

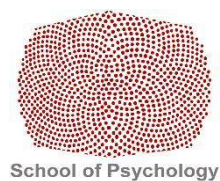
**Executive Functions, Creativity, and Mental Health in Homeless Young People:  
Implications for Housing Outcome**

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**Thesis submitted for the degree of Doctor of Philosophy**

**February 2018**





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## Table of Contents

DECLARATIONS AND STATEMENTS .....	iii
ACKNOWLEDGEMENTS.....	v
Table of Contents .....	vii
Index of Tables .....	xi
Index of Figures.....	xiii
SUMMARY .....	xv
CHAPTER 1: INTRODUCTION.....	1
Youth Homelessness .....	3
Context .....	3
Definition.....	5
Risk Factors for Homelessness .....	9
Theoretical Perspectives.....	11
Executive Functions .....	27
Definition.....	27
Theoretical Perspectives.....	29
Creativity.....	32
Development of Executive Functions and Influencing Factors .....	33
Mental Health in Young People .....	39
Summary, Rationale, and Aims .....	42
CHAPTER 2: SYSTEMATIC REVIEW .....	49
Homelessness.....	52
Foster Care .....	53
Poverty .....	54
Mental Health .....	54
Potential Implications.....	56
Methods .....	57
Results.....	61
Cognitive Domains and Tests .....	61
Definitions.....	62
Quality Assessment .....	78
Comparisons to Young People without Experience of Homelessness, Foster Care, or Poverty.....	79

Comparisons to Norms .....	80
Associations with Cognitive Functioning.....	85
Comparisons Among Young People with Similar Experiences.....	85
Relationships with Mental Health .....	86
Discussion .....	91
How the Systematic Review Informed the Thesis.....	97
Conclusions .....	100
CHAPTER 3: PROFILE.....	103
Methods .....	106
Pilot studies .....	106
Participants.....	113
Materials and Procedure .....	118
Analysis.....	130
Results .....	135
Discussion.....	147
Limitations.....	150
Conclusion .....	155
CHAPTER 4: COMPARISON .....	157
Methods .....	159
Participants.....	159
Materials and Procedure .....	161
Statistical Analysis.....	171
Results .....	174
Main Analysis .....	175
Sensitivity Analysis .....	182
Creativity Analysis .....	186
Discussion.....	187
Limitations.....	190
Conclusion .....	191
CHAPTER 5: MENTAL HEALTH AND HOUSING OUTCOME .....	193
Method .....	199
Materials and Procedure .....	199
Statistical Analysis.....	202



Results.....	203
Anxiety, Depression, and Executive Functions.....	203
Executive Functions and Housing Outcome .....	204
Discussion .....	211
Limitations .....	218
Conclusion .....	219
CHAPTER 6: GENERAL DISCUSSION .....	221
Key Findings by Chapter .....	222
Findings in the Context of Previous Literature .....	226
Findings in the Context of Theoretical Perspectives .....	230
Strengths and General Limitations .....	237
Feasibility Notes .....	243
Implications for Practice .....	246
Future Directions .....	251
Conclusions .....	253
References.....	257
Appendix 1. Adapted NOS from Systematic Review Chapter 2 .....	317
Appendix 2. Pilot study ratings and results from Chapter 3. ....	321
Appendix 3. Negative Outcomes Group EF Performance from Chapter 5 ....	327



## Index of Tables

Table 1. Search strategy. ....	57
Table 2. Characteristics and key findings of studies included in the systematic review. ....	64
Table 3. Quality Assessment of included studies using adapted Newcastle-Ottawa Scale (NOS). ....	81
Table 4. Relations between cognitive functioning and mental health in young people who have experienced homelessness, foster care, or poverty. ....	87
Table 5. Pilot tasks and EF domains. ....	110
Table 6. Demographic profile of the homeless group. ....	114
Table 7. Background characteristics of the homeless group. ....	118
Table 8. Comparison papers providing comparative data. ....	132
Table 9. Descriptive statistics for EF performance in the homeless group and corresponding comparison papers. ....	137
Table 10. Zero-order correlations between predictor and criterion variables entered into multiple regression analyses. ....	144
Table 11. Summary of multiple regressions exploring individual contributions of potential predictors of EF performance, taking account of the contributions of the other predictors in the model. ....	145
Table 12. Demographic profiles of the homeless and housed groups. ....	163
Table 13. Background characteristics of the homeless and housed groups. .	164
Table 14. Descriptive statistics for EF performance and IQ by group. ....	176
Table 15. Descriptive statistics (transformed) for EF performance by group with IQ as a covariate. ....	177

Table 16. Descriptive statistics (transformed) for EF performance by group with SES as a covariate. ....	178
Table 17. Descriptive statistics (transformed) for EF performance by group with highest level of education as a covariate. ....	179
Table 18. Structure coefficients, squared structure coefficients, and standardised discriminant function coefficients from discriminant analysis.	181
Table 19. MANOVA and Sensitivity Analyses. ....	185
Table 20. Descriptive statistics for the AUT. ....	186
Table 21. Logistic regression models for the predictors working memory, anxiety score, and their interaction on housing outcome. ....	206
Table 22. Logistic regression models for the predictors working memory, depression score, and their interaction on housing outcome. ....	207
Table 23. Profile of participants with negative outcomes, those who maintained, and those who progressed. ....	209

## Index of Figures

Figure 1. Diagram of U. Bronfenbrenner’s (1977) bioecological model. ....	13
Figure 2. PRISMA flow diagram depicting the systematic review process. ....	59
Figure 3. The pilot process. ....	107
Figure 4. EF tasks and corresponding domains. ....	121
Figure 5. Screenshot of BCST-64. ....	122
Figure 6. Screenshot of Corsi Backwards. ....	124
Figure 7. Screenshot of IGT. ....	125
Figure 8. Screenshot of Stroop. ....	126
Figure 9. Screenshot of ToL. ....	128
Figure 10. Profile of EF performance in homeless young people. ....	139
Figure 11. Performance on an abbreviated measure of IQ. ....	141
Figure 12. Procedure. ....	167
Figure 13. Sample items from the FAS-II (Currie et al., 2008). ....	170
Figure 14. Frequency distribution of discriminant scores across the homeless and housed groups. ....	182
Figure 15. Pathways linking working memory and housing outcome. ....	235
Figure 16. Slide from presentation given to Llamau staff at Full Team Meeting 21/09/2017. ....	247
Figure 17. Practical suggestions to improve and/or reduce difficulties with working memory. ....	250
Figure 18. Mean ratings of enjoyment for pilot EF tasks given by participants for the cognitive tests. ....	321
Figure 19. Mean difficulty ratings for pilot EF tasks. ....	321
Figure 20. Mean ratings of boredom for pilot EF tasks. ....	322

Figure 21. Profile of EF in homeless young people with negative outcomes (n=6), compared to the average performance of the homeless group as a whole (represented by zero). .....327

## SUMMARY

**Background:** Homeless young people represent one of the most vulnerable groups in society, yet little is known about cognition, and especially executive functioning, in this group. Executive functions (EFs), higher-order cognitive processes important for adaptation, have been identified as likely key contributors to the capacity to exit homelessness. However, most homeless young people have experienced multiple adversities, with potential implications for EF development. To address gaps in current knowledge, this thesis aimed to profile executive functions among homeless young people and compare the profile to housed young people. Associations between EFs and mental health, and relationships between EFs and short-term housing outcomes were also explored.

**Methods:** Sixty-nine homeless young people (16-19 years) from a homelessness charity, and 37 age-matched housed young people from a college/sixth form participated. Computerised EF tasks spanned the domains of working memory, set shifting/flexibility, planning, impulsivity/risky decision making, selective attention/inhibition, creative thinking, and verbal fluency.

**Results:** Homeless young people demonstrated worse performance than housed youth on several EF tasks, particularly working memory and impulsivity/risky decision making. No differences were found between the groups in creativity. Rates of anxiety were higher in the homeless group, but not depression. Working memory predicted progression into more independent accommodation, such that those with longer working memory spans were twice as likely to have progressed rather than maintained after six months. Anxiety and depression did not seem to moderate this effect. A minority of young people had negative housing outcomes and were profiled separately.

**Conclusion:** Findings from this thesis suggest that EFs should not continue to be overlooked by researchers and services, as they can impact on a homeless young person's ability to move towards independence. Emerging adulthood, as a sensitive period for EF development, is likely to represent an opportune time for intervention to improve the likelihood of positive housing outcomes in homeless young people.





## CHAPTER 1: INTRODUCTION

Some of the most basic universal human rights include the right to shelter and food, the right to live in safety, the right to education, and the right to be treated equally without discrimination (United Nations, 1948). For many homeless young people, the reality is very different, and these young people represent one of the most vulnerable groups in society. There is likely to be a complex interaction of structural and individual factors that contribute to or else maintain youth homelessness (e.g., Bramley & Fitzpatrick, 2017). It is important to note that researchers investigating individual factors do not necessarily locate blame within the individual, and it is likely that structural factors, such as availability of affordable housing and welfare support, contribute to individual difficulties (e.g., Bramley & Fitzpatrick, 2017). Research on individual factors attempts to explore these difficulties.

The main areas of focus of research on individual difficulties undertaken with homeless young people have been: health-based, such as substance use and an increasing interest in mental health (e.g., Bousman et al., 2005; Craig & Hodson, 1998; Edidin, Ganim, Hunter, & Karnik, 2012; Greene, Ennett, & Ringwalt, 1997; Hodgson, Shelton, van den Bree, & Los, 2013; Milburn et al., 2017; Nyamathi et al., 2010); risk-oriented, such as risky sexual behaviour and victimisation (e.g., Greene, Ennett, & Ringwalt, 1999; Kipke, Simon, Montgomery, Unger, & Iversen, 1997; Rice et al., 2013; Tyler, Whitbeck, Hoyt, & Cauce, 2004); or centred around experiences, including trauma and coping (e.g., Bender, Yang, Ferguson, & Thompson, 2015; Dashora, Erdem, & Slesnick, 2011; Hyde, 2005; Kidd, 2003; Kolar, Erickson, &

Stewart, 2012). These are all important factors to consider, however, we know that multiple difficulties are faced by homeless young people in these domains. Despite adolescence and emerging adulthood representing key periods of development for cognitive skills and abilities, especially those related to frontal lobe function like executive functions (e.g., Selemon, 2013), crossover between the cognitive and neuropsychological fields and the literature on homeless young people is in its infancy, with skills in the cognitive domain often overlooked (Fry, Langley, & Shelton, 2017; Parks, Stevens, & Spence, 2007). There is also only one study in homeless young people, to my knowledge, that has explored the impact of cognitive functioning on outcomes directly relevant to homeless young people's lives, specifically the ability to earn enough to live on (Saperstein, Lee, Ronan, Seeman, & Medalia, 2014). This thesis profiles executive functions in homeless young people, compared to EF performance in a group of housed young people, and explores the potential impact on homeless young people's lives via associations with anxiety and/or depression and short-term housing outcomes. In contrast to the majority of previous work with this group (see e.g., Haber & Toro, 2004), this thesis aims to look for strengths and positive messages as well as identifying difficulties.

This chapter, in combination with Chapter 2, places the thesis in the context of previous work in the field, work in related fields, and relevant theoretical perspectives. Definitions of key terms are introduced and core concepts explained. First, we consider the context of youth homelessness in the UK, definitions of homelessness and "young people", and theories that inform youth homelessness that are considered most relevant to this thesis.

The concepts of resilience and emerging adulthood are then summarised and defined before moving onto a consideration of the role of executive functions and mental health. In the final section, the aims and rationale for the thesis are outlined.

## **Youth Homelessness**

### ***Context***

It is difficult to obtain accurate statistics on rates of youth homelessness, as only those who present to local authorities and are housed under statutory duty (eligible, not intentionally homeless, and in priority need) are counted; this data tends to only be available by country in official statistics, not across the UK as a whole (e.g., Homeless Link, 2015; Mackie, Thomas, & Hodgson, 2012). In England and Wales, young people aged 16 to 17 years, care leavers aged 18 to 21 years, and those considered vulnerable through difficulties with mental health or fleeing violence, for example, are considered in priority need (Centrepoint, 2015; Mackie, Thomas, & Bibbings, 2017). Data for 16 and 17 year olds is often missing from Government reported statistics, as these young people fall under the Department for Education who do not report on homelessness (Centrepoint, 2015). To address some of the gaps in reporting, the youth homelessness charity Centrepoint (based in England), attempted to obtain more accurate estimates of youth homelessness, using Freedom of Information requests to local authorities across the UK and data from other service providers to get a more complete picture. Using this data, they estimated that 150,000 young people present as homeless to their local authority across the UK every year (Centrepoint, 2015). This includes those who are offered different options or

not eligible to be housed under statutory duty, but does not include those who do not present to the local authority and may be living precariously or the 'hidden homeless', for example individuals who are sofa surfing. Furthermore, more than 30,000 young people are estimated to be turned away without assistance by local authorities in England and Wales annually (Centrepoin, 2015). This means we still do not have the whole story in terms of youth homelessness in the UK.

Young people under the age of 25 represent almost half of people accessing homelessness services in England (Homeless Link, 2015), and 38% of those presenting to their local authority as homeless in Wales (Mackie et al., 2012). Just under 60% of single homeless people in Wales became homeless before the age of 20, making it more likely they would experience repeat homelessness (Mackie & Thomas, 2014). Young people aged 16-19 years (the age group concentrated on for this thesis) have the highest poverty rates of all adults in the UK, with 34% considered to live in poverty (assessed by income after housing costs), followed by 29% of 20-24 year olds (MacInnes, Tinson, Hughes, Born, & Aldridge, 2015). This is likely to increase with the incoming changes to benefits, which will disproportionately affect young people (e.g., Bramley & Fitzpatrick, 2017; Stevens & Blenkinsopp, 2015). These changes include: 18 to 21 year olds no longer automatically qualifying for housing benefit, rollout of Universal Credit where those younger than 25 will receive less than 80% of the amount received by their older counterparts, with up to a minimum of six weeks' wait for the first payment, and introduction of a Youth Allowance that will be highly conditional on obtaining work, training, or apprenticeships (Bramley & Fitzpatrick, 2017; Fitzpatrick et

al., 2017; Homeless Link, 2015; Stevens & Blenkinsopp, 2015). Given the young people affected most by these changes are likely to have little in the way of family support (the presence of which seems to represent an underlying assumption by policymakers), coupled with the contexts of a lack of affordable housing and employment instability (e.g., zero hour contracts), indicates this group are likely to be at further elevated risk for homelessness in the future (e.g., Centrepoin, 2015; Fitzpatrick et al., 2017; Homeless Link, 2015; Stephens & Blenkinsopp, 2015).

