousins from her paternal side, JG had learned her biological father was not who she thought. She matched with a lady who would have been her half great niece. JG said,

And as I don't have any siblings, I don't have any nieces and nephews. So, in looking at it and working through, I realised that that there had to be a problem with my birth father.

She described this as "completely and absolutely, and utterly unexpected". Furthermore, she had endeavoured to find out who her biological father was, eventually connecting him to the local gynaecologist in the town she was born in. She described the place (a house that had been converted into a surgery and waiting rooms), and that he was a "a pioneer in gynaecology and women's reproductive systems. And [it was] very well known that the women of Wagga thought he was just wonderful. I don't know what that might mean". She contemplated the circumstances, and said her mother's husband "was the town

clerk, so he had a position to uphold in Wagga” but also mentioned her mother telling her a story about where she [the mother] bred English Springer Spaniels and talked to a man who bred cows. He suggested a mixture of disinfectant and water before mating to help conceive and JG questioned whether “she said 'I said to myself, if it's good enough for the cows is good enough for me', and she got the disinfectant and here I am”.

4.10 Cultural Affinity

Multiple participants expressed feeling connected to their cultural identity, which was either based on their interest, a connection that was reinforced by their DNA results (HD, AV), or new ethnicity estimates that linked them to a culture known in these areas (CH). Alternatively, one participant questioned her current cultural identity (RG).

HD and her brother grew up as “Kiwi kids” and “both our parents who are New Zealanders who were born in New Zealand, and I believe their parents were also. So, they didn't really know much about where they were from; only that they had a strong sense of European in them and European ancestors”. DNA confirmed her ethnicity estimates and she “found out that I am 62% from England, Wales and Northern Europe, 25% Irish and Scottish and 13% Polynesian, which includes Tongan, Samoan and Hawaiian”. She was already aware that her maternal grandmother was Māori and she was just learning more about it. Growing up in a high school where there were a lot of cultural groups, she felt if she had been part of another culture she would have been “more encouraged to join the group knowing that I have it in me”. Now she could confirm her grandmother’s Māori heritage (from the Polynesian ethnicity estimate).

When asked about a story that resonated with her identity, AV said, “I was born in Russia and we moved to New Zealand when I was six years old. So, I've been here for around nearly sixteen years, but I still feel very Russian”. She said they only spoke Russian at home but she felt little parts of “Kiwi culture” in her and also felt she resonated with different parts of the world. She had a lot of Latin and Asian friends, did Latin dancing like bachata and learned Chinese for seven years: “I kind

of feel very, very multicultural”. Her test results reinforced her Russian connection but not the Latin and Asian cultural interests.

CH’s newfound Korean ethnicity estimates made her “feel like I’m able to be part of this culture as well”, but she did not know whether it had anything to do with her DNA. However, RG had expected only Irish ethnicity estimates, “I was really mad. Because like, my results came back and instead it said, you're like 77% Irish and I was going that's really high”. As the results updated on Ancestry.com, her Irish percentage kept decreasing: “It’s making me angry because it’s almost like an identity crisis”. She felt “angry slash sad” when she saw the Irish decrease. She added,

they're back on the upswing now. But it was almost like, I wanted to say they were lying to me, but it's scientific. They're not lying to me. But you kind of feel like your whole childhood in the way that you were brought up is like wrong, but it's not wrong. That was the most recent heritage. Most Irish maybe 100 years back that wasn't with us, but my parents wouldn't have known that you know. So it was, yeah, it was a lot of different emotions, I think.

4.11 Seeking Answers

Participants who had unexpected information because of their DNA tests detailed that they wanted answers and truth about where they had come from, specifically about their parents or grandparents. These participants included CR, KB, and BD.

CR had felt angry when she found out her biological grandfather was not who she thought. She said, “I feel like I’ve been robbed of cousins, and I’ve been robbed of aunts and uncles”. As her dad was an only child and her mum only had a sister, she thought she could have missed out spending time with “this whole family I never got to know and I still don’t know. How do I build that connection now?”. She also wondered whether she had worked with biological family members and how much family life she had missed. She explained that she could not get answers from the grandparents because they had died. DNA matches had not been helpful and could not connect her to her biological grandfather. She said, “I don’t want to wreck people’s lives”. In attempt to find answers, she had tried to approach geneticists and genealogists for help, and even though the matches were high and close, they have not been able to find the answers either. She said she did not feel “lost, but

results and their effect on individuals' perceptions of their identities (for instance, [4.2 Family Belonging](#) and [4.10 Cultural Affinity](#)).

DNA matches, and for AD, his religious community. By feeling belonging to a group, participants expressed 'social identity', which is influenced by membership of a group (Coulmas, 2019). This aligns with Jenkins (2014), who claimed that social identity is how an individual chooses to identify themselves as, depending on the context of their situation and interaction with others. Essentially their social identity can be whichever 'identities' they choose to align with. This is reflected in participants' perspectives in this research, where their 'social identity' can manifest as varied forms of identity.

When discussing their DNA test results, multiple participants expressed wanting to feel they belonged to a group and to foster communication with, for example, newfound family members. HD received confirmation of her Māori ancestry through her Polynesian ethnicity estimate. HD had wanted a connection to another group so she could have felt more involved in cultural groups during her time in high school. She also wanted confirmation to "strengthen the sort of like, assurance and importance of Pasifika and Māori viewpoints", where she felt valued and able to comment on issues directly related to her. HD's perspective is similar to how people strive to be themselves, gravitating towards situations they see as fitting them and distancing themselves from situations they may feel alienated from (Schmader & Sedikides, 2018). Similarly, RG expressed she would have liked more diversity to be reflected in her ethnicity estimates. She wanted the feeling of belonging to another group (based on her ethnicity estimates) to be able to foster her communication about different viewpoints, where her perspective could be valued when commenting on social issues. It is clear that there was some desire for a DNA connection to validate participants' opinions and viewpoints, allowing for more social commentary. Through expressing a desire for diversity and diverse genetic make-up, participants demonstrated their want to belong to different groups. A DNA test can help achieve this, which demonstrates the effect that DNA testing can have on participants' perceptions of their identities.

Comparatively, KB felt she did not belong to a group and was searching for ways to foster communication with groups she wanted to belong to. KB recounted a family story where she noticed that she did not look like others in her family and her grandmother's comments about her father being the local pub owner "scared" her.