Legislation in Wales, in the form of the Housing (Wales) Act (2014) puts statutory duty on local authorities to prevent homelessness, on top of their legal duty to help those already homeless and in priority need (National Assembly for Wales, 2014; Mackie et al., 2017), which will hopefully help to mitigate the impact of some of the incoming benefit changes. Many young people across England and Wales would be considered a priority for temporary accommodation upon presenting as homeless to the local authority, unless they were deemed to be intentionally homeless, that is, having done or neglected to do something that resulted in homelessness (Mackie et al., 2012, 2017). This means there tend to be fewer young people on the streets than in other countries; this does not mean young people do not experience sleeping rough, but it is less likely to be for long periods of time (Quilgars, Johnsen, & Pleace, 2008).

### ***Definition***

Homeless youth can be considered a distinct group from homeless adults and families, and include those who have run away, those who have

been kicked out of home, and those aging out of foster care or released from prison, some or all of whom may have spent time on the streets (Toro, Dworsky, & Fowler, 2007). The utility of typologies of youth homelessness based on reasons for becoming homeless, such as that discussed by Toro and colleagues (2007), has been questioned, however, as the groups tend to overlap and they are not informative in terms of services and/or resources required (e.g., Narendorf, Bowen, Santa Maria, & Thibaudeau, 2018). Despite the diverse backgrounds of homeless young people, ultimately what qualifies them as homeless is their lack of non-transitory, appropriate, and safe accommodation in which they can live and call 'home'.

To be considered legally homeless in the UK, young people need to be evicted, to have family or friends withdraw permission for them to stay, to be at risk of violence or abuse in the home, to have their family home repossessed, to not have a home and be living on the streets or in emergency accommodation, and in certain cases to be living in overcrowded or poor living conditions where these cannot easily be improved (Shelter, 2018). The definition of homeless young people used in this thesis is: any young person between the ages of 16 and 19 years that was living in supported accommodation provided by the charity Llamau at the time of testing who were, by association, legally homeless. This included young people who had recently been staying at friends' houses (or 'sofa surfing') and the occasional young person who had recently slept rough, as well as those asked to leave / choosing to leave the family home, those aging out of foster care, those released from custody, and those escaping domestic violence or abuse. It could be argued that these young people were all likely to be lacking a sense

of 'home' and that the accommodation they currently had with Llamau was transitional, with no permanence, associated emotional attachment, or sense of belonging. This sample falls under the category of 'houselessness' (specifically subcategory 3.3: 'Transitional supported accommodation', pp. 23) in the Europe-wide typology of homelessness (known as ETHOS) developed by the European Observatory on Homelessness and FEANTSA (see Busch-Gertseema, Edgar, O'Sullivan, & Pleace, 2010).

Llamau is a Welsh charity that provides a range of services predominantly for homeless young people and women escaping domestic violence (with or without children) that includes supported accommodation, refuge provision, advice, family mediation, alternative education, missing children's workers, and tenancy support. Young people referred to Llamau (see Chapter 3 for a description of the referral process) often have complex needs, may also display challenging behaviours, and are in some cases young people that are 'too complex or challenging' for other services. To be eligible to access Llamau's young people's supported housing services, described in detail in Chapter 3, young people must be legally homeless and eligible to make a homelessness application or care leavers (usually due to placement breakdown or turning 18 years old), and need support to gain independent living skills, with those accessing the SAFE projects (see Chapter 3) also required to be in priority need (i.e. 16/17 years old). Last year, Llamau supported over 8,500 young people, women, and children across Wales (Llamau, 2017a). Over the period of data collection and follow-up (February 2016 to May 2017), 314 young people were supported by Llamau in SAFE and

supported housing projects (see below for a description of these types of housing project).

Each young person is allocated a support worker who develops a support plan with appropriate goals in partnership with the young person, assisting them with accessing education / training / employment opportunities and managing benefits, with the ultimate goal of equipping young people with the skills to live independently. Most supported accommodation at Llamau is staffed 24 hours a day, so that young people always have a member of staff to go to for support. Staff who cover housing projects assist young people's support workers to ensure each young person's support plan is being followed and continue encouraging young people to work towards their goals. Accommodation for 16 to 19 year olds mostly comprises SAFE projects, 24 hour short-term (average 6-12mths) supported accommodation projects for young people aged 16 and 17, and young people's medium-term (average 1-2 years) supported accommodation, which is often staffed 24 hours a day and can house young people up to the age of 21. These projects house between two and nine young people at a time, and can be found across South East Wales in Cardiff, the Vale of Glamorgan, Caerphilly, Newport, Risca, Torfaen, Bargoed, Merthyr Tydfil, Bridgend, and Porthcawl. There are then projects that young people can move on into that provide less support, moving towards independence. Llamau strives to give person-centred support, tailored to the individual's aspirations, strengths and needs (Llamau, 2017a).



### ***Risk Factors for Homelessness***

Many factors have been proposed to increase a young person's likelihood of becoming homeless, but the picture is complex and causal pathways unclear. Proposed contributory factors include: poverty, residential mobility, family conflict, change in family structure, abuse or violence in the home, mental health problems, issues with sexuality/identity, traumatic events and/or victimisation, problems at school, criminal activity, substance use, and having runaway in the past (Brakenhoff, Jang, Slesnick, & Snyder, 2015; Cutuli, Montgomery, Evans-Chase, & Culhane, 2017; Embleton, Lee, Gunn, Ayuku, & Braitstein, 2016; Hyde, 2005; Koegel, Melamid, & Burnam, 1995; Martijn & Sharpe, 2006; Rice et al., 2013; Rosario, Scrimshaw, & Hunter, 2012; Shelton, Taylor, Bonner, & van den Bree, 2009; Toro et al., 2007; Tyler & Schmitz, 2013; van den Bree et al., 2009). It has also been suggested that the trauma of homelessness itself, including chaotic lifestyle and increased risk of victimisation, may overshadow the effects of other risk factors, such as family history and experience of abuse (MacLean, Embry, & Cauce, 1999).

There is some evidence of interaction between risk factors. Early adversity tends to combine with poverty to impact health, mental health, and addiction (Luchenski et al., 2017), and those with adverse experiences in childhood are more likely to become homeless as adults (Cutuli et al., 2017). Youth identifying as LGBTQ are at increased risk of homelessness, and this is suggested to be as a result of family conflict around the young person's sexuality and/or gender identity (Milburn, Ayala, Rice, Batterham, & Rotheram-Borus, 2006; Rice et al., 2013; Rosario et al., 2012). School

difficulties, such as being suspended or expelled, tend to be more common in homeless youth, and this is likely linked to higher incidence of learning disabilities found in this population (Barwick & Siegel, 1996; Toro et al., 2007). Changes in family structure, mental ill health, criminal activity, substance use, and repeated attempts to run away are also likely to contribute to young people becoming homeless through new or additional family conflict, though many of these relationships could be bi-directional (Milburn et al., 2017; Toro et al., 2007; van den Bree et al., 2009).

Groups of young people that are considered at risk for homelessness include those in poverty, those removed from home, and those in custody (Toro et al., 2007). A recent meta analysis identified poverty as a key driving factor in young people becoming homeless across both developed and developing countries (Embleton et al., 2016). Young people who are in foster care are one of the groups considered at risk for homelessness, and just under half of adolescents aging out of foster care followed over 2 years were found to be in precarious housing situations, with 20% classed as chronically homeless (Fowler, Toro, & Miles, 2009). Over a longer follow-up period, Dworsky and colleagues found rates of homelessness among care leavers to lie between 31% and 46% (Dworsky, Napolitano, & Courtney, 2013). Similar rates were found in young offenders. Between 35% and 46% of young offenders who were surveyed as part of the Psychiatric Morbidity Survey reported having experienced homelessness (Lader, Singleton, & Meltzer, 2000). However, it has been suggested that homelessness is just one more stressful thing for poorer young people to cope with, and that there are broader poverty-related factors that are driving undesirable outcomes, which could be argued to apply

to all of the groups just described (e.g., Buckner, 2008; Buckner, Bassuk, Weinreb, & Brooks, 1999). This is explored in Chapter 2, where cognitive functioning in homeless young people is compared to two at-risk groups, those in poverty and care leavers.

### *Theoretical Perspectives*

The homelessness literature more broadly has largely evolved with little theoretical foundation (e.g., Haber & Toro, 2004), however there are useful theoretical perspectives from other areas of psychology that can be applied to the study of homeless young people. Outlined briefly here are those perspectives considered most relevant to the current thesis, covering ecological theory, theories relating to risk, stress-based theories, attachment theory, and a theory relating to scarcity. These theories were not formally tested, but informed the work presented.

#### *Ecological*

An overarching perspective is reflected in ecological theories, namely that proposed by Bronfenbrenner (e.g., Bronfenbrenner, 1977, 1994), which place a developing young person at the centre of a set of wider nested systems or interconnecting contexts that interact to impact on development over time. These systems range from the microsystems in the immediate environment, such as the family and peer group, to the more distal macrosystems, such as the material resources and availability of affordable housing within a culture. This is not a passive model, the young person also interacts with the systems at various levels which shapes their development, and relationships and

influences within and between systems can vary over changing circumstances and time. The model is illustrated in Figure 1.

For homeless young people, it is likely that relationships with family have not been positive, and while there may be peer relationships providing some support, these could also have a negative influence if young people affiliate with the 'wrong crowd', for instance. Potentially maladaptive relationships in these microsystems may also interact with each other and with other systems to influence development, for example, it may be that socialising with older peers compounds existing conflict with family or affects attendance at school. If the neighbourhood is under-resourced, there are likely fewer opportunities to meet peers that may have a positive influence through after school clubs or activities, and having little entertainment may lead to engaging in vandalism or other criminal activity with older peers. One of the macrosystems that affect the resources of the neighbourhood would be the current economic climate and the political application of austerity measures. Once homeless, the organisation providing accommodation and support to young people, and their policies and ways of working, are also likely to be important contributors to continuing development, via their interactions with other systems. For example, having the opportunity to build positive relationships with a trusted adult role model, facilitated by an organisation that routinely provides well-trained key workers and works in a relational way, is likely to help to improve a young person's relationship building skills with other people in their life and contribute positively to development.

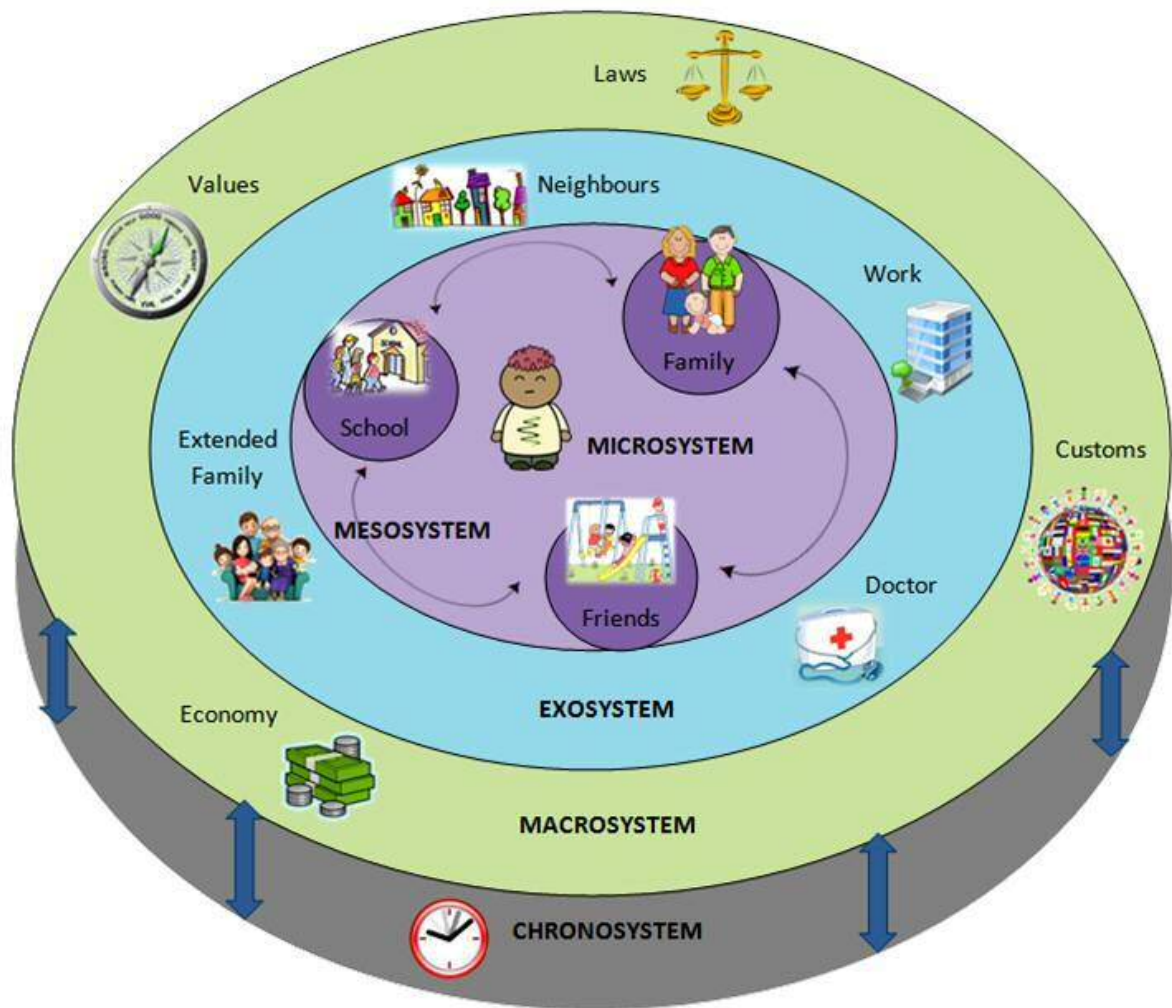


Figure 1. Diagram of U. Bronfenbrenner's (1977) bioecological model.