Through this story, KB expressed a lack of belonging, where she did not feel accepted. She looked back on multiple occasions where she was left out of family gatherings. These stories expressed not having valued involvement with a group (Ahnallen et al., 2006; Schmader & Sedikides, 2018).

After her DNA results and further searching revealed her biological father was the local pub owner, KB endeavoured to get in touch with him and his side of the family. Essentially, she had to renavigate to which group she felt she belonged and where she was valued. She described that prior to the DNA test, she felt a lack of belonging to the family she was raised in, and her relationships and communication seemed to reaffirm the lack of belonging to the group. After finding her biological family, she felt connected to them and was now in communication with those members of the family, feeling valued and accepted, thereby accepting her DNA results and her new family identity. However, she rejected belonging to the Jewish community, and thus rejected certain aspects of her DNA test results. By selectively rejecting or accepting certain aspects, DNA tests can clearly change perceptions of one's identity, but not necessarily every aspect. KB did not accept her Ashkenazi Jewish DNA and did not identify with the Jewish community, but she did align with her newfound biological family. Although KB was able to find a sense of belonging through communication with DNA matches, BW and BD were still searching for group belonging through attempting to establish communication with their biological family members.

BW had tried to get in contact with his biological son for over 20 years, but was now leaving it to his son to get into contact with him. BD's search for further communication allowed her to make contact with some DNA matches, but she had not been able to get in touch with DNA matches who could help confirm her belonging to her biological family group. Her identity renavigation was completely unexpected. BD had been using her DNA test results in her search for answers about her biological grandparents.

BD elucidated how she felt in relation to finding out she was not who she thought she was. She said that after she learned her biological grandparents were not who she thought they were, she "rejected them" and "was angry with them".

By rejecting them, and feeling angry and broken-hearted, she had to renegotiate her personal identity and her belonging by finding acceptance in the new environment, knowing her grandparents were not biologically related to her. This response by BD confirms that personal identity is developed through negotiating and renegotiating their place in relation to the situation (Coulmas, 2019; Zolfaghari et al., 2016). As part of BD renegotiating her personal identity, there was also the added aspect of realigning to the new situation and the importance of these relationships. This shows the value of relationships for identity development, especially in a familial group.

As in the case of BD, all of the participants who discussed group belonging, described their DNA results as a tool to help facilitate communication and learn more about themselves and their identities. DNA test results helped solidify their feelings of belonging to a group or rather, they were continuing to use the test results as a tool to try and foster communication. Only for BW did his test reinforce his biological connection to his son, but not to get directly in touch with him.

Fostering communication was integral to affecting participants' perceptions of their identities and the way they socially constructed who they thought they were. Therefore, communication either reinforced their perception of their identities or highlighted their attempt to renegotiate their individual identities and their feelings of belonging to the group they identified with.

5.2.1 DNA Reinforcing/Contradicting Family Identity Claims

With respect to group belonging, there are different socially constructed groups. Although communication was used to foster their group belonging, participants also frequently mentioned their feelings of belonging to a family. Therefore, family is one of these socially constructed groups and the feeling of belonging to this group was evident in participants' perceptions of their DNA results. Participants exhibited a change in perception of their family identity, or in some cases had adopted multiple family identities due to their DNA results being different to their family identity claims.

CR further questioned what her biological family would be like, comparing herself to the two families and looking for potential similarities, thereby separating two potential familial identities. This participant's perception of their family identity has some semblance with social comparison, another dimension of social identity theory. This dimension refers to categorising and identifying with a group and comparing their group to other groups, usually relational (McLeod, 2019; Tajfel & Turner, 1979). In this case, CR described her membership of her biological family and the family that raised her as having membership of two different groups – one through a biological sense, and the other in what she had believed to be her family identity. In doing so, she has socially compared herself, redefined her group belonging, and has associated herself with two distinct family groups.

Furthermore, CR used the term “love” in aligning herself with the family she was raised in and feeling a sense of belonging, which is much like NH described feelings of belonging when asking her grandmother questions about their relations and RG talking about her uncles playing the fiddle and going to barn dances while growing up. These participants associated themselves to a family group and their positive shared experiences, describing the relational element that made them feel included and part of the family. This is similar to achieving satisfactory group identification, which can be described as a sense of belonging formed by group identities that are relational and that include peers and exclude others (Coulmas, 2019). Walker (2015) also described love as having a crucial role in “a sense of safety and belonging” (p. 102). Although, Walker's (2015) research focused on child adoptees, the feeling of belonging to a family is extremely relevant to these participants' perceptions of their identity and reflects that belonging is often intertwined with strong emotions – in this case positive emotions.

It is evident that relationships are reflected on by these participants, conforming to families having their own group boundaries and identity. Soliz and Harwood (2006) described families as having ‘intergroup’ and ‘intragroup’ relationships, where family members share an inherent ingroup for all members but also have individual identities showing intragroup boundaries within the family. The difference lies in the separating familial identities and where inclusion allows for belonging within group boundaries. Thus, participants' positive emotive affiliations reinforce their

family belonging and the relationships within each family group. Participants' narratives demonstrate that they looked for inclusion in order to retain separate identities or place more value on their biological identity. When this inclusion is disrupted, as was the case for certain participants after learning their DNA test results, their sense of identity is affected.

For example, BD had identified with the English side of her family until her mother told her that she [the mother] was adopted. BD recounted that she was "horrified" because she loved her grandparents. This demonstrates another dimension in social identity theory, namely social identification. Social identification occurs when individuals adopt the identity of the group they have categorised themselves as belonging to, confirming to the norms of the group and attaching an emotional significance to their identification with the group (McLeod, 2019). This dimension also provides a reference for an individual to create and define their place in society (Tajfel & Turner, 1979). Therefore, with participants attaching emotional significance to their identification with their social (and familial) identities, unexpected information like that shown by CR and BD can change perspectives and the way they identify themselves. This may lead to feelings of exclusion from their perceived family groups.

Although DNA test results can cause this drastic change of social and familial identities, DNA matches also allowed these participants to try get in contact with those who could help them find more information, allowing for inclusion and a sense of belonging within their family. These matches can mitigate the effect of an identity crisis by providing answers and support. CR and BD expressed "love" for their family members, suggesting strong emotional attachment and thus it was a greater shock finding out their biological identity did not match their perceived family identity. However, JG also experienced misalignment of these identities, but said the results and new information about her biological father being not who she thought did not affect her. She said she loved the family she grew up in and was still happy to be in contact with them, showing that different participants articulated varied impacts on their identities. A positive emotional significance can reinforce family belonging by fostering relationships and strengthening family identities.

However, it can also cause re-evaluation of this identity and individuals' belonging within the group.

Based on the participants responses it can be argued that notions of family are shifting and cannot be clearly outlined as LEXICO's (2020) dictionary definition attempts to do. Similar to Isensee's (2015) claim that notions of family have come under more scrutiny in recent years where family was usually defined within the nuclear family dynamic (consisting of married parents and their biological or adopted children). Family is socially constructed and participants' have varied perceptions on what constitutes as their family. This family may be living as a unit but not necessarily that of "one of more parents and their children" (LEXICO, 2020, para. 1) or even the descendants of a common ancestor. Although in some cases, like that of CR, BD, and JG, participants may have lived in a family unit when DNA test results revealed that the family they thought they belonged to was not fully biologically connected. Nevertheless, they still associated this unit with one of their family identities. This reframing of their individual perceptions of their family identities conforms with claims from authors such as Stallard and de Groot (2020, p. 289) who stated that DNA test results:

can be disruptive, and often individuals are resistant to redefining the family group. In the case of special groups like adoptees, those with unknown parents, those with half-sibs and stepsiblings, new information can shatter the model of family identity that had been built up for many years.

With genetic testing revealing DNA matches that increase when more biological relatives take the test, people who test in the future may also have unexpected results, forcing them to renegotiate their family identities. These test results may increase their feeling of inclusion and therefore feeling a sense of belonging to their family, or they may feel excluded and look for answers. They may even feel a certain degree of belonging to both their biological relatives and the family they grew up with, changing their perception of their family[ies] and what constitutes as their family identity[ies], as was voiced by these participants.

their perspectives of group belonging with their test results, aligning themselves to their ethnicity estimates, and religious or cultural groups (as discussed earlier in this chapter). Thus, relationships seem to be a fundamental aspect resonating with varied social groups, including family, allowing for the feeling of belonging. The degree to which people perceive themselves as part of an in-group and have a family and shared relational culture is important, thereby marking their identification with the group (Soliz & Rittenour, 2012, as cited in Colaner et al., 2018). As Soliz et al.'s (2009) intergroup research found, there were benefits to individuals forming a cohesive shared family identity because it facilitated a shared belonging within a family.

Participants' questioning of their shared family identity resulted in more questions about themselves as individuals, as was the case with CR and BD. Without having these answers about themselves, participants used further emotive words to describe their feelings of emptiness. CR felt "vacant" and said, "we [she and her mother] feel like we're in limbo". KB and BD also expressed a shift of perception of who they thought they were and wanted answers. BD articulated a similar sense of emptiness as CR, but was able to find partial answers as she had met her biological grandfather's family although she was still searching for her biological grandmother's identity. These participants wanted truthful answers in order to understand their own place within the family and their individual identities, to find out where they came from as well as relationships and connection to their parents/grandparents. This was much like how Stallard and de Groot (2020) described those who were searching for parents or grandparents (like BD who was looking for her birth grandfather) used DNA tests to "discover results that could significantly reconfigure their familial identity and relationships" (p. 287). These findings highlighted the importance of familial relationships to determine one's belonging and the role of DNA testing to help achieve this.

Having strong relationships with their parents and grandparents resembles Soliz and Harwood's (2006) study on shared family identity. Their study specifically focused on the grandparent and grandchild relationship and showed "personal communication emerged as a strong influential factor in perceptions of shared family identity across all grandparents" (p. 100). Therefore, a strong relationship

with one's grandparents, and in this case, also one's parents, participants' self-identities were likely to have had a more substantial shift where they had to realign their perceived shared family identity. Again, these findings reinforce the importance of relationships and feelings (affective understanding) as part of belonging (Wood and Black, 2016, as cited in Turner, 2019).

5.2.3 Shared Family Identity Through Affective Associations of Genealogy

Shared family identity and belonging was detailed through a historical lens, whereby 'genealogy' and 'ancestry' were used interchangeably when participants referred to their family background. Participants referred to their connections to their ancestors, which created self-perceptions and prompted more interest into how the ethnicity estimates connected them to ancestors and their ethnic identity.

CH was "shocked" her results were not fully Chinese, and her mother was unaware they had family history connecting them "with the Korean people". CH did feel encouraged to look at her ancestry and it gave her "the chance to re-think about my origins and think about my ancestry family". Feeling more encouraged to investigate her ancestry and focusing on her Korean ethnic ancestry is in line with how Kramer (2015) claimed ancestry creates a sense of belonging, producing connectedness to geographical areas, ancestors and categorisations of ethnic identity. Although she still felt primarily Chinese, the unexpected ethnicity estimate allowed her to feel potentially connected to another ethnic group, thereby spanning ethnic boundaries. Chandra (2006) defined ethnic identity as a subset of identity categories whereby attributes of being a 'member' of that group is usually associated with one's descent. This demonstrates how DNA test results can potentially break ethnic barriers, showing that individuals are not necessarily one ethnicity.

For some, DNA testing can help achieve identifying their shared ancestral identity through further genealogical research. For example, AM, DJ, CR, NH, JC, BD and JG were actively doing genealogical research to find their origins using DNA test results to connect with biological relatives. There was also an association between their genealogy connecting them to a group with a shared family identity and history. For instance, DJ mentioned using his DNA (from his Y-DNA paternal test) alongside his

genealogical work to eventually connecting his 'snip' (as a result of the DNA test) to support his research and giving him "a clan with some really good Scottish history". According to Chandra (2006), descent is usually linked with genetically acquired attributes, cultural and historical inheritance, or lifetime inheritance markers, such as one's last name. DJ aligned his paternal lineage with cultural and historical inheritance, but assumed this identity only after receiving his DNA test results and connecting them to the clan, feeling "accepted into the clan" based on his DNA and the clan accepting his membership through his paternal connection. By having a connection, he was welcomed into the clan and their traditions, thereby encompassing feelings of belonging and commitment to a group, focused on ethnic knowledge and behaviours (Umaña-Taylor, 2015; van Bochove et al., 2015).