To attempt to provide a coherent theoretical framework for research with homeless populations, Haber and Toro (2004) extended and applied ecological approaches to the study of homelessness. Homelessness, according to the ecological-developmental perspective, arises as a consequence of a combination of both individual and more distal factors, and can be conceived as an extreme form of poverty or the result of lack of resources (Davies & Allen, 2017; Haber & Toro, 2004). The family is considered an important influence, as it is in both ecological and developmental approaches, that can mitigate or exacerbate the impact of this lack of resources on young people at

risk of experiencing homelessness, for example through increased family conflict leading to relationship breakdown, one of the most common reasons cited for young people becoming homeless (Haber & Toro, 2004; see e.g., van den Bree et al., 2009). Although the focus of this thesis is on individual factors in homeless young people, namely executive functions, ecological perspectives demonstrate how these can interact with varying contexts in a young person's life to influence development.

### *Risk Amplification Model and Cumulative Risk*

One theory that directly applies to homeless young people is the Risk Amplification Model (RAM; Whitbeck, Hoyt, & Yoder, 1999). The RAM posits that negative experiences young people have after becoming homeless amplify the effects of earlier adverse experiences, via negative patterns of social interaction and behaviour, increasing risk for victimisation and poor mental health. This is not dissimilar to the idea of cumulative risk which proposes that having multiple risk factors increases risk for negative outcomes (Sameroff, Seifer, Baldwin, & Baldwin, 1993). Cumulative risk is relevant to homeless young people as they are likely to have several risk factors, such as adverse childhood experiences, substance use, mental health difficulties, and lack of practical and psychological resources in the home environment (e.g., Haber & Toro, 2004). It is possible that both of these theories could also apply to cognitive development, as both early adversity and situational factors such as poverty have been found to impact on brain development (e.g., Hackman & Farah, 2009; Pechtel & Pizzagalli, 2010), and it would follow that experiencing severe poverty, for example, as a result of becoming homeless could exacerbate the effects of early adverse experiences on the

still-developing brain, with consequences for cognitive and executive function.

### *Continuum of Risk*

Another theory relating to risk and directly applicable to homeless young people is the continuum of risk proposed by Masten and colleagues (Masten, Miliotis, Graham-Bermann, Ramirez, & Neeman, 1993). This aligns with the cumulative risk idea in that those with greater exposure to risk are less likely to adapt successfully. While homeless young people are much more likely to fall towards the greatest risk end of the continuum than many other young people, due having few resources and significant stress exposure, it does not mean that they are automatically considered to have the greatest risk - some young people who are homeless may not have as many risk factors present as young people who have experienced other types of adversity, such as out-of-home care. However, as homeless young people tend to have experienced a great deal of adversity earlier in life and have the stress of homelessness itself to cope with on top of that, they are often considered to be at the extreme end of the continuum (Buckner, 2008; Masten et al., 1993).

### *Allostatic Load*

A prominent risk factor in the theories presented in the previous section was stress, and particularly early life stress. In parallel with ideas around cumulative risk, allostatic load refers to adverse effects of the build-up of stress, resulting in the stress regulation system becoming dysregulated, affecting subsequent responses to stress (McEwen, 2000). There are several ways this can occur: with repeated exposure to stress, the stress hormone

response becomes overactive; the body fails to habituate to repeated stressors of the same type; stress response does not progress to recovery stage but is prolonged; insufficient stress response due to conditions such as fibromyalgia. Allostatic load has been linked to socioeconomic status (SES) in young people, as it is likely that those from poorer backgrounds have greater levels of chronic stressors to contend with (e.g., Evans & Schamberg, 2009). As homeless young people are likely to have been exposed to chronic stress, their stress response may be heightened and/or prolonged due to greater allostatic load, affecting brain development and function (e.g., Evans & Fuller-Rowell, 2013; McEwen, 2000). Chronic stress may also result in hypervigilance, meaning young people may experience a constant state of heightened anxiety and feel threatened in everyday situations. This in turn can affect relationships, responses to situations perceived as threatening, and trusting others, presenting barriers to positive social interactions needed to build support networks, as well as impacting on cognition (e.g., Evans & Kim, 2013; Hawkley & Cacioppo, 2010; Lupien, McEwen, Gunnar, & Heim, 2009).

### *Adverse Childhood Experiences*

Although allostatic load encompasses the accumulation of perceived stress of many kinds, there has been renewed interest in recent years in early life stress, particularly Adverse Childhood Experiences (ACEs). The original study coining the term ACEs was conducted by Felitti and colleagues in the United States, and found that having a greater number of ACEs increased risk of health problems commonly associated with early death (Felitti et al., 1998). ACEs were defined in the original study to include: psychological abuse, physical abuse, sexual abuse, exposure to substance use in the home,



exposure to mental illness in the home, violent treatment of mother or stepmother in the home, criminal behaviour in the household (Felitti et al., 1998). Young people who have experienced ACEs have been found to have reduced hair cortisol, indicating dysregulation of the stress regulation system (Kalmakis, Meyer, Chiodo, & Leung, 2015). However, what are considered ACEs or early life stress varies between studies. No matter how ACEs are defined, though, they have been found to be common in homeless populations (e.g., Maguire, Johnson, Vostanis, Keats, & Remington, 2010; Maguire, Keats, & Sambrook, 2006). Homeless young people have often experienced multiple ACEs - a recent report found over 60% of homeless young people had experienced four or more ACEs compared to 14% in the general population - making them more vulnerable to negative outcomes (e.g., Bellis et al., 2015; Llamau, 2017b; Smith, Phillips, & Hodgson, 2015). A recent meta-analysis found that child maltreatment was associated with poorer working memory and attention, and its influence on executive functioning has been found to extend into mid-adulthood (Masson, Bussi eres, East-Richard, Mercier, & Cellard, 2015; Nikulina & Widom, 2013). This suggests homeless young people may have difficulty in areas of executive functioning, by virtue of their exposure to early adversity.

### *Attachment*

Another factor related to early experiences is attachment. Attachment theory is credited to originate with Bowlby (1958), influenced by Lorenz and Harlow's work with animals (Harlow & Zimmermann, 1958; Lorenz, 1935), and was later extended by both Bowlby and Ainsworth (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969; Bretherton, 1992). Bowlby believed that in the

first few years of life, infants instinctively sought close relationships with their primary caregivers in order to increase their chances of survival (Bowlby, 1958, 1969). The primary caregiver could then act as a secure base from which an infant could explore the world, safe in the knowledge they could return to this person for protection and comfort when needed. These early relationships were considered to affect infants' internal working models of what positive and caring relationships are like and how they see the world (e.g., Ainsworth, 1989; Bowlby, 1958, 1969, 1977). Different attachment patterns were identified by Ainsworth (Ainsworth et al., 1978) and added to by Main and Solomon (1986), comprising: secure, avoidant, resistant, and disorganised. Each pattern is characterised by distinct observed behaviour displayed by the infant when separated temporarily from the primary caregiver (Ainsworth et al., 1978; Main & Solomon, 1986). Internal working models and attachment patterns formed early in life are considered to affect young people's ability to form relationships and connect with others later in life (Bowlby, 1977; Gorrese & Ruggieri, 2012; Brown & Wright, 2001).

Attachment behaviour is thought to involve executive processes, such as planning, to perform 'goal-corrected' behaviour (e.g., Ainsworth, 1969). Secure attachment has been proposed to facilitate development of EF skills in children through providing a context of stability to learn to regulate their thoughts, behaviour and emotions (Calkins, 2004; Cole, Martin, & Dennis, 2004; Sroufe, 1996). Secure attachment could also encourage EF development through its positive effects on frontal lobe development (Glaser, 2000). Bernier and colleagues conducted a prospective study investigating links between attachment patterns and EF, finding that securely attached

toddlers demonstrated better performance on EF tasks and were rated more highly on EF skills by their teachers, aged 5-6 years (Bernier, Beauchamp, Carlson, & Lalonde, 2015). As homeless young people are at risk not only of non-optimal frontal lobe development (as seen from previous sections), but also of not having meaningful early relationships (for example, due to abuse / neglect or being taken into care) and hence secure attachment (e.g., Stein, Milburn, Zane, & Rotheram-Borus, 2009; Stefanidis, Pennbridge, MacKenzie, & Pottharst, 1992), this suggests they are particularly vulnerable to disturbances in EF development.

### *Scarcity*

Moving away from early experiences, the scarcity theory links a lack of resources to cognition. Mullainathan and Shafir (2013) proposed that scarcity - the feeling of not having enough to meet your needs - occupies the mind, reducing the cognitive resources available for processing other things. Those from poorer households experience chronic scarcity and this has the potential to have a substantial impact on their day-to-day cognitive functioning (Mullainathan & Shafir, 2013). Mani and colleagues tested this theory with a set of well-controlled experiments (Mani, Mullainathan, Shafir, & Zhao, 2013). In the first set of experiments, they primed participants to think about money and their finances prior to completing a set of cognitive tasks. Half had scenarios where the hypothetical monetary outlay was not too great, and the other half had scenarios where the hypothetical monetary outlay was substantial. Poorer participants demonstrated worse performance on the tasks after the substantial outlay finance questions than those who were more affluent, whereas performance was similar for both income groups after the

small outlay scenarios. The second set of studies was naturalistic. Sugar cane farmers in India were compared on cognitive performance before harvest and after harvest, that is, when they were relatively poor and relatively rich. Effects of timing were mitigated as farmers harvested at different times of the year. Consistent with the first set of studies, they found that farmers performed more poorly on the cognitive tasks in their pre-harvest period than in their post-harvest period. Some farmers were tested at post-harvest first to reduce any training effects, and results were similar when stress variables were taken into account. These findings suggest that people struggling financially not only lack material resources, but also have reduced cognitive resources available (Mani et al., 2013). It should be noted that scarcity does not only refer to economic resources, but also to factors such as time and social contact (Mullainathan & Shafir, 2013). Given the likelihood that homeless young people face chronic scarcity, not only from a lack of resources but also limited social support, it follows that they may also have reduced availability of cognitive resources for planning, processing, reasoning, and making informed decisions.

The theories presented so far (ecological/ecological-developmental, RAM, cumulative risk, continuum of risk, allostatic load, ACEs, attachment, and scarcity) suggest that homeless young people are likely to have difficulties with cognitive functioning, and specifically executive function, due to multiple risk factors that accumulate and exacerbate adversity, the effects of chronic stress, including several ACEs, early relationships, and increased cognitive load as a result of scarcity. However, this is a very pessimistic picture. In the next section, a more positive theoretical

perspective is presented which explores the possibility of good executive function performance in homeless young people.

### *Resilience*

Definitions of resilience have evolved over time, and there are different perspectives on its meaning. Some have considered resilience a trait, others as a process or a response emerging as a result of multiple processes, a pattern over the lifespan, or a desirable outcome despite difficulties (e.g., Fergus & Zimmerman, 2005; Luthar, Cicchetti, & Becker, 2000; Masten, 2014; Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003; Sapienza & Masten, 2011). Resilience could represent one, some, or all of these things, but most researchers would agree that it involves positive adaptation or development in a context of risk and/or adversity (Cicchetti, 2010; Luthar et al., 2000; Rutter, 1985; Zolkoski & Bullock, 2012). The current definition proposed by Masten is, “The capacity of a dynamic system to adapt successfully to disturbances that threaten system function, viability, or development” (Masten, 2014, p.10). There is debate as to how to operationally define and study resilience, yet, despite this uncertainty, findings in this area have been remarkably consistent (Cicchetti, 2010; Luthar et al., 2000; Masten, 2014; Ong, Bergeman, & Boker, 2009). There are also issues relating to the measurement of resilience, primarily what constitutes adaptation / positive development and how these are objectively measured. This remains a challenge and measuring resilience still involves researcher judgements on what represents adversity and adaptation / positive development (Alvord & Grados, 2005; Luthar et al., 2000; Masten & Coatsworth, 1998; Rutter, 2012; Zolkoski & Bullock, 2012). An alternative

view to the one presented by Masten conceptualises resilience as a trait (see e.g., Block & Block, 1980; Block & Kremen, 1996; Bohane, Maguire, & Richardson, 2017; Hart, Hofmann, Edelstein, & Keller, 1997; Ong et al., 2009; Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996; Tugade & Fredrickson, 2004). This is often termed ‘resiliency’, measured using self-report questionnaires, and is considered an aspect of personality or personality type, representing how ‘resilient’ or ‘brittle’ someone is across a range of situations, including how they cope and respond to challenge generally (e.g., Block & Block, 1980; Block & Kremen, 1996; Hart et al., 1997; Robins et al., 1996; Tugade & Fredrickson, 2004). The conceptualisation of resilience as trait-based is potentially problematic because of the implication that the presence or absence of resilience is fixed and not contingent on the presence of adversity; it may be that it is easier for certain people to cope with adverse situations better than others, and perhaps that they tend to demonstrate resilience more often than others, but this is also likely to interact with context and timing (Cicchetti, 2010; Fergus & Zimmerman, 2005; Luthar et al., 2000; Masten, 2014; Rutter, 2006). Regardless of whether resilience is considered from a dynamic systems or trait-based perspective, it is highly relevant to youth homelessness considering the risks faced by this vulnerable group.

The concept of resilience relates to Bronfenbrenner’s ideas around an individual developing in the context of many systems with which they regularly interact, as it is likely many systems are involved in fostering resilience processes, both within and outside the individual (e.g., Bronfenbrenner, 1977, 1994; Fraser, Richman, & Galinsky, 1999). Resilience

and its focus on assets and resources in addition to risk also relate to the idea of developmental cascades, where both positive and negative effects can impact across domains, levels, and systems, of functioning (Masten & Cicchetti, 2010; Sapienza & Masten, 2011). This has implications for the potential for intervention as, in theory, positive effects of intervention in one area can spread to other areas of functioning and impact future development (Masten & Cicchetti, 2010; Masten & Coatsworth, 1998; Patterson, Forgatch, & DeGarmo, 2010). The likelihood of these cascades of competence can be enhanced by targeting periods of transition and sensitive periods of development, such as during late adolescence / emerging adulthood (e.g., Luthar et al., 2000; Masten & Cicchetti, 2010). When applying a lens of resilience, we consider thriving despite adversity and shift focus onto more positive approaches, rather than just mitigating risk (e.g., Fergus & Zimmerman, 2005).