DJ's feeling of connection and self-identification through his genealogical research and DNA test results adheres to Bernal et al.'s (1990, as cited in Umaña-Taylor, 2015) conceptual model of ethnic identity development. In this model, ethnic identity is associated with self-identification choices, knowledge of the ethnic group, and positive feelings and preferences toward the behaviours and traditions within the ethnic group (Bernal et al., 1990, as cited in Umaña-Taylor, 2015). Self-identification choices are important, as identity is continuously changing throughout one's life (Erikson, 1968, as cited in Umaña-Taylor, 2015). These self-identification choices and positive associations with behaviours and traditions strengthen one's ethnic identity, as in the case of DJ.

AD's ethnic identity association also shows identification with and knowledge about his Anglo-Indian ancestry, but the connection of belonging is focused on negative feelings, rather than positive. This is evident in his description: "if you have ancestry going back to the colonisers and the colonised, they can develop a very specific brand of self-loathing". By experiencing belonging to shared history, these can reinforce positive or negative ethnic identity associations as was apparent by the contrasting perceptions of participants. Research looking at the Anglo-South Asia links during the time of 'The British Raj' showed that alongside their ethnic identities there were also positive associations where individuals held multiple cultural identities based on their current sociocultural interactions (Dey et al.,

2017), thus, showing the importance of sociocultural perceptions, interactions and narratives to maintain or alter their identities.

AM described that she knew being “of mixed heritage [...] My mother's Māori and my father is Pākehā so many people can't tell that I'm part Māori”. Like AD, she associated her family history with her ethnicity estimates but she found it quite annoying when people did not believe she was of mixed heritage (her test confirmed she was 50% Polynesian and 50% European). She liked that her heritage was confirmed by her DNA test results, which subsequently confirmed her belonging to her ethnic and family identities through genealogy. This is similar to how van Bochove et al. (2015) outlined ethnic identity, namely “as a self-definition [that] should be distinguished from ethnic identity as a feeling of belonging, because individuals who use a given ethnic label may vary widely in their sense of belonging to their ethnic group” (p. 654). In this case, the DNA results confirmed her self-identified ethnic labels, providing confirmation of her sense of self, as described by the fact she felt she “knew” and “sure enough” her DNA test came back with the expected results. This is also in line with Callister and Didham’s (2009) assertion that “there are a variety of factors that influence how people construct their ethnic identity, many of them having some biological basis” (p. 73). In the case of DNA results, some choose to identify with the DNA test results that provide ethnicity estimate labels, whereas others dismiss them.

5.2.4 Identity Associations Through Family Stories

In this research, participants were asked to tell a story that resonated with their identity. Some participants recounted narratives their DNA helped discover, confirm, or that made them question their family belonging. In some instances, participants shared personal narratives in reference to their own beliefs and personal identity.

DD talked about her personal story, aligning her family stories to that of her own. In this story she described her drive to run a marathon after an upsetting experience and how this translated to who she was: “Once I make my mind up, I'm going to do something so yep, that's sort of my identity [...] I am quite determined”. She said that if she had received different ethnicity estimates from her DNA test, it would

not have changed her because she was “happy” with who she was. Her confidence and self-perception of being determined reflect Izenberg’s (2016) dimensions that shape a personal identity, including the bodily self, relational self and the reflective self. By linking her personal story to her family (she discussed family members supporting her when she ran the marathon) and her sense of self, she established that she knew who she was and that the DNA test results would not have changed this sense of identity. Her story contrasted with the majority of participants whose identities were impacted by the DNA test results.

Other participants referred to their family stories shaping who they are, with this being affected by their DNA test results. CR’s identity story was centred on “the perspective of family history”. She talked about growing up in her family and being interested in history, discussing family history with relatives. DJ also associated identity with an interest in family history. He talked about his grandmother’s side of the family who were Irish and who clung to a story about a family member becoming a heavyweight boxing world champion. Additionally, his grandmother talked about their family coming from London, but through his haplogroup (Y-DNA) testing and genealogy research, he found they were Scottish. Consequently, he started identifying being part of a Scottish family and clan. CR and DJ’s stories confirm Elliot and Brodwin’s (2002) claim that genetic testing can disrupt identity claims. CR’s unexpected results, for example, disrupted some of the family narratives she had grown up with as these stories no longer held a biological connection for her. Instead, the results allowed her to foster two familial identities. In contrast, DJ was interested in learning new family stories associated to his newfound Scottish results and he felt connected to this new group identity.

AM retained her identity as her DNA results helped her confirm her family stories and learning a new story about an English ancestor on her mother’s side who ended up on a boat to New Zealand, living in various Māori settlements and travelling between whaling stations until he ran away with the slave wife of a Māori chief. The DNA test results allowed her to connect to relatives who had done further research and confirmed they had the same story, thereby corroborating her claims rather than disrupting them. Despite DNA test results potentially disrupting identity claims, they can also corroborate these claims confirming origin stories, family

genetic isolation, other effects (including random ones), and heredity” (Schneider et al., 2019, p. 877). These differences are also evident through appearance as described by participants. These genetic differences affecting individuals’ appearances create in-groups and out-groups, where participants feel belonging by looking or acting like one another.

CH associated her newfound Korean ethnicity estimates with her appearance and the wider biogeographic region. Prior to receiving the ethnicity estimates, CH had moved to Korea and had been told she looked Korean, which she described as an “interesting coincidence”. She wondered if sub-consciously there was a connection that prompted her to move to Korea and redefine her connection to another ethnic identity. This connection through appearance embodies biogeographic ancestry, whereby the features inherited from biological ancestors show different regions of origin and the further apart, the more genetic differences between them (Schneider et al., 2019). Remarkably, despite CH feeling her results did not have a substantial impact on her, she reflected deeply on her personal identity and the potential group identity through shared biogeographic ancestry. This reinforced Bernath’s (2015) assertion that in the last twenty years DNA has become synonymous with identity, creating strong links between social identity and biological identity. She stated that in people’s collective unconscious people’s biological side is “a matter of great significance in our society” (Bernath, 2015, p. 35).

For participants, like KB, sharing appearance helped them feel more connected to their biological families and connect to her biological father. This likeness through biographic ancestry is present in ancestry-informative DNA markers. These markers are found in groups from particular geographic regions which are passed down through one’s DNA and can help predict traits such as eye or hair colour (Schneider et al., 2019). Likeness created through these ancestry-informative DNA markers combined with their DNA test results affected participants’ perceptions of their identities, allowing them to feel more connected through physical likeness. In KB’s case, it allowed for her to align her biological identity and separating her family identities. Prior to the DNA test, she felt she did not quite look like anyone else in the family, and so, this realisation helped elucidate why she felt she did not belong. Ahnallen et al. (2006) described that a lack of commonality of physical features with

unrelated to biological relationships. However, SB did have an interest in the Vikings and a potential family history she was unaware of after receiving 20% Scandinavian. While this fostered an interest to belong to that group it did not change her feelings of belonging in New Zealand.

CH's Korean ethnicity estimates linked her to Korea where she moved to before being aware of her results but at the time of the interview, she did not identify belonging to Korea as a place. In contrast, DJ felt accepted into his Scottish clan. He linked his feelings of attachment to the place to his paternal haplogroup, connecting him as a key member of the clan (as he has more DNA connecting to his progenitor than other members who share the clan name). By referring to "making history", he elucidated his active involvement in the clan, reinforcing his connection to Scotland. He specifically mentioned feeling connected to his heritage when visiting a cathedral in Scotland going back to his family roots. These experiences are in line with Wood and Black's (2018) assertion that place attachment is created through feelings and experiences. DNA test results can allow for a link to be found and an attachment to be formed, but it would depend entirely on whether the person would identify with their results as many participants did. This did not mean, however, that participants identified with a place as their 'home', rather, that they felt comfortable there. HD's confirmation to her ancestry and connection to New Zealand, had made her feel "more encouraged to visit and sort of have a look into the history behind it [mural or sculptures connected to her ancestry]", while AV was able to see her ethnicity estimates showing a connection to Lithuania. She associated Lithuania with being close to Scandinavia where she felt very calm when she visited it during her study exchange.

Furthermore, HD and AV expressed a desire for their ethnicity estimates to reflect areas they felt extremely interested in or connected to in some way. HD wanted her results to reflect some Italian, but instead her DNA reinforced "strong ancestors related back to London". She was also surprised to learn her Polynesian was higher than she thought (based on her appearance). This was similar to AV who wanted some of her interest in Latin or Asian culture to be from her ancestors or genetics. She said she was still happy, and found it "cool to see that I'm very European, but perhaps is the, you know, like it's the environment that's kind of shaped to have an

interest in other cultures". Both connected their feelings of place belonging to their social identities, wanting their DNA to reflect the group they felt an inherent interest in. Therefore, they would then be able to confirm their curiosity through a biological connection. Social identity is how one fits into a group and their membership to this group (commonly associated to one's ethnic identity) (Coulmas, 2019). HD's and AV's stories demonstrate how DNA reinforces individuals' feeling of connection to places, but their stories also support the idea that identities and interests to places are not always connected through ethnicity estimates. Rather, they detailed desire for there to be a link, wanting their DNA results to be synonymous with their feeling of connection.

Little research has been done on people's feeling of belonging to the land of their ancestors or feeling connected to a land to which one has no clear biological connection³⁶. As discussed, DNA test results either confirmed participants' feeling of having a connection to a place or demonstrated that the connection was based on their own beliefs rather than being biologically based. Participants' stories demonstrated similar qualities of belonging to a place than belonging to a group or family. They aligned themselves to the environment they felt was most authentic, and where the values associated with their identity were validated, which is in line with Schmader and Sedikides's (2018) assertion. By aligning themselves to an environment they felt was authentic to their identities, participants link their feeling of place belonging to aspects of their heritage.

5.3.1 National Identity Through Place Connection

Closely associated with participants' feeling of place belonging is their affiliation with a specific nation and national pride. DNA test results either reinforced participants' national identity or, alternatively, the results allowed them to find new

³⁶ There have been a few recent studies about place belonging but these been focused on different areas of study and do not sufficiently explain participants' understanding of belonging to a place. For instance, Nic Craith (2012) wrote about belonging, cultural patterns and body language through language in a cultural context, Den Boer (2015) wrote about the relationship between people and place in refugee studies, and Torres (2020) wrote about place, belonging and exclusion of older adults facing neighbourhood change.

HD talked about how she and her brother grew as “Kiwi kids”, not knowing much about where they were from, but that they were aware of European and Māori ancestry. This was confirmed through her ethnicity estimates and her associating her ethnicity estimates to feeling part of a culture. This perception of cultural identity is similar to findings from Holliday’s (2010) study in which participants associated their cultural identities to a variety of factors, including family history and community. Community was shown to be an influential factor for HD when she described her interest in other cultural groups during her high school experience prior to receiving her DNA test results.

While growing up, HD said there were a lot of cultural groups, and she felt if she were part of another culture she would “be more encouraged to join the group knowing that I have it in me”. By stating “knowing that I have it in me”, she implied that a biological connection, like ethnicity estimates, would encourage her to feel more involved with a particular culture. Through the confirmation of her grandmother’s Māori heritage (from her Polynesian ethnicity estimate), her biological connection was reaffirmed and she felt she could learn more about the culture because it was her own. Expressing that a biological connection would reinforce her feelings of connectedness to another culture is in line with how Overmier (1990, as cited in Ahnallen et al., 2006) theorised that having a sense of belonging and importance of belonging within a social network are crucial in forming and maintaining one’s self-identity in adolescence and adulthood. This is further shown by CH, whose newfound Korean ethnicity estimates made her “feel like I’m able to be part of this culture as well”. DNA test results have affected their perceptions of their identities, legitimising their exploration of cultures and making them feel more inclined to explore alternative cultural identities as part of their sense of self.

AV’s story that resonated with her identity was about how she was born in Russia and moved to New Zealand at the age of six. She said she still felt Russian, but she also felt a little part of “Kiwi culture” in her. She added that she resonated with different parts of the world through Latin dance, her multicultural friends, and that she learned Chinese for seven years. She said “I kind of feel very, very multicultural”. In this sense, AV can be seen as inexplicitly expressing ‘hyphenated

cultural identity', where an individual can integrate multiple and distinct social identities, namely their ethnic and national identities that are both important to their sense of self (Chu et al., 2017).

AV had validated her Russian identity: "I still feel very Russian" and "We only speak Russian at home". She retained her cultural identity through her DNA test results, but she also associated her interest in different cultures with making her feel multicultural. This is similar to Lawton and Foeman's (2017) description that younger participants in their research had a desire for their DNA tests results to have a strong multicultural base; they wanted to be everything. Thus, these participants held multiple cultural identities and, as mentioned by Samovar et al. (2007), cultural socialisation and exposure to varied cultures can affect one's personal identity development. AV's exposure to various cultures allowed her to create positive cultural associations and hold multiple cultural identities based on her sociocultural interactions, which is in line with findings from Dey et al.'s (2017) research.