Among studies investigating resilience in young people from low-income families, cognitive skills and abilities are consistently indicated as positive factors (Masten, 2014). Executive functions in particular have been found to be one of the key protective factors for at-risk young people, and could represent one component of a set of ‘tools’ for successful adaptation (Blair & Raver, 2012; Cutuli & Herbers, 2014; Masten & Coatsworth, 1998; Masten et al., 1999; Sapienza & Masten, 2011). For example, Buckner and colleagues focused on young people from poor backgrounds, some of whom had previously been homeless, and found that those who seemed to be functioning well across several domains had reported better executive function skills (Buckner, Mezzacappa, & Beardslee, 2003, 2009). Further, Masten and

colleagues (2012) found that executive functions were important for homeless children, and predicted school adjustment over and above IQ (Masten et al., 2012). The other key protective factor that has been identified was parenting quality (Cutuli & Herbers, 2014; Masten et al., 1999). Given this is not something that can be easily improved for homeless young people, especially with probable difficult relationships with family, executive functions could be particularly important for this group (Masten, 2014). Taking a developmental cascades approach, developing executive functions may help to adapt and/or cope with future adversity (Masten & Cicchetti, 2010).

To summarise this section, although the resilience literature is complex and there remain debates around definition and measurement, resilience is a useful theoretical concept for this thesis as it broadly refers to positive adaptation or development in the face of adversity. This enables consideration of potential assets and strengths in addition to risks and vulnerabilities, and there is some indication from the previous literature that cognitive skills and abilities, and executive functions in particular, may represent important protective factors for homeless young people. In this thesis, resilience is considered to be related to the overall adaptive functioning of homeless young people, despite their experience of multiple adversities, including homelessness itself. The next section moves on to introduce the psychological perspective on emerging adulthood, a period in which the participants of this research fell within.



### *Emerging Adulthood*

Adolescence and adulthood are well-established periods of development, considered to span approximately 11 or 12 to 18 years and 18 years onwards, respectively (e.g., Spear, 2000). However, young people are not automatically adults upon turning 18; the developmental milestones associated with reaching adulthood have shifted with changes in culture, and in some cultures at least, there is a period of transition which allows for an extension to the exploration of adolescence whilst working towards the independence of adulthood (e.g., Arnett, 2016; Settersten Jr., 2007). This has been termed 'emerging adulthood' and is generally considered to span the ages of 18 to 25 years, though likely encompasses the ages of 16 to 18 years and up to the age of 30 for some young people (Arnett, 2000, 2016; Henin & Berman, 2016; Spear, 2000). Emerging adulthood is an important time for exploring future directions and identity, features instability in many areas, focuses on the individual, and is accompanied by feelings of not being a child anymore yet not reaching adulthood either (Arnett, 2000, 2007, 2016). It is often a time of housing instability, the example given by Arnett is of young people having moved out or away for further study but are not settled and may return to the family home (Arnett, 2000).

Critics of the idea of emerging adulthood argue that it only applies to a subset of young people (as illustrated by the example of housing instability), namely those who are middle or upper class who have the family socioeconomic resources and support for exploration (e.g., Furstenberg Jr., 2010; Hendry & Kloep, 2007). However, some evidence exists for common experiences in this period across social classes, in that rates of endorsement

of items covering key features of the theory (exploring identity, instability, self-focus, feeling there are lots of possibilities, and not yet feeling like an adult) were found to be consistent among emerging adults across a broad spectrum of social classes in the United States (Arnett, 2016). In terms of housing instability, emerging adults represent a substantial group within those known to homelessness services: 49% in England and 38% in Wales, respectively (Homeless Link, 2015; Mackie et al., 2012), providing support to the idea of residential instability as part of emerging adulthood that does not apply solely to the middle classes. Drawing on the care leaver literature, many young people age out of foster care during emerging adulthood, meaning they experience two major transitions concurrently (e.g., Goodkind, Schelbe, & Shook, 2011). Care leavers are expected to become independent very quickly with limited support, leading to elevated risk of homelessness and other forms of instability such as unemployment (e.g., Arnett, 2007; Fowler, Toro, & Miles, 2011; Jones, 2014). Regardless of social class, it is clear that emerging adulthood represents a time of transition to independence, and brings with it a range of challenges.

The period proposed as emerging adulthood coincides with the later stages of cognitive and brain development, and in particular the development of the frontal lobes which tend to underpin executive functioning, for example planning (e.g., Steinberg, 2005). Consequently, it represents a window of opportunity in which it may be possible to positively impact on cognitive growth and development (e.g., Masten, 2014; Knoll et al., 2016). Despite the many risks and possibilities of this age group, they remain relatively neglected in the literature, compared to adolescents and adults

(Henin & Berman, 2016). In the next section, we move on to consider executive functions and factors that could affect their development, as well as relevant theoretical perspectives.

## **Executive Functions**

### ***Definition***

Despite much research interest in executive functions, a formal definition is still lacking (Jurado & Rosselli, 2007; Lehto, Juujärvi, Kooistra, & Pulkkinen, 2003). Generally speaking, executive functions are considered to be higher-level cognitive processes that often interact with lower-level cognitive processes, and work in a goal-directed way to allow us to adapt to novel situations or circumstances (Alvarez & Emory, 2006; Best & Miller, 2010; Diamond, 2013; Gilbert & Burgess, 2008; Huizinga, Dolan, & van der Molen, 2006; Miyake & Friedman, 2012; Zelazo & Carlson, 2012). They are important for everyday life, especially education and employment, and have been found to predict many developmental outcomes, as well as predict risky behaviour in adolescents / emerging adults (Diamond, 2013; Jurado & Rosselli, 2007; Miyake & Friedman, 2012; Pharo, Sim, Graham, Gross, & Hayne, 2011; Zelazo & Carlson, 2012). The distinction between automatic and controlled processes is important in many theories of executive function, and executive functions are thought to become involved when automatic or routine responses are not sufficient (Diamond 2013; Gilbert & Burgess, 2008). Executive functions are often credited to have originated from Luria's work, and Luria was one of the first to link executive functions with the frontal lobe, coining the term "frontal functions" (Chan, Shum, Toulopoulou, & Chen, 2008; Jurado & Rosselli, 2007; Luria, 1980). Although executive functions are

still believed to predominantly rely on frontal lobe function, particularly that of the prefrontal cortex, there has been a shift towards considering the importance of connectivity with other related brain areas (Gilbert & Burgess, 2008; Jurado & Rosselli, 2007; Steinberg, 2005).

Many researchers have reported on 'core' executive functions, with reference to Miyake and colleagues' (2000) study, as comprising shifting, updating working memory, and inhibition. However, the authors themselves clearly stated that, "We are not claiming that the three investigated executive functions are the only executive functions, nor would we suggest that they are anything like the fundamental units or primitives of cognition" (Miyake et al., 2000, p. 89). As such, executive functions studied in this thesis encompassed a broader range of domains, including those commonly studied and those that were likely to be important for obtaining and maintaining accommodation: set shifting, working memory, risky decision making / impulsivity, selective attention, inhibition, planning, creative thinking, and fluency. A widespread problem in the study of executive functions is task impurity, that is, because executive functions often recruit other executive functions and lower-level cognitive processes, tasks assessing executive functions are unlikely to be tapping just one component (Best & Miller, 2010; Huizinga et al., 2006). It may be that some executive functions involve combinations of cognitive processes, and it is likely that working memory is required for many widely used executive function tasks (e.g., Diamond, 2013). As this difficulty has yet to be overcome, though there are some promising approaches (e.g., using latent variables as in Miyake et al.,

2000), it should be born in mind when results are presented for individual executive functions.

### ***Theoretical Perspectives***

A full review of theories of executive function is beyond the scope of this thesis, so in this section I summarise and include a selection considered most relevant to the investigations presented. Theoretical debates about executive functions tend to centre around whether it is a single entity or system, or whether it is multifaceted and made up of several connected entities / systems (Best & Miller, 2010; Huizinga et al., 2006; Lehto et al., 2003). Most evidence seems to point towards executive functions being multifaceted and one of the most widely cited theories is that of unity and diversity described by Miyake and colleagues (Miyake et al., 2000; Miyake & Friedman, 2012). Executive functions demonstrating both unity and diversity was first proposed by Teuber in 1972, and later expanded by Miyake's group (Miyake et al., 2000, Miyake & Friedman, 2012; Teuber, 1972). This view posits that executive functions are both connected and separable, which is supported by frequent findings of small to moderate correlations among executive function tasks and extraction of latent factors accounting for different aspects of executive function performance (Gilbert & Burgess, 2008; Miyake et al., 2000; Miyake & Friedman, 2012). The conceptualisation of executive functions as related but distinct, as proposed by the unity and diversity model, forms the basis of the approach to executive functions in this thesis.

Another theory of executive function that relates to this thesis is the idea of different types of executive functions. Zelazo and colleagues proposed that there are two types of executive functions, 'hot' and 'cool' that work together in an adaptive way (Happaney, Zelazo, & Stuss, 2004; Zelazo & Carlson, 2012). 'Cool' executive functions are those that have been traditionally studied, and are more logical / rational, operating largely without influence of motivation or emotion, and thought to be related mainly to dorsolateral prefrontal cortex function (e.g., Chan et al., 2008; Happaney et al., 2004; Zelazo & Carlson, 2012). In contrast, 'hot' executive functions are driven by emotional and motivational influences, are more representative of everyday decision-making, and are thought to be associated with orbitofrontal and ventromedial prefrontal cortex function (e.g., Chan et al., 2008; Happaney et al., 2004; Zelazo & Carlson, 2012). For example, the Iowa Gambling Task, used in this thesis, is considered a task that taps 'hot' executive function, as the uncertainty of risk and reward is motivating and engages more emotional decision making (Bechara, 2004; Bechara, Damasio, Damasio, & Anderson, 1994; Happaney et al., 2004). Performance on the task has also been associated with real-life risky behaviour (e.g. Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2005), which is something many homeless young people have a tendency to engage in (e.g., Bailey, Camlin, & Ennett, 1998). Therefore it was important that the range of executive function tasks used in this thesis tap both 'hot' and 'cool' executive functions.

The idea of 'hot' and 'cool' EF is not dissimilar to Metcalfe & Mischel's (1999) proposal of 'hot' and 'cool' systems, however the two concepts differ

in an important way. Whereas the contrast between the ‘hot’ and ‘cool’ systems centred around top-down versus bottom-up processing, when motivations and/or emotions are involved, different top-down processes are thought to be required (‘hot’ EFs) than when the context is neutral (Metcalf & Mischel, 1999; Zelazo & Carlson, 2012). In terms of the validity of the distinction between these two types of EF, there is evidence from lesion studies that there is a dissociation between impairment demonstrated when the dorsolateral PFC is damaged and impairment following orbitofrontal lesions (Happaney et al., 2004; Zelazo & Carlson, 2012). In other words, difficulties with ‘hot’ EF tasks, e.g. the IGT, can occur in the absence of difficulties with ‘cool’ EF tasks (Bechara, 2004; Zelazo & Carlson, 2012).

Although not a theory of executive function *per se*, Baddeley and Hitch’s (1974) theory of working memory has been highly influential and includes executive components (see e.g., Baddeley, 1996, 2012; Baddeley & Hitch, 1974, 1994; Jurado & Rosselli, 2007). According to the multi-component model, working memory comprises several components that deal with the maintenance of incoming sensory information, specifically verbal and visuospatial information, and are controlled by a central executive component (Baddeley, 1992, 2012; Baddeley & Hitch, 1974, 1994), with an episodic buffer to link to long-term memory added almost three decades later (Baddeley, 2000, 2012). The central executive shares similarities with executive functions as it was proposed to regulate cognitive processes, and Baddeley considered that it could encompass Norman and Shallice’s (1986) Supervisory Attention System (SAS; Norman & Shallice, 1980, 1986; see also, Baddeley, 1996, 2012; Baddeley & Hitch, 1994; Jurado & Rosselli, 2007; Miyake et al.,

2000), which focuses on control of attention. It is important to note that working memory is not just another term for short-term memory; it involves additional manipulation of information stored in short-term memory (e.g., Baddeley, 1992; Diamond, 2013). Baddeley and Hitch's (1974) model highlights the probable contribution of working memory to other executive functions and a potential distinction between verbal and visuospatial abilities. There is preliminary indication from previous work that homeless young people may perform particularly poorly on tasks tapping verbal ability, reflected in very low verbal IQ (Hodgson, 2014), but it may be that visuospatial abilities are relatively intact if they rely on a different system. Having reviewed relevant theoretical perspectives relating to executive function, the next section explains the conceptualisation of creativity as part of the executive function umbrella, before moving on to consider executive function development and factors that may influence executive functioning.

### ***Creativity***

Creativity, or thinking outside of the box, has been included under the umbrella of EF in this thesis in line with broader conceptualisations of EF (Diamond, 2013), and due to its likely utility for young people facing adversity (e.g., Cohen, 2012). Creativity as a concept has been difficult to pin down, resulting in diverse definitions and approaches across research groups (e.g., Runco, 2007; Sternberg & Lubart, 1999). Broadly, though, it is recognised that creative outputs should have: novelty or originality, and appropriateness or effectiveness. That is, to be considered creative, an idea must be new, unusual, or a novel reframing of an existing one, and it must be deemed appropriate or useful in the target context (Barron, 1955; Runco & Jaeger,



2012; Stein, 1953). Guilford (1950, 1967) was one of the main advocates of the psychometric approach to creativity and he believed that creative potential could be measured using divergent thinking tasks as a proxy for creativity. Divergent thinking tasks are those that require generation of many possible responses and ideas, with no 'correct' answer, in contrast to convergent thinking tasks (often found in schools) that require following task rules to obtain the right answer (Runco & Acar, 2012). Though there are many other varied approaches to the study of creativity, including those that focus only on prodigious individuals (see e.g., Runco, 2007; Sternberg, 1999), it is Guilford's approach that is adopted in this thesis, measuring creative potential in a range of young people with a divergent thinking task. The ability to think outside of the box is likely to be useful in adverse situations, such as those often encountered by homeless young people. Indeed, it could be that creative thinking is well-developed in homeless young people, as a result of adaptation to their undesirable surroundings and/or situations, and could represent a protective factor contributing to resilience (Cohen, 2012; Damian & Simonton, 2015; Ritter et al., 2012; Runco, 2007; Simonton, 2000). There is some preliminary evidence that lends support to this idea (Dahlman, Bäckström, Bohlin, & Frans, 2013), which is discussed as part of the systematic review in Chapter 2.