Other participants, such as RG, also had positive associations with the culture she grew up in and expected her ethnicity estimates to reflect this. She expected to be fully Irish, and initially, her ethnicity estimates showed she was 77% Irish. However, with ongoing updates, the Irish percentage kept decreasing. She said, "It's making me angry because it's almost like an identity crisis" and she voiced a sudden disturbance in her sense of self and how she socially identified, which has the potential to lead to an identity crisis. DNA test results are continually updating as more people are tested. As a result of this dynamic and changing nature of current DNA test results, these tests can have ongoing disturbances to individuals' identities.

An identity crisis is defined as disturbances to the self while it is being established during adolescent years (Coulmas, 2019; Fearon, 1999; Harvard University, 2020; Izenberg, 2016). Disturbances to an established sense of self is likely having a greater impact. RG concurrently mixed and matched her racial and cultural identities. Her DNA test results influenced her identity narrative but did not change her perspective due to her lived experience of culture, which is much like Lawton

description, she identified her belonging through comparison with other familial groups. This conforms with social comparison, categorising herself as part of the group and no longer feeling part of this group (McLeod, 2019; Tajfel & Turner, 1979).

Despite being an adult, CR also expressed genealogical bewilderment, which can be described as “potential identity problems that can be experienced by a child who has been separated from her birth parents” (Walker, 2015, p. 93). Genealogical bewilderment may include questions about who one is and where one belongs (Walker, 2015), much like CR’s feelings of not knowing a quarter of who she thought she was, thus associating her personal identity with her family lineage. Similarly, KB also experienced genealogical bewilderment. She connected with new biological family members after coming to terms with her unexpected results, finding another half-sister on her paternal side although her biological half-sister’s parents denied the validity of the test. Her experience conformed to Stallard and de Groot’s (2020) assertion that those receiving DNA test results can be resistant to having to redefine their family group. Although KB redefined her new belonging within another family (her biological family) and attempted to help her newfound biological half-sister renavigate identities, her half-sister’s family did not. In terms of relationships, feeling and space (Wood & Black, 2016, as cited in Turner, 2019), KB renegotiated her identity and was able to find her own belonging, helping another biologically related individual in the same situation. This reinforced the potential of DNA complicating the notion of family while broadening possibilities (Stallard & de Groot, 2020).

Similarly, JG had found a DNA match likely to be her half great niece, which led her to find out that there was a problem with her birth father (as she did not have any siblings). She described this as “Completely and absolutely, and utterly unexpected”. When she did further research, she found her biological father was the local gynaecologist in the town she was born and so believed her birth may have been the result of him being a “pioneer in gynaecology”. However, JG seemingly focused her realignment of her identity to her autobiographical completeness, trying to understand her unexpected results and how they shaped her understanding of self, whereas CR and KB had to re-evaluate their family

identities and new relationships, rather than solely focusing on their autobiographical completeness. Autobiographical and genealogical connectedness were mentioned by Walker (2015), who wrote about children's psychological development where one uses elements of connectedness to create a sense of belonging, a coherent sense of self and a clear identity. As a result of the DNA test and further research, this was the case for JG.

5.5 Summary

As the research question is "How do DNA test results affect individuals' perceptions of their identity/identities?", this chapter has shown that participants' perceptions of their identities have in fact been affected by their DNA test results.

These effects varied, which suggest that identities are socially constructed and that participants attached a strong importance to feelings of belonging. Belonging was present within varied identities, including social, biological and family identities. For some participants, these identities aligned, or they retained two separate family identities with one of these connecting to their biological identity and the other being centred to the family they felt a certain degree of belonging to. DNA test results were shown to reframe the notions of family and how participants perceived their identities. The extent to which participants perceived their identities to be affected are largely dependent on how they categorised themselves within the group of 'family' and whether DNA reinforced or disputed these claims. DNA test results altered their perception of belonging within family, directly connecting to their identities.

Different aspects resonated with each participant's perception of their identities, with some making associations through shared history (e.g., family stories, affective associations to their genealogy, or shared cultures and behaviours). Other participants' DNA test results allowed for alteration of participants' biological and family identities or even their feeling of place connection. Thus, their biogeographic ancestry and feeling of connection altered their feelings of belonging to ethnic, national, and cultural identities.

Relationships, especially family relationships, proved to be a core aspect in participants' perceptions of their identities, where they confirmed or renavigated who they thought they were and where they belonged. Unexpected information prompted identity adaptation to their personal, group, family and biological identities. These were dependent on participants' identification choices, and the importance they attached to each.

It was also evident that although some participants may identify with ethnicity estimates, their identity was largely based on lived experiences, thus looking for reaffirmation of their beliefs. In some cases, drastic unexpected information or disturbances to their sense of self can allow for re-development of their identity, reconstituting who they thought they were, what their DNA told them, and how they perceived themselves. Thus, the findings concluded that DNA test results affected participants' perceptions of their identities in varied ways, and finding truthful answers allowed for cohesion in their identities so they could be confident in their belonging and sense of self – a mutable process that continues throughout individuals' lives.

land or a place so they could ultimately understand who they were and where they came from.

Most prominently was the shift of family and biological identities as a result of DNA testing. Some participants' notions of family shifted significantly and those who learned that their parent or grandparent(s) were not who they thought them to be had to renegotiate their family identity, splitting it into two separate identities: family and biological.

Identity disruption from DNA test results evidently affects individuals' perceptions of their identities, leading to different perceptions of family and identity renegotiation. This had an affective impact on participants' feelings of loss or prompted their interest to find answers, especially for those who had close associations with family stories as part of their own identity. For many participants the DNA test results allowed for answers to be found through genealogy, or to feel connected to new places and cultures, providing new possibilities for their identity formation. This is similar to how DD commented that DNA testing may "open many doors about how they feel about themselves [...] it might make their family a lot bigger, which might make them feel comfortable". In many cases, these new possibilities do open new doors, changing the alignment of different identities and expansion of what may constitute part of one's family identity.

There was also deliberation whether higher centimorgans resulted in a biological connection of closer likeness and characteristics. Some participants debated that, even though their DNA through ethnicity estimates did not match areas to which they felt a connection, their connection lay in shared experiences and exposure to varied cultures and influences. Current sociocultural perceptions, interactions and narratives seem to affect individuals' self-perceptions of their identities, which may explain why some embrace their mixed ethnic ancestry and others reject it.

Some participants also expressed that their feelings of place connection correlated directly to their ethnicity estimates. Therefore, this research allowed participants to reflect on their own identities. Their perceptions showed that the vast majority's identity had been affected by their DNA test results, with some being more substantial than others. Place connection was shown to be both perceived as

connected to their results whilst also being disproved through DNA test results. Identities were often connected to a place. Therefore, there was no evidence to prove or disprove that identity affected their place connection but it did certainly affect some participants' perception of their feeling of belonging.

Even though there may not have been a significant shift of identity – such as a shift in family identity, or the assimilation to another culture and nation, based on Y-DNA results – this reflection by participants has prompted them to look at their identity perception prior to testing and how the test affected where they were at the time of the interviews. Other than the participants, this research showed how people strived for connecting their personal identity with their collective identity and creating a sense of belonging. There is no doubt, however, that DNA test results can affect individuals' perceptions of their identities.

6.3 Implications

Over the last twenty years, developments in genetics – such as the completion of the Human Genome Project (HGP) and further funding to other projects – have allowed for more affordable and available commercial testing. Although they are commercial and therefore less in-depth than more expensive tests, they reveal possibilities for those who are curious about themselves or their family, and who want to search for answers of some sort. For some, results may be unexpected, thus opening the possibility that what they had grown up knowing as the truth, may not have been what they thought it to be. This opens up more possibilities and potential conflict within their identities where they have to renegotiate who they are as a person and where they belong. Secrets that may have been kept under wraps for generations, such as infidelities, child abductions, unknown parents or family members, are now at risk of being uncovered. This may have far-reaching consequences not yet fully explored in practice and scholarship.

Through varying family dynamics, DNA test results are likely to influence family structures, raising questions about what constitutes a family and how genetics may play a role in the social structure of a family. Along with family dynamics, people's perception and communication around family and belonging are likely to be re-evaluated, creating new relationships or changing existing ones. Supplementary to

identities in relation to participants' narratives, such as personal and collective identities, and how these might apply to other communities and people. For instance, studies could explore whether one's identity with their geographic region has some relationship to their DNA, if it is purely a manifestation of experiences and lifestyles or even if it is merely an imagined relationship. More complex research could include whether genetic memory has an influence on one's identity to a place and whether there is an inherent feeling of connectedness between one's DNA and subconscious memory. Alternatively, research could explore whether feelings of belonging to a family is constructed or potentially biological. In other cases, further research could be done to see if the age at which a DNA test is taken has an influence on how one perceives their identity changing.

With more DNA tests being more available and affordable than previously, future research adding to current literature, could delve into those who experienced unexpected results; how they might feel connected to their biological and family they were raised in, or if they experienced a lack of connection to one. This may include adoption, sperm donation and other forms of 'biological parents' where one may question their biological origins through new innovative technologies and how DNA test results connects them to these people. It could look at how DNA testing connects these people and how they communicate with one another and develop relationships and new networks.

Overall, additional research would be beneficial to look at how much of identity is biologically or socially constructed. Ultimately, people are looking for belonging whether it be through shared experiences, cultural or ethnic identity, or even family and communities.

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Appendices

Appendix A: Indicative Questions for Semi-Structured Interviews

Prior to this final list, there were two iterations that were extremely similar. After the first interview (with CH) the questions were slightly modified to give more detailed and focused answers on their identity; then after the second interview (with BW), the questions were further revised to allow for broader answers but still focused within the research question. Interviews with all other participants used the same indicative questions with some reshuffling and impromptu questions based on respondents' answers.

Below are the indicative questions:

- 1) Can you tell me a story that resonates with your identity?
e.g., something that talks about you as a person
- 2) How did your DNA test results affect this?
- 3) Do you feel like it impacted your identity in any other ways?
- 4) Did you find out anything about yourself that was unexpected?
- 5) What test did you take and what did you initially expect?
- 6) Has the test changed your perspective at all?
- 7) Since you got the DNA test results, do you have a recent story that resonates with your identity (whether it's the same or changed)?
- 8) Will you be taking any further steps to get more information since the DNA test or is this a one-off?
- 9) Is there anything you'd like to add?

Appendix B: Participant Interview Times, Type and Location

Participant's Initials³⁸	Time of interview³⁹	Interview type	Location during interview
CH	0:14:53	Video call	Korea
BW	0:10:40	In-person	New Zealand
AM	0:19: 28	In-person	New Zealand
RG	0:13:40	Video call	The United States of America
SB	0:21:44	In-person	New Zealand
DD	0:34:37	In-person	New Zealand
DJ	0:55:13	Video call	New Zealand
CR	0:44:13	Video call	New Zealand
HD	0:11:43	In-person	New Zealand
AV	0:07:31	In-person	New Zealand
NH	0:18:48	In-person	New Zealand
KB	1:08:26	Video call	Australia
JC	1:23:36	In-person	New Zealand
AD	0:41:19	In-person	New Zealand
BD	1:01:50	Video call	New Zealand
JG	0:58:34	In-person	New Zealand

³⁸ Refer to [Chapter 4.1: Introduction](#) in this research for detail about findings from participants.

³⁹ Time of interview is '0:00:00', showing the total 'hours: minutes: seconds' of each participant's interview.

Appendix C: Detailed Participant Summaries

P's Initials	Reason for taking a DNA test	Test taken	Findings and Results/Consequences of DNA test
CH	To find out health information and had some interest in cultural and ethnic roots.	<i>Unspecified commercial test.</i>	Unexpected results. Thought she only had Chinese ancestry but also had some unknown Korean ethnicity estimates and had coincidentally moved recently to Korea.
BW	Legal purposes to prove paternity.	<i>Paternity test.</i>	Confirmed paternity for the legal case. He still wants to reconnect with his son after trying to get in contact for twenty years. Now has a young daughter and he wondered how similar his son would be to him, as he saw his own traits passed to his daughter.
AM	Interested in culture and ethnicity.	<i>Ancestry DNA.</i>	Confirmed her ethnicity was mainly Māori and Pākehā and did further genealogical research, finding more stories about her family.
RG	Interested in culture and ethnicity and wanted her results to correspond with her strong Irish identity to get confirmation.	<i>Unspecified commercial test.</i>	Had Irish ethnicity estimates, confirming her Irish identity. Also had a large percent of unexpected British and other European ethnicity estimates. She would have liked more diversity.
SB	Took the test because it seemed interesting.	<i>Ancestry DNA.</i>	Found British and Scandinavian (“Viking”) ancestry, which was updated showing only British and other European ethnicity estimates. This caused a shift of identity perception. Descended from a New Zealand settler family, she strongly identified with place connection and being from a pioneer background. Expressed an interest in her ancestry, family stories, and visiting places related to her heritage.
DD	Took the test because it seemed interesting.	<i>Ancestry DNA.</i>	Had expected European results but also found the DNA connected her to extended family which she was not aware of. Frequently mentioned her immediate family and own individual characteristics and personality of being a strongminded person. She showed