### ***Development of Executive Functions and Influencing Factors***

This section explores what is understood about the development of executive functions, particularly related to adolescence and emerging

adulthood, how this corresponds to brain development in this period, and factors that may affect executive function development. Although some executive functions appear to emerge during early childhood, maturation continues into emerging adulthood and possibly beyond, corresponding to the protracted development of the prefrontal cortex (Best & Miller, 2010; Blakemore, 2012; Casey, Tottenham, Liston, & Durston, 2005; Huizinga et al., 2006; Jurado & Rosselli, 2007; Selemon, 2013; Steinberg, 2005; Zelazo & Carlson, 2012). There is some evidence that different executive function domains may have different developmental trajectories, and this may relate to differential development of the regions of the prefrontal cortex associated with their function (Best & Miller, 2010; Blakemore & Choudhury, 2006; Huizinga et al., 2006; Jurado & Rosselli, 2007).

Looking at brain development in adolescence and emerging adulthood, it is evident that prefrontal cortex is not only the last area to develop fully, but that there are key differences in its structure and function during development. Several studies have found structural changes, in that grey matter decreases during adolescence, reaching adult levels around age 30. Conversely, white matter, representing functional changes, increases steadily up until approximately 22 years old. These changes are most marked and emerge last in the prefrontal cortex (e.g., Blakemore, 2012; Casey et al., 2005; Selemon, 2013; Steinberg, 2005). Linked to this, a recent study found that segregation of the frontal lobes into modules or sub-regions of white matter networks was increased during adolescent brain development and further that the strengthening of these module boundaries was linked to improvements in executive functioning during the transition to adulthood

(Baum et al., 2017). Reflecting back to Zelazo's theory of 'hot' and 'cool' executive function, there is some evidence that 'hot' executive functions develop later than 'cool' executive functions, and this is complemented by evidence that the ventromedial prefrontal cortex, one of the regions associated with 'hot' executive function, may develop at a different rate to other regions of the frontal lobe (Happaney et al., 2004; Steinberg, 2005; Zelazo & Carlson, 2012). A similar disparity in development during adolescence and emerging adulthood concerns the relatively late emergence of executive functions and maturation of related brain areas, which aid regulation and control of emotions and impulses, compared to the onset of the emotional turmoil and impulses of puberty (e.g., Blakemore & Choudhury, 2006; Dahl, 2004; Spear, 2000; Steinberg, 2005; Yurgelun-Todd, 2007), a metaphor for which was coined by Dahl as "starting the engines with an unskilled driver" (Dahl, 2004, p. 17).

Thus far we have seen what typical development of executive functions and related brain development looks like; in this section, factors that may disrupt or impact on executive function development that are likely to relate to homeless young people's experiences are considered. Two major factors that are commonly experienced by homeless young people and have been linked to executive function development are maltreatment / early life stress and poverty. Across a range of ages, maltreatment was related to poorer executive functioning and working memory (DePrince, Weinzierl, & Combs, 2009; Masson et al., 2015; Wenzel & Gunnar, 2013), and familial trauma explained unique variance in EF performance after controlling for anxiety, socioeconomic status, and potential brain injury (DePrince et al., 2009).

Childhood maltreatment was also found to predict poorer executive functioning in adulthood (Nikulina & Widom, 2013). More broadly, early life stress is associated with executive function difficulties (among other cognitive difficulties) and the protracted development of the prefrontal cortex renders it particularly vulnerable to the effects of early adversity (Pechtel & Pizzagalli, 2011).

Young people living in poverty have demonstrated worse performance on executive function and working memory tasks than their relatively better off counterparts, and socioeconomic status has been associated with executive function and working memory across a broad range of income (Farah et al., 2006; Noble, McCandliss, & Farah, 2007). The relationship between poverty and school achievement was also found to be mediated by executive functioning (Lawson & Farah, 2017). In their review of socioeconomic status and its effects on brain development, Hackman and Farah concluded that socioeconomic status was an important predictor of executive function, and even when performance was equivalent, there were differences in brain function (Hackman & Farah, 2009).

Both maltreatment / early adversity and poverty / socioeconomic status represent factors that can impact negatively on the development of executive functions and associated brain regions. Given the increased likelihood of these factors occurring in homeless young people, it is likely that executive function development, and corresponding brain development, may be compromised. However, in a recent longitudinal study of young people and families being investigated by welfare services, housing instability

(operationalised as number of moves in the previous 12 months) was found to affect cognitive development more generally from pre-school age to adolescence over and above the effects of poverty and maltreatment, as well as other risks (Fowler et al., 2015). Altogether, this indicates that homeless young people are at particular risk for underdeveloped brain regions and connectivity supporting cognition due to their unstable housing situation, on top of vulnerability for sub-optimal development of executive functions by virtue of probable early adversity and lack of economic resources.

The development of executive functioning has been considered a key characteristic of adolescence and emerging adulthood, marking developmental periods of cognitive achievement (Crone, 2009). Adolescence and emerging adulthood have also been considered sensitive periods for the development of both executive function and the prefrontal cortex, meaning increased susceptibility during these periods to environmental influences, such as those described above (Blakemore & Choudhury, 2006; Fuhrmann, Knoll, & Blakemore, 2015; Selemon, 2013; Steinberg, 2005). This can be construed as positive as well as negative, in that adolescence and emerging adulthood may represent a time when adverse environmental influences may have a particularly negative impact, but also that there are opportunities during this period for intervention and training (Casey et al., 2005; Knoll et al., 2016; Masten, 2014). Indeed, executive functions have demonstrated improvements with practice coupled with concurrent changes in brain structure and function (e.g., Masten, 2014; Zelazo & Carlson, 2012), and although there are some questions as to whether training generalises to other tasks and domains (see e.g., Shipstead, Redick, & Engle, 2012), attempts to

train executive functions have been found to benefit disadvantaged young people, with improvements not only in the trained task, but also in untrained tasks and in academic achievement more broadly (e.g., Holmes & Gathercole, 2014; Jolles & Crone, 2012). A recent study demonstrated feasibility for a cognitive skills training intervention, including executive functions, in homeless young people (Medalia, Saperstein, Huang, Lee, & Ronan, 2017), which indicates there is potential for intervention with executive functions in this vulnerable group during adolescence and/or emerging adulthood.

To summarise this section, the varied definitions and conceptualisations of executive functions among researchers have hindered interpretation, but some common threads can be drawn. Executive functions represent higher-level cognitive processes that are often recruited for novel situations and/or goal-directed behaviour, and are important for many facets of everyday functioning. Traditionally, executive functioning has been linked to the frontal lobes, but there is increasing recognition of the importance of connectivity between areas. A common challenge with the study of executive functions is that tasks tend to measure more than one component or cognitive process, and that what are considered executive functions vary between studies. The main theoretical debate in this area is whether executive functions represent a single system or multiple connected systems, though there is evidence for a combination of the two (the unity and diversity model). Theories of types of executive function ('hot' and 'cool') and of the executive components of working memory were also introduced, as well as the idea of creative thinking as a domain of executive functioning. The development of executive functions and related structural and functional

changes in associated brain regions continues through adolescence and into adulthood, with different components of executive function and their proposed corresponding sub-regions in the brain demonstrating differential developmental trajectories. In addition to housing instability itself, homeless young people are likely to have been exposed to maltreatment or early adversity and/or come from economically disadvantaged backgrounds, increasing their risk for compromised executive function development. On a more positive note, adolescence and emerging adulthood are likely to represent key periods of opportunity for training or intervention to improve executive functions, and there is some emerging evidence for the feasibility of this endeavour in homeless young people. The next section moves on to briefly introduce the concept of mental health as it relates to this thesis.

### **Mental Health in Young People**

Adolescence and emerging adulthood contain common ages of onset for many mental health problems, including depression and anxiety (American Psychiatric Association, 2013; Kessler et al., 2007; Patel, Flisher, Hetrick, & McGorry, 2007; Paus, Keshavan, & Giedd, 2008). The most recent survey undertaken in England indicated that in 16-24 year olds rates of current (past week) generalised anxiety were 6.3%, 2.3% reported having had a depressive episode in the past week, and 8.4% did not meet criteria for any single anxiety or depressive disorder but had an overall high score across current anxiety and depression symptoms, defined as having a combination of anxiety and depression not otherwise specified (McManus, Bebbington, Jenkins, & Brugha, 2016). These rates were very similar to the worldwide rates reported

for anxiety and depression in a recent meta-analysis in children and adolescents (Polanczyk, Salum, Sugaya, Caye, & Rhode, 2015).

Anxiety is defined in DSM-5™ as involving excessive fear and anticipation of what might happen in the future, and encompasses a set of disorders, from generalised anxiety disorder and panic disorder to more specific disorders such as phobias and social anxiety (American Psychiatric Association, 2013). Generalised anxiety disorder, for example, requires that excessive worry or fear is present most days and feels out of control, and can include the following symptoms: feeling restless or on edge, fatigue, problems thinking and remembering, being irritable, tense, problems sleeping (American Psychiatric Association, 2013; Ruscio et al., 2017). In people diagnosed with anxiety disorders, symptoms (like those described above) impact on functioning in a variety of areas and induce distress (American Psychiatric Association, 2013; Beesdo, Knappe, & Pine, 2009).

According to DSM-5™ (American Psychiatric Association, 2013), the key indicators of depression are low mood and loss of interest in activities that previously were enjoyable or held interest. Other symptoms include: problems with weight, sleep problems, fatigue, psychomotor problems, feelings of worthlessness or guilt, thoughts of dying, problems thinking, concentrating, and making decisions. As with anxiety disorders, these affect function across a range of domains and cause distress (American Psychiatric Association, 2013; Kessler et al., 2003). Both anxiety and depression can affect cognition, and there is accumulating evidence that executive functions are impacted in those with depression (Castaneda, Tuulio-Henriksson,



Marttunen, Suvisaari, & Lönnqvist, 2008; Evans, Kouros, Samanez-Larkin, & Garber, 2016; Iorfino, Hickie, Lee, Lagopoulos, & Hermens, 2016; McClintock, Husain, Greer, & Cullum, 2010; Snyder, 2013; Wagner, Müller, Helmreich, Huss, & Tadić, 2015) and anxiety (Airaksinen, Larsson, & Forsell, 2005; Castaneda et al., 2008; Fujii et al., 2013; Iorfino et al., 2016; Shackman et al., 2006), though this may vary by type of anxiety disorder (Airaksinen et al., 2005; Castaneda et al., 2008; Iorfino et al., 2016). It follows that there is a probable link between executive functioning and experience of anxiety and/or depression.

Mental ill health is extremely common in homeless young people, with 88% screening for any current psychiatric disorder and 73% screening for comorbid disorders (Hodgson, Shelton, & van den Bree, 2014). Rates of anxiety in homeless young people vary between 22% and 32% and rates of depression have been found between 12% and 33% (e.g., Cauce et al., 2000; Hodgson, Shelton, van den Bree, & Los, 2013; Saperstein, Lee, Ronan, Seeman, & Medalia, 2014). The minimum reported prevalence rates for homeless young people represent almost four times and six times the rates of anxiety and depression, respectively, compared to young people from the general population (see previous paragraph for percentages; McManus et al., 2016), and more than three and 4.5 times the worldwide rates (6.5% and 2.6%, respectively; Polanczyk et al., 2015). There are a number of reasons as to why homeless young people may be more vulnerable to mental health difficulties, and it is likely there is a bi-directional relationship whereby those with poor mental health are more likely to become homeless in the first place, in addition to homelessness as a risk factor for mental illness (e.g.,

Hodgson et al., 2013). The increased likelihood of having experienced adversity at a young age is one potential contributory factor, as ACEs have been found to be associated with and predict poor mental health (Beesdo et al., 2009; Björkenstam, Vinnerljung, & Hjern, 2017; Chapman et al., 2004; Dahl et al., 2017; Green et al., 2010; Moffitt et al., 2007). A related factor is exposure to chronic stress, as the stress of homelessness on top of other probable stress-inducing factors is likely to accumulate and lead to dysregulation of the stress regulation system, which has also been linked to the development of mental health problems (Hammen, 2005; McEwen, 2003). In addition, living in poverty has been identified as a risk factor for psychiatric disorder across the world (Beesdo et al., 2009; Kessler et al., 2003; Lorant et al., 2003; Moffitt et al., 2007; Najman et al., 2010; Patel & Kleinman, 2003; Ruscio et al., 2017). As homeless young people have increased vulnerability to both poor executive functioning and mental ill health, and there is some evidence for a link between the two, it was important to explore this potential link as part of this thesis (see Chapter 5).

### **Summary, Rationale, and Aims**

This chapter has provided background and context to the work described in this thesis, with investigation of the current literature in this area to follow in Chapter 2. First, we saw that youth homelessness is a real problem, with official estimates hiding those who are ‘hidden homeless’, and that it is likely to get worse for young people with incoming welfare changes, such as the housing benefit cuts for 18-21 year olds and the change to Universal Credit. These changes are at the macrosystem level, and are likely to impact on young people’s risk for homelessness through proximal

processes, for example escaping a toxic family environment to live with friends peripatetically as they cannot afford more stable accommodation of their own. Homeless youth are a distinct group from homeless adults and families, due to their unaccompanied status and differences in factors contributing to homelessness in this group. Young people in poverty and those aging out of foster care are two groups considered at risk for homelessness. Theoretical perspectives relevant to homeless young people were considered and include: ecological theories, theories of accumulating / amplifying risk and risk on a continuum, chronic stress, early adverse experiences, and scarcity. All of these perspectives indicate homeless young people are likely to have difficulties with executive function. However, resilience approaches suggest that there may be some areas of executive functioning that represent positive development or adaptation among homeless young people, with some evidence that this is the case (e.g., Buckner et al., 2003, 2009; Masten, 2014; Masten et al., 2012). As such, in Chapter 3 I aim to explore the profile of executive function in homeless young people to identify areas of strength and need. This is then compared to executive functioning in housed young people in Chapter 4. In addition, the concept of developmental cascades suggests that positive effects of intervening in one area can impact on other areas of functioning and subsequent development, with implications for the application of the results of this thesis.

Adolescence and emerging adulthood represent sensitive periods of development that may provide opportunities as well as vulnerabilities, and have been identified as key periods of development for executive functions

and related brain regions. For this reason, I chose to recruit young people in transition between adolescence and emerging adulthood, aged 16-19 years. However, the systematic review presented in Chapter 2 has a wider age focus (16-24 years), though still encompassing late adolescence and emerging adulthood. This is owing to the scarcity of research on cognitive functioning in homeless young people and groups at risk for homelessness, as well as the wide age bands used in studies in this area, which tended to span multiple developmental periods. Executive functions are higher-level cognitive functions that are crucial for being able to adapt to new situations, and likely to be important for obtaining and maintaining accommodation, as well as everyday living. To examine the importance of executive functions for homeless young people, in Chapter 5 I explore the possibility that executive functions could predict short-term housing outcomes in the homeless group. Executive functions are closely linked to frontal lobe function and connectivity. One of the most prominent theories of executive functions envisages them as distinct but related constructs, and this seems to be consistent with the evidence. Executive functions that are influenced by emotion and motivation have been distinguished from those that are more logical and rational, and these 'hot' executive functions are considered more representative of everyday decision making. Accordingly, a range of tasks were included in the current study, tapping both 'hot' and 'cool' executive functions. Homeless young people have often experienced early life stress or maltreatment and/or poverty, which represent two factors associated with compromised executive function development, though housing instability itself is also a risk factor for sub-optimal cognitive development. It has been

demonstrated that it is feasible to intervene to train executive function skills as part of a broader cognitive skills training programme in homeless young people. This is very promising in terms of potential for improvement and application of the findings in this vulnerable group.

Creativity can be thought of as part of executive functioning; it has been identified as a potentially adaptive way of thinking that may be helpful in adverse situations, and there is preliminary evidence that street youth are better at more creative thinking than young people who are not living on the streets. This is something I aim to explore in this thesis (in Chapter 4), to investigate whether the finding holds for homeless young people not living on the street. Problems with mental health are very common in homeless young people, including the common mental disorders of depression and anxiety, and there is a lot of evidence to suggest that there is a link between depression and/or anxiety and executive functions. As homeless young people have increased vulnerability to depression, anxiety, and likely also executive function difficulties, the possibility of a link between them is investigated in Chapter 5. For the homeless group, potential interactions between executive functions, depression and anxiety in predicting short-term housing outcome were also explored.

This thesis broadly aims to examine executive functioning (including creativity) in homeless young people, compared to housed young people, and potential relationships with mental health and housing-related outcomes. Unlike many other studies in the area and in accordance with resilience approaches, I am looking for positive development in addition to

vulnerabilities. This work will address gaps in the literature in that it will assess a broad range of executive function domains and include an age-matched comparison group, as well as consider how executive functions can impact on homeless young people's lives, specifically their mental health and pertinent short-term outcomes. The work presented here is the first in the United Kingdom to investigate executive functions in homeless young people and, to the author's knowledge, the first in the world to explore whether executive functions can predict short-term housing outcomes in homeless young people. The principal aims of this thesis are as follows:

1. To review the current literature in the broader area of cognitive functioning in homeless young people, compared to two groups at-risk for homelessness and young people without experience of homelessness, to inform the main study (Chapter 2).
2. To profile executive functions in homeless young people, identifying domains of strength and need (Chapter 3).
3. To compare the executive function profile with that of a comparison group of housed young people, noting similarities and differences (Chapter 4).
4. To explore links between executive functions and depression and anxiety in homeless and housed young people (Chapter 5).
5. To explore whether executive function performance would predict housing outcome at least six months later in homeless young people, and whether this was influenced by depression and/or anxiety (Chapter 5).

Chapter 6 goes on to discuss the findings in the context of the current literature and theoretical perspectives presented here, as well as consider implications for practice. This chapter provides context around youth homelessness, presents theoretical perspectives that informed the work, explains key concepts, provides a brief overview of mental health in young people, and presents the aims and rationale for the thesis. The next chapter moves on to systematically review the broader literature around cognitive functioning in homeless young people, those who are care leavers or living in poverty and therefore at risk for homelessness, and young people who have not experienced homelessness. The focus then shifts to how the review informs the thesis and concludes with a re-iteration of the aims.





## CHAPTER 2: SYSTEMATIC REVIEW

This chapter builds on the background and context for this thesis and relevant theoretical perspectives which were presented in Chapter 1 by reporting on a systematic review conducted as part of the thesis. Whilst the other chapters in this thesis concentrate on executive functions in young people 16 to 19 years old, initial scoping searches revealed a dearth of studies in this area; therefore the scope of the systematic review was broadened to published literature relating to all areas of cognitive functioning, and the age band extended to encompass 15 to 24 years, a period commonly considered as 'youth' (United Nations, 2007). As such, the purpose of the systematic review was to examine published literature relating to cognitive functioning in homeless young people compared with housed young people and two populations of young people who are considered at risk of homelessness, care leavers and young people in poverty, with the ultimate aims of summarising the available literature, highlighting specific areas requiring further study, and informing this doctoral work. Any links between cognition and mental health reported in the included studies were also explored. The work in this chapter has been published in a peer reviewed journal:

Fry, C. E., Langley, K., & Shelton, K. H. (2017). A Systematic Review of Cognitive Functioning Among Young People Who Have Experienced Homelessness, Foster Care, or Poverty. *Child Neuropsychology*, 23(8), 907-934.

Young people who have experienced homelessness, foster care, or poverty are among the most vulnerable in society, due to experiences

including unstable housing, disrupted schooling, scant resources, and inadequate social and psychological support (e.g., Bradley & Corwyn, 2002; Haber & Toro, 2004; Stein, 2005). They may also have multiple risk factors which could accumulate to increase the likelihood of unfavourable outcomes (Sameroff, Seifer, Baldwin, & Baldwin, 1993). Masten, Miliotis, Graham-Bermann, Ramirez, and Neemann (1993) proposed a continuum of risk, in which those with greater exposure to adversity and more risk factors present are less likely to adapt successfully than young people without such exposure. In general, homeless young people are considered to be at the extreme end of this continuum, due to being exposed to multiple adverse experiences and stressors, in addition to the stress of homelessness itself (Buckner, 2008; Masten et al., 1993).

However, there is no consensus on the cognitive profiles of homeless young people and whether these are consistent with a continuum of risk. Cognitive functioning could be an important factor in increasing the risk for becoming homeless, as well as presenting barriers to exiting homelessness, for example by contributing to the breakdown of family relationships (Backer & Howard, 2007; Milburn et al., 2009). Poverty and homelessness tend to be intertwined, including a high prevalence of a history of poverty among homeless adults (Patterson, Moniruzzaman, & Somers, 2015). Similarly, studies of young people aging out of care found an increased likelihood of homelessness (Courtney & Dworsky, 2006; Dworsky, Napolitano, & Courtney, 2013; Fowler, Toro, & Miles, 2009), and studies of homeless adults have identified a high level of foster care in childhood (Patterson et al., 2015; Roos et al., 2014). Together, this suggests that members of each of these groups

may be at different points on the same trajectory. In other words, poverty and foster care groups include a disproportionate number of people 'at risk' for homelessness, theoretically placing the groups at different points along the same continuum of risk (Masten et al., 1993). This indicates that there are factors common to young people who have experienced homelessness, foster care, or poverty, including instability at home and school, reduced access to resources and opportunities, and a relative lack of social support (e.g., Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Milburn et al., 2009). However, less is known about how these factors relate to cognitive development and consequently result in poorer outcomes.

To date, there has not been a review and synthesis of the literature on cognition in these groups of young people, making it difficult to establish any commonalities in cognitive profiles. Cognitive skills can be referred to as thinking skills that underlie academic competence and successful adaptation (Sternberg et al., 2000). It is possible that, in the context of disadvantage, cognitive skills and abilities may constitute a key set of 'tools' that set apart those who adapt well and make effective use of the resources available to them and those who do not (e.g., Masten & Coatsworth, 1998). Domains of cognition include memory, attention, verbal ability, and higher-order thinking processes known as the executive functions. This review focuses on cognitive functioning in young people who have experienced homelessness, comparing them both to young people with similar adverse experiences (i.e., poverty and foster care) who are at risk for homelessness, and to young people who do not have these experiences.

The United Nations' definition of youth spans the period of 15-24 years of age (United Nations, 2007), encompassing both late adolescence and emerging adulthood (18-25 years; Arnett, 2000). There is evidence that late adolescence and emerging adulthood form a sensitive period of development, with numerous changes occurring in the brain; the frontal lobes in particular are still developing (Blakemore, 2012). Thus, it is important to consider the cognitive profiles of particularly vulnerable groups of young people, including those who have experienced homelessness, foster care and poverty with a view to developing appropriate interventions and support.

### **Homelessness**

It has been estimated that there are over 100 million children and youth living on the streets worldwide (Thomas de Benitez, 2007). This is likely to be an underestimate of the true figure: homelessness often encompasses not only those who live on the street, but also those living in unsuitable accommodation, such as bed and breakfasts or youth hostels (Toro, Dworsky, & Fowler, 2007), and those who live peripatetically with acquaintances and friends (Reeve & Batty, 2011). It is possible that aspects of cognitive functioning among young people who have experienced homelessness contribute, or make it more difficult, to secure and maintain accommodation. This may be because of problems or deficits in the ability to make informed decisions, problem-solve, plan, and because of limited social skills (Backer & Howard, 2007).

There remains a distinct paucity of research on the cognitive profiles of homeless youth during late adolescence and emerging adulthood, especially

compared to homeless adults and children within homeless families (e.g., Parks, Stevens, & Spence, 2007). The only previous systematic review in this area, Parks and colleagues (2007), identified just two studies conducted with homeless adolescents that met very broad inclusion criteria: one falling outside of our date range, compared glue-sniffing street youth with street youth who did not sniff glue (Jansen, Richter, & Griesel, 1992), the other used self-ratings of ability rather than objective cognitive tests (Ryan, Kilmer, Cauce, Watanabe, & Hoyte, 2000).

### **Foster Care**

In 2013, just over 400,000 children and youth were in foster care in the United States, with around 50,000 leaving care between the ages of 16 and 20 years (US Department of Health & Human Services, 2014). Some estimates indicate that 30-40% of young people in care experience four or more changes of placement, with up to 10% experiencing ten or more placements (Stein, 2005). Young people leaving care are at high risk of becoming homeless, which is likely to be exacerbated by cognitive impairment (Backer & Howard, 2007; Kerman, Wildfire, & Barth, 2002). Indeed, 57% of children in foster care have been reported to have language delays and 33% cognitive delays, compared to 4 to 10% prevalence in the general population (Leslie et al., 2005).

Reviews of young people in foster care have typically used academic tests or educational attainment as an index of cognitive development, rather than objective cognitive tests (e.g., Stein, 2005). Young people who have experienced foster care are more likely to have experienced disrupted

schooling, with potential implications for academic attainment (Pecora et al., 2006). Therefore, it is probably more instructive to focus on measures of cognitive functioning, including memory, attention, planning, and problem solving.

## **Poverty**

Just over 75 million children and youth live in poverty in the world's wealthiest countries (UNICEF, 2014). Young people living in poverty are likely to lack not only financial resources, but also material, social, and cultural resources (Bradley et al., 2001). The poorest children and adolescents in some of the wealthiest countries are at risk for reduced memory capacity, impaired cognitive development and lower educational achievement (UNICEF, 2010). Indeed, many studies have demonstrated cognitive deficits in low socio-economic status (SES) children compared to high SES children (Brooks-Gunn & Duncan, 1997).

A systematic review of cognitive functioning for an adolescent age group living in poverty has not been published. Bradley and Corwyn's (2002) comprehensive review investigated the effect of SES on children's development and identified a link between SES and both IQ and verbal ability. It remains to be established if this finding generalises to adolescence and emerging adulthood.

## **Mental Health**

It is well established that there are higher rates of mental illness in those who have experienced homelessness, foster care, or poverty than in the general population (e.g., Akister, Owens, & Goodyer, 2010; Hodgson, Shelton,

van den Bree, & Los, 2013; Patel & Kleinman, 2003). For example, Hodgson and colleagues (2013) found that among young people who had experienced homelessness, 88% screened for any current mental health disorder and 73% for comorbid mental health disorders, compared to 32% and 12% respectively in the age-matched general population. Specifically, prevalence of anxiety disorders was 49% (vs. 4%), 42% screened for substance dependence (vs. 11%), rates of PTSD were 36% (vs. 5%), prevalence of mood disorders was 19% (vs. 2%), and psychosis was present in 7% (vs. 0.2%). Poor mental health has well-documented relationships with lower levels of cognitive functioning in both psychiatric and general populations (e.g., Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008). Indeed, Baune and colleagues reviewed the literature on neuropsychological functioning in adolescents and emerging adults with Major Depressive Disorder (MDD) and found a broader range of cognitive deficits in those with MDD compared to controls (Baune, Fuhr, Air, & Hering, 2014). A recent meta-analysis also found that adolescents with MDD displayed impaired performance on tasks of executive function compared to their healthy peers (Wagner, Müller, Helmreich, Huss, & Tadić, 2014). It is especially important to examine relationships between mental health and cognitive functioning in disadvantaged populations, such as young people who have experienced homelessness, foster care, or poverty. While cognitive skills and abilities have been found to be associated with adaptive behaviour (e.g. Clark, Prior, & Kinsella, 2002), these groups are more likely to face challenging situations, as well as having higher rates of mental illness, than peers without these experiences, which may compromise adaptation and recovery from adversity.

## Potential Implications

Although there are mixed findings for the effectiveness of cognitive skills training (see Klingberg, 2010, Melby-Lorvåg & Hulme, 2012, Morrison & Chein, 2011, and Shipstead, Redick, & Engle, 2012, for discussion), there is some evidence that it may be beneficial to low SES children (Jolles & Crone, 2012). There is also tentative evidence to suggest that cognitive skills training in certain domains can lead to broader benefits, for example in academic performance (Holmes & Gathercole, 2014). These findings suggest that aspects of cognitive functioning may be a good target for intervention, which could in turn lead to broader, long-term benefits for young people who have experienced homelessness, foster care, or poverty.

Given the lack of synthesised data in this area, our aim was to review and synthesise across three literatures to address four key questions:

1. Do young people who have experienced homelessness, foster care, or poverty differ from young people without such experiences, with respect to cognitive skills and abilities?
2. If they differ, which areas of cognitive functioning are impaired and/or enhanced?
3. Does cognitive functioning differ between the three groups?
4. Among the studies included in this review, is cognitive functioning associated with mental health disorders in young



people who have experienced homelessness, foster care, or poverty?