P's Initials	Reason for taking a DNA test	Test taken	Findings and Results/Consequences of DNA test
			interest in doing genealogy research, making contact with immediate family in her region and potentially contacting extended family members in the future.
DJ	Very interested in genealogy and wanted to take a DNA test to help with this research.	Unspecified test to find haplogroup (paternal line).	Found he was not British as he thought, instead found strong Scottish ancestry. Reinforced a strong Scottish identity and identification with Scotland and made family connections. Furthered his decade-long interest in genealogy and felt connected to the places his ancestors were from (in Scotland), while he also developed a political and national identity as a Scot and believed DNA helped him find his overall identity.
CR	Was interested in ethnicity and thought the test results might be interesting.	AncestryDNA.	Results showed she did not share DNA with her expected immediate family members, prompting her to do further research. These unexpected results showed her biological grandfather was not who she thought, causing a major change in perspectives and identity questions. DNA connected her to the biological family, but she has not found distinctive answers as the family connection was from a New Zealand settler family who had many children. She was looking for answers as to who her biological grandfather was and hoped people connected to the family would take a DNA test to confirm the connection. Also expressed a multitude of emotions including feeling loss, interest, and desire for belonging to the family.
HD	Was interested in her ethnicity and the culture it could be related to for belonging. Wanted confirmation of her Māori and U.K. ancestry and to see if her DNA connected to places that she felt interested in.	AncestryDNA.	Ethnicity estimates confirmed her Māori, British, Irish and Scottish ancestry. Felt she was able to have more understanding and sense of belonging, and felt more interested to visit cultural heritage areas in New Zealand that related to her family history after confirmation. She was disappointed her interest in Italian culture was not related to her ethnicity estimates.
AV	Interested in ethnicity and culture. Wanted her interest in various cultures, especially	AncestryDNA.	Had expected Russian ethnicity estimates (confirmed as 70% with Eastern Europe and Russia, linked to Czech Republic, Slovakia, Poland, and Lithuania), but was surprised by her

P's Initials	Reason for taking a DNA test	Test taken	Findings and Results/Consequences of DNA test
	Latin culture, to be DNA related to have a connection to the place.		other DNA estimate: 30% Baltic States linked to Latvia and Lithuania. Found that many of the places she felt connected to corresponded with ethnicity estimates (being close by in similar regions) in her DNA results despite being not aware at the time. However, she did find her interest in Latin culture (connected to Latin America and Spain) had no DNA connection through ethnicity estimates.
NH	Thought the test would be interesting and was interested to find more about her mom's side of the family. Expected British ethnicity results.	MyHeritage DNA.	Results gave confirmation of (primarily) British ethnicity estimates, validating family stories. She visited places connected to her ethnicity estimates, where she felt belonging to her family and places connected to her ancestry. Stayed with family members discovered through the DNA matches, and connected with other extended family, also doing more genealogy research (which she described as joyful but addictive).
KB	After a trip to Hawaii, her husband said she looked partially Polynesian, so she took the test out of interest to see whether she was and to see her ethnicity and cultures.	AncestryDNA.	Found mixed results: Polynesian, Melanesian (Australian Aboriginal), Ashkenazi Jew, British and European with various other results. She felt she did not belong in her family but did not understand why, also recalling specific events where she felt she did not belong. The DNA test showed her unexpected results: her biological father was not the father that raised her. She got in touch with her biological family, found her biological father and other half-sisters (from different mothers) and an extended family living close by of which she was unaware, while navigating new dynamics in her life.
JC	Interested in her genealogy research and had interest in her ethnicity. Expected mostly British ethnicity estimates.	FamilyTree DNA.	Confirmation on European ethnicity estimates. She also found communication with others through genealogy research and helping others connect to their biological families. Also, she was interested in possible connections between her genetics and appearance.
AD	Curious about ethnicity and wanted confirmation of family stories.	AncestryDNA.	Results confirmed he is Indian and British. After high school he had an epiphany about his cultures, finding religion through it. DNA test reaffirmed his family stories and ancestry, and his belonging through religion in the Muslim community. From the test, he mentioned

P's Initials	Reason for taking a DNA test	Test taken	Findings and Results/Consequences of DNA test
			the potential genetic or cultural influence to one's individual characteristics and demeanour, family ancestry and finding belonging in his community.
BD	Her son suggested she take a DNA test because she has always been curious about her biological grandparents (specifically her grandmother), after she had learned at a young age her mother was adopted. She did the test for this reason and to help genealogical research. She was curious about her grandparents and who she potentially acted and looked like.	<i>23andMe and then AncestryDNA.</i>	Found further group connection and communication with her local genealogy group and was able to connect to more people in her family. The DNA test helped her genealogical research and identified a potential grandmother, but she has not been able get more information from the biological family. She still felt curious and lost, wanting to find answers and questioning whether she would be accepted or rejected to her biological family.
JG	Interested in genealogy as a life-long career, so she took the test because it was important to her and she wanted to test and compare her ethnicity estimates and connect to family for her genealogy research.	<i>AncestryDNA, MyHeritage, FamilyTree DNA, 23andMe, and LivingDNA.</i>	She had mapped her family lineage back multiple generations of her mostly British heritage, but found that the DNA did not connect to one of the lines subsequently finding out her biological father was not who she thought. Her biological father was the local gynaecologist in the Australian town, and she was aware her mother really wanted a child. She felt the revelation did not impact her as she had not spent much time with her legal or biological father but had an impact on her genealogical research. Had further questions about her genealogy, family stories (where she detailed stories about the potential circumstances around her conception), and her 'exotic' West African DNA that she was not aware of.