## Methods

This systematic review was completed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009), a checklist for ensuring the transparent reporting of systematic reviews that is recognised worldwide. An electronic search of Web of Science (Thomson Reuters), MEDLINE(R) and PsycINFO (both via Ovid), was conducted. Articles published from January 1, 1995 to February 1, 2015 were searched, using the search strategy detailed in Table 1. A manual citation search was also conducted.

*Table 1. Search strategy.*

	Operator	Definition
#1	Homeless Keywords	homeless OR roofless OR "sofa surfing" OR shelter OR "temporary accommodation" OR "bed and breakfast" OR street OR hostel OR "fixed abode" OR "couch surfing" OR tramp OR vagrant OR refuge
#2	Poverty Keywords	poverty OR poor OR "low SES" OR "low socioeconomic status" OR "low income" OR benefits OR welfare OR "free school meals" OR subsidi\$ed OR unemployed
#3	Foster care Keywords	"foster care" OR careleavers OR "care leavers"
#4	Boolean operator	#1 OR #2 OR #3
#5	Age group Keywords	"young people" OR youth OR adolescen\$ OR "young adults" OR teen\$ OR "young men" OR "young women"
#6	Cognitive Keywords	cogniti\$ OR "executive function" OR "executive dysfunction" OR attention OR memory OR "working memory" OR "thinking skills" OR "problem solving" OR language OR "decision making" OR planning OR inhibition OR "set shifting" OR reasoning OR flexibility OR fluency

#7	Boolean operator	#4 AND #5 AND #6
#8	Limits language	English language
#9	Limits date	1995-2015
#10	Limits subjects of studies	Human
#11	Limits types of studies	Journal article
#12	Boolean operator	#7 AND #8 AND #9 AND #10 AND #11
#13	Selection	Duplicates removed Articles not meeting inclusion criteria manually excluded

Papers were screened using inclusion and exclusion criteria decided in advance. Only journal articles were included; other types of publication were excluded. Although the United Nations' definition of youth, 15-24 years (United Nations, 2007), was used following the decision to expand the age range initially (as described in the introduction to this chapter), a number of studies using wide age bands meant the age criteria had to be reconsidered. Because of the relative lack of research on youth in these areas, studies were not excluded if they overlapped the target age range (15-24 years; United Nations, 2007) and the mean age was 11 years or older, as this is often the recognised onset of adolescence (Spear, 2000).

Firstly, having removed duplicates, studies were screened by title and abstract. One hundred studies were subsequently subjected to full-text screening; articles that did not meet the inclusion criteria were excluded. All stages were checked by two researchers independently and any discrepancies were resolved by discussion. For some studies, more information was needed if they were to be included. In this instance, the corresponding authors of the papers were contacted. Two authors kindly provided the data requested

(Flouri, Mavroveli, & Panourgia, 2013; Staiano, Abraham, & Calvert, 2012). A manual citation search of the 26 included studies yielded five additional studies which met inclusion criteria, making a total of 31 included studies (see Figure 2).

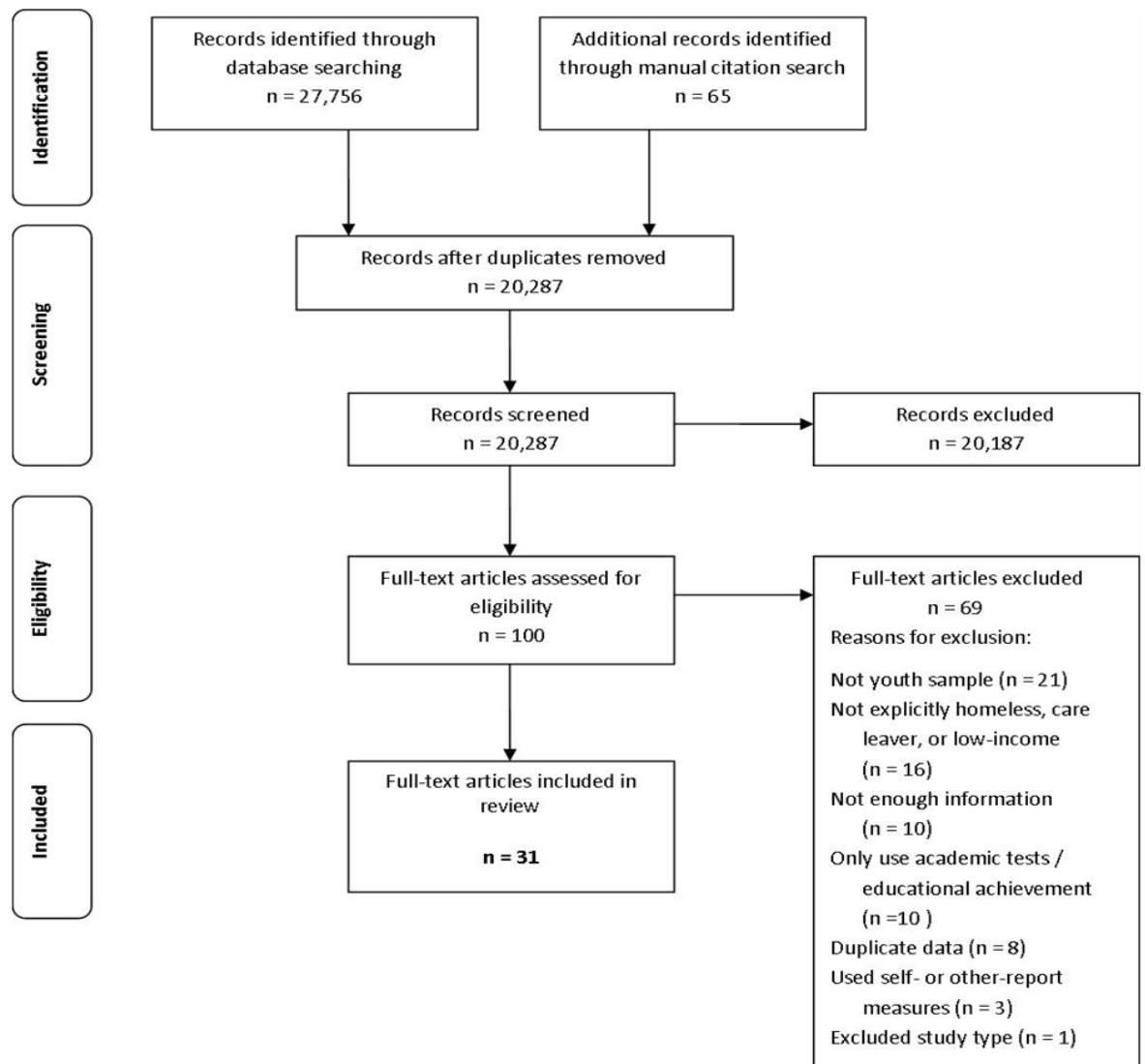


Figure 2. PRISMA flow diagram depicting the systematic review process.

Information extracted included study/participant characteristics, relevant descriptive and inferential statistics, putative risk(s) and outcome(s) of interest, how the authors interpreted their results, and any relations with

mental health identified. Where studies had not used relevant comparison groups, comparisons with published norms were made where possible (see Table 2).

An adapted version of the Newcastle Ottawa Scale (NOS; Wells et al., 2000) was used to assess the quality of methodology and reporting of the included studies. Each study was categorised by design as case-control, cohort, or norm-comparison, and assessed on items relating to three areas: selection (i.e., definition of homelessness/foster care/poverty, representativeness, selection of comparison group), comparability (i.e., controlling for relevant factors), and outcome (i.e., method of assessment, follow-up/non-responders). One star was awarded where the criteria were met (e.g., where cognitive performance was assessed using validated objective cognitive tests). Two stars could be awarded for comparability (e.g., controlled for education and other factors). The maximum number of stars that could be awarded differed by design, as some criteria were not applicable. Ratings from two or more independent researchers were compared, averaging 95% agreement, and disagreements resolved by discussion to reach consensus. In their comprehensive review of quality assessment tools, Deeks and colleagues (2003) recommended only the NOS and five other tools for use in systematic reviews, out of 194 tools identified, based on their coverage of core internal validity criteria.

The authors decided that it would be inappropriate to conduct meta-analyses on the data yielded by this review because the studies were too heterogeneous in terms of definitions of homelessness, foster care, and

poverty, cognitive tests used, design, and type of sample (Egger, Smith, & Sterne, 2001).

## **Results**

Thirty-one articles were included in the review: 22 used samples of young people who had experienced poverty, six used samples of young people who had experienced homelessness, and three used samples of young people who had experienced foster care. The majority of these were conducted in the United States ( $n = 18$ ), with the rest in South America ( $n = 4$ ), Canada ( $n = 2$ ), Sweden ( $n = 2$ ), Israel ( $n = 2$ ), the UK ( $n = 1$ ), the Caribbean ( $n = 1$ ), and the Seychelles ( $n = 1$ ). Fourteen studies were based on cross-sectional design, while another 10 used longitudinal methods. The remainder used a retrospective design ( $n = 3$ ) or were randomised control trials ( $n = 4$ ). All-male samples were used in three studies, two of which used military conscription data, and the third because of anticipated differences between male and female street children.

### ***Cognitive Domains and Tests***

The majority of studies investigated general cognitive functioning ( $n = 18$ ), however there was also good representation of individual cognitive domains: executive function ( $n = 10$ ), learning and memory ( $n = 10$ ), attention ( $n = 7$ ), and language ( $n = 3$ ). Often studies assessed more than one domain. Learning and memory are intrinsically linked, with different types of learning often falling under the umbrella of non-declarative memory (e.g., Squire, 2004). Tests used to assess these cognitive domains varied extensively from

those used for military conscription tests to memory paradigms. Full details of the tests used in each article can be found in Table 2.

## ***Definitions***

### *Homelessness*

Definitions of homelessness ranged from those literally living on the street to the formerly homeless. Four studies had samples of current or former street youth (Borges-Murphy et al., 2012; Dahlman et al., 2013; Pluck et al., 2015; Rohde et al., 1999), with varying requirements for duration, but all samples were generally unsupervised by adults and had no stable place to stay. Only two had comparison groups: low-income housed youth recruited from similar programs (Dahlman et al., 2013), and age-matched adolescents (Borges-Murphy et al., 2012). Saperstein and colleagues (2014) recruited young adults enrolled for at least one month in a residential and vocational support program for homeless young people. As this scheme was designed to facilitate transition to independent living, and the majority of participants were in employment, these young people were in a relatively more stable position than those living on the street. In Rafferty, Shinn, and Weitzman's (2004) study, formerly homeless adolescents had spent between one night and 56 months in emergency shelter. The comparison group had been on welfare in the six months prior to recruitment and had not been in shelter in the past month.

### *Foster care*

The definitions provided by studies in the foster care category demonstrated considerable heterogeneity. Vinnerljung and Hjern (2011)

identified participants through the National Child Welfare Register (Sweden). Data for those who had entered foster care before 7 years of age and had remained in care for at least 12 years prior to age 18 were compared to both an adoption group and a majority population group. Participants in Kira, Somers, Lewandowski, and Chiodo's (2012) study were asked about foster care experiences as part of the Cumulative Trauma Scale. Foster care was classed as an attachment disruption and therefore a potentially traumatic event. Berger, Bruch, Johnson, James, and Rubin (2009) defined out-of-home care as having been removed from home between the initial and follow-up assessments (approximately 2.5 years). However, this included group homes, emergency shelters, psychiatric hospitals, residential treatment facilities, detention centres, and temporary accommodation. This heterogeneity and overlap with the homeless populations in other studies makes interpretation of the results for foster care difficult.

Table 2. Characteristics and key findings of studies included in the systematic review.

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Homelessness						
Borges-Murphy et al. (2012)	Brazil	11-16	16 youth in shelters 11 age-matched controls	Selective attention Memory	Non-verbal dichotic listening test Memory for verbal and non-verbal stimuli	Homeless youth had significantly lower mean scores than age-matched controls.
Dahlman et al. (2013)	Bolivia	10-17	36 street-involved male youth 31 housed low SES male youth	Executive function General cognitive functioning Creativity	WCST-64 Children's Colour Trails Test Leiter-R Alternative Uses Task	Street youth performed at a similar level to low SES youth on tests of executive function and general cognitive functioning, yet significantly outperformed low SES youth on a test of creativity/divergent thinking.



Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Pluck et al. (2015)	Ecuador	10-17	37 former street youth	General cognitive functioning	WASI: Block Design, Matrix Reasoning	Former street youth had very low mean raw scores <sup>a</sup> .
Rafferty et al. (2004)	United States	11-17	45 formerly homeless youth  86 low SES never homeless youth	General cognitive functioning	WISC-R: Similarities	No significant difference found between groups, with both scoring about 1SD below the normative mean <sup>a</sup> .
Rohde et al. (1999)	United States	16-21	50 street youth	General cognitive functioning	WAIS-R	Street youth performed within the average range <sup>a</sup> , with stronger performance IQ scores compared to verbal IQ scores.
Saperstein et al. (2014)	United States	18-22	55 homeless youth enrolled in a residential and	Verbal memory  Working memory	WMS-IV  CVLT-II	64% of homeless youth scored 1SD below the normative mean in at least one cognitive domain, with particular impairments in memory and working

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
			employment program	Attention Processing Speed Executive function	WAIS-III D-KEFS: Selected subtests	memory. Full scale IQ was in the low average range, approximately 1SD below the normative mean <sup>a</sup> .
Foster care						
Berger et al. (2009)	United States	7-17	342 young people who have experienced out-of-home placement  2,111 young people who have not experienced out-of-home placement	General cognitive functioning	Kaufman Brief Intelligence Test	No relationship was found between out-of-home placement experience and cognitive functioning. Mean raw scores for both groups were just over half of the maximum score on both subtests <sup>b</sup> .
Kira et al. (2012)	United States	11-17	12 youth who have experienced foster care (out of a larger sample who have	General cognitive functioning	WISC-IV	Foster care experience was significantly negatively related to working memory. Full scale IQ for the whole sample (all 'attachment

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
			experienced 'attachment traumas')	Working memory		traumas') was just over 1SD below the normative mean <sup>a</sup> .
Vinnerljung & Hjern (2011)	Sweden	18 (inferred as not given in the paper)	1,551 male youth who have experienced foster care 464,848 male youth from the majority population	General cognitive functioning	Military conscription intelligence test	Youth who had experienced foster care performed just over 0.5SD below majority population youth.
Poverty						
Alaimo et al. (2001)	United States	12-16	2,063 youth from a representative national sample (NHANES-III)	General cognitive functioning	WISC-R: Block Design, Digit Span	Poverty Index Ratio (higher = higher income) was significantly positively associated with cognitive functioning.

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Campbell et al. (2002)	United States	21	23 young adults from low SES families who had not received any intervention	General cognitive functioning	WAIS-R	Both mean full-scale IQ and verbal IQ were low average compared to norms, whereas performance IQ was within the average range <sup>a</sup> .
Chappell & Overton (2002)	United States	15-24	268 youth in 10 <sup>th</sup> grade, 12 <sup>th</sup> grade, or college  Median split into low SES and high SES groups but <i>n</i> for each group not given	Reasoning	Overton's Selection Task: General solution score	High SES students scored significantly higher than low SES students.
Coles et al. (2002)	United States	13-17	53 youth from low SES families who had not been prenatally exposed to alcohol	Sustained attention	Continuous Performance Test-type task	Non-exposed low SES youth scored over 1SD below the mean of a normative sample <sup>c</sup> .

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Evans & Schamberg (2009)	United States	17-18	195 young adults, approximately half below the poverty line and half middle SES  Exact <i>n</i> not given	Working memory	Simon game	Proportion of childhood spent in poverty was significantly negatively related to working memory in young adults. Middle SES young adults had a higher average working memory span than low SES young adults.
Flouri et al. (2013)	United Kingdom	10-19	280 secondary school students eligible for free school meals  1083 secondary school students not eligible for free school meals	General cognitive functioning	Raven's Standard Progressive Matrices Plus	Eligibility for free school meals was significantly associated with lower cognitive functioning.
Goldberg et al. (2011)	Israel	16-17	811,487 youth from a national sample	General cognitive functioning	Modified Otis-type intelligence test	SES was significantly positively related to cognitive functioning.

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
					Verbal analogies Non-verbal analogies	
Hackman et al. (2014)	United States	10-18	304 youth recruited from schools  SES was assessed as a continuous measure	Working memory	Corsi Blocks Spatial Working Memory Object Two-back WISC-IV: Digit Span Backwards	Low parental education was significantly associated with lower scores on working memory tasks.
Hemmingsson et al. (2007)	Sweden	18-20	44,995 males from a national sample  54.9% low SES, exact <i>n</i> not given	General cognitive functioning	Military conscription cognitive test	As a general pattern, there were higher percentages (60-70%) of low SES males in the lower IQ bands (below average), than in the higher IQ bands (30-50%).

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Howell et al. (2006)	United States	13-17	53 youth from low SES families who had not been prenatally exposed to alcohol	General cognitive functioning	WISC-III	Non-exposed low SES youth had mean full-scale IQ scores in the borderline range, with verbal and performance IQ scores just falling into the low average range <sup>a</sup> .
Ivanovic et al. (2000)	Chile	17-19	16 non-undernourished low SES young adults	General cognitive functioning	WAIS (Spanish)	All IQ scores for non-undernourished low SES young adults were within the average range <sup>a</sup> .
Johnson et al. (2010)	Canada	19-26	132 low SES young adults without speech/language impairment	Language General cognitive functioning	Peabody Picture Vocabulary Test-III WAIS-III: Selected subtests	Higher family SES and maternal education in childhood were associated with higher scores on a language task in young adulthood. Childhood language scores significantly predicted occupational SES in young adulthood. Full-scale IQ for young adults without speech or language impairment was average compared to norms <sup>a</sup> .

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Kobrosly et al. (2011)	Seychelles	17	463 youth from a national sample (SCDS)	Executive function Learning Attention Memory Working memory	CANTAB: Selected subtests	SES was significantly positively associated with performance on all tasks.
Kramer et al. (1995)	United States	12-16	849 youth from a national sample (NHANES-III)	General cognitive functioning	WISC-R: Digit Span, Block Design	Family income was significantly positively related to performance. Maternal education below high school level was significantly associated with lower cognitive functioning.
Lupien et al. (2001)	Canada	15-16	24 low SES high school students	Memory Language	Declarative memory task	No significant differences between low SES and high SES students were found on memory or language tasks. Low SES students significantly



Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
			34 high SES high school students	Selective attention	Verbal fluency task  Visual detection task	outperformed high SES students on the selective attention task.
Myerson et al. (1998)	United States	14-21	2726 high school and college students from a national sample (NLSY)	General cognitive functioning	Armed Forces Qualification Test	SES was significantly positively related to cognitive functioning in both high school and college students.
Ornoy et al. (2010)	Israel	12-16	27 low SES youth who had not been prenatally exposed to drugs  51 high SES youth who had not been prenatally exposed to drugs	General cognitive functioning	WISC-III	Non-exposed high SES youth had significantly higher scores on the majority of subtests than non-exposed low SES youth. Scores on the Picture Arrangement subtest did not significantly differ between the two groups.

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Robey et al. (2014)	United States	14-16	46 youth from low SES families who had not been prenatally exposed to drugs	Prospective memory Executive function Working memory Verbal Memory Attention General cognitive functioning	Memory for Future Intentions Task D-KEFS: Colour-Word Interference Test CANTAB: Spatial Working Memory California Verbal Learning Test-Children Conners' Continuous Performance Test-II	Non-exposed low SES youth made approximately twice as many between-search errors on a working memory task, scored between average and mildly atypical on a test of sustained attention <sup>e</sup> , and scored within 1SD of the normative mean on tests of executive function <sup>f</sup> and verbal memory <sup>g</sup> . Full-scale IQ was within the average range <sup>a</sup> .

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
					WASI: Matrix Reasoning, Vocabulary	
Skoe et al. (2013)	United States	14-15	33 high school students from low SES families  33 high school students from high SES families	Working memory  General cognitive functioning	WASI  Woodcock-Johnson Test of Cognitive Abilities: Numbers Reversed, Auditory Working Memory	Students with low maternal education scored significantly lower on working memory than students with high maternal education, however IQ for both groups did not significantly differ and fell within the average range <sup>a</sup> .
Staiano et al. (2012)	United States	15-19	54 low SES school students  Baseline scores were used (before intervention)	Executive function	D-KEFS: Design Fluency, Trail Making	As a total D-KEFS score was calculated by summing the raw scores on the two subtests, no comparisons could be made.

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
Tine (2014)	United States	17-21	21 low SES college students who did not receive any intervention  18 high SES college students who did not receive any intervention  Pretest scores were used	Selective attention	d2 Test of Attention	High SES college students significantly outperformed low SES college students at pre-test.
Walker et al. (2005)	Jamaica	17-18	64 non-stunted youth from low SES neighbourhoods who had not received any intervention	Reasoning Working memory Language General cognitive functioning	Raven's Standard Progressive Matrices  Digit Span Backwards  Corsi Blocks	Non-stunted low SES youth had extremely low scores (below the 5 <sup>th</sup> percentile) on a test of cognitive functioning compared to normative data <sup>h</sup> . Working memory raw scores were within 1SD of the normative mean <sup>i</sup> .

Study	Country	Age range	Sample size and groups used	Cognitive domains	Cognitive tests	Key findings
					Peabody Picture Vocabulary Test WAIS	

*Note.* CANTAB = Cambridge Neuropsychological Test Automated Battery™, CVLT = California Verbal Learning Test™, D-KEFS = Delis-Kaplan Executive Function System™, NHANES-III = National Health and Nutrition Examination Survey, NLSY = National Longitudinal Survey of Youth, SCDS = Seychelles Child Development Study, SES = socio-economic status, WAIS = Wechsler Adult Intelligence Scales™, WASI = Wechsler Abbreviated Scales of Intelligence™, WCST-64 = Wisconsin Card Sort Test™-64 Card Version, WISC = Wechsler Intelligence Scales for Children™, WMS = Wechsler Memory Scale™.

<sup>a</sup> Flanagan & Kaufman (2009), <sup>b</sup> Bain & Jaspers 2010), <sup>c</sup> Chen Hsiao, Hsiao, & Hwu (1998), <sup>d</sup> De Luca et al. (2003), <sup>e</sup> Strauss, Sherman, & Spreen (2006), <sup>f</sup> Homack, Lee, & Riccio (2005), <sup>g</sup> Donders (1999), <sup>h</sup> Raven (2000), <sup>i</sup> Wilde, Strauss, & Tulsky (2004).

## *Poverty*

Almost all of the included studies indexed poverty using SES. Indicators of SES were diverse across studies: parental education ( $n = 15$ ), parental occupation ( $n = 7$ ) and family income ( $n = 10$ ), were used either in combination or isolation. One study used eligibility for free school meals. A handful of studies used indicators to calculate ratios ( $n = 3$ ), such as a Poverty Index Ratio, where annual family income and family size were compared to the federal poverty line (e.g., Alaimo, Olson, & Frongillo, 2001). Some studies used indexes ( $n = 6$ ), for example the Hollingshead Social Status Index (Hollingshead, 2011). Neighbourhood SES was assessed in six studies, either as a single indicator or in combination with other indicators of SES. Indicators were measured in different ways: some were split into categories or levels, others used a median split, and still others used a continuous measure.

## *Quality Assessment*

Overall ratings ranged from between one out of six stars ( $n = 1$ ) to six out of seven stars ( $n = 4$ ), with the majority of studies receiving at least half of the total stars they could have been awarded (total available differs depending on design, see Table 3). Twelve studies scored 70% or greater overall. However, several studies did not present basic demographic and descriptive data. Reporting of definition and duration of homelessness, foster care, or poverty was variable, and several studies had limitations associated with sampling. Often studies used convenience sampling (e.g., from local hostel or other support program) or the sampling methods were not sufficiently described. For example, some studies recruited participants from poor or low-income neighbourhoods, or described participants as from poor

backgrounds, without further explanation. Many studies did not attempt to control for number of years of education. Relevant comparison groups were lacking in a third of studies ( $n = 11$ ). Although many studies used standardised tests, the measures reported varied greatly. In addition, whether the scores were raw or converted to standard scores was inconsistent. This limited the extent to which comparisons could be made across studies.

### ***Comparisons to Young People without Experience of Homelessness, Foster Care, or Poverty***

Seven of the included studies compared young people who had experienced homelessness, foster care, or poverty to a group without these experiences. Young people from low SES families tended to perform at a lower level on tests of general cognitive functioning (Chappell & Overton, 2002; Ornoy et al., 2010, but see Skoe et al., 2013), and working memory (Skoe et al., 2013) than their high SES counterparts. No differences were found in memory or language performance (Lupien et al., 2001). One low SES group demonstrated superior performance compared to the high SES group on a selective attention task (Lupien et al., 2001), though Tine (2014) found the opposite. Young people who had experienced homelessness demonstrated poorer performance on selective attention and memory tasks compared to age-matched controls (Borges-Murphy et al., 2012). In the foster care category, Vinnerljung and Hjern (2011) found impaired general cognitive functioning in young people who had experienced foster care compared to the general population. Overall, young people who had experienced homelessness, foster care, or poverty seemed to show cognitive difficulties to a greater extent than peers without these experiences.

### ***Comparisons to Norms***

A further nine studies were compared to available norms (two by the authors themselves) for the cognitive tests used (see Table 2). Performance of young people who had experienced poverty tended to be below the normative averages in the domains of general cognitive functioning (Campbell et al., 2002; Howell et al., 2006; Walker et al., 2005; but see Ivanovic et al., 2000) and sustained attention (Coles et al., 2002; Robey et al., 2014). Conversely, young people who had experienced poverty were comparable with norms on tests of verbal memory and executive function (Robey et al., 2014). Performance on tests of working memory was variable (Robey et al., 2014; Walker et al., 2005). In the homeless category, Saperstein and colleagues (2014) found impaired performance compared to norms in their sample on tests of general cognitive functioning, executive function, working memory, attention, and verbal memory. General cognitive functioning was also found to be low in Pluck and colleagues' (2015) sample of former street youth. However, Rohde and colleagues (1999) found general cognitive functioning to be within the average range of performance among street youth. Collectively, the poverty groups tended to show performance below the normative averages across a range of cognitive domains, albeit with inconsistencies, and there was some evidence of low general cognitive functioning among homeless young people.



Table 3. Quality Assessment of included studies using adapted Newcastle-Ottawa Scale (NOS).

Study	Design	Selection				Comparability		Outcome		
		Definition / ascertainment of exposure	Representativeness	Selection of non- exposed /controls	Definition of controls	Based on study design or analysis (max. 2 stars)	Assessment of outcome	Same method of ascertainment	Follow-up/ non- responders	
Homelessness										
Borges- Murphy et al. (2012)	Case- control	-	-	-	-	-	★	★	★	-
Dahlman et al. (2013)	Case- control	★	-	★	★	-	★	★	★	-
Pluck et al. (2015)	Norm comparison	-	-			-	★	★		-
Rafferty et al. (2004)	Case- control	★	-	★	★	-	★	★	★	★
Rohde et al. (1999)	Norm comparison	★	-			-	★	★		★
Saperstein et al. (2014)	Norm comparison	-	-			★	★	★		-
Foster care										
Berger et al. (2009)	Cohort	★	-	★		-	★	★		-
Kira et al. (2012)	Cohort	-	-	★		-	★	★		-

Study	Design	Selection			Comparability		Outcome		
		Definition / ascertainment of exposure	Representativeness	Selection of non- exposed /controls	Definition of controls	Based on study design or analysis (max. 2 stars)	Assessment of outcome	Same method of ascertainment	Follow-up/ non- responders
Vinnerljung & Hjern (2011)	Cohort	★	★	★		- ★	★		★
Poverty									
Alaimo et al. (2001)	Cohort	★	★	★		- ★	★		-
Campbell et al. (2002)	Norm comparison	★	★			- ★	★		-
Chappell & Overton (2002)	Cohort	★	-	★		★ ★	★		-
Coles et al. (2002)	Norm comparison	-	-			- ★	★		-
Evans & Schamberg (2009)	Cohort	★	-	★		- ★	★		-
Flouri et al. (2013)	Cohort	★	★	★		- ★	★		★
Goldberg et al. (2011)	Cohort	★	★	★		- ★	-		★
Hackman et al. (2014)	Cohort	★	-	★		- ★	★		★

Study	Design	Selection			Comparability		Outcome		
		Definition / ascertainment of exposure	Representativeness	Selection of non- exposed /controls	Definition of controls	Based on study design or analysis (max. 2 stars)	Assessment of outcome	Same method of ascertainment	Follow-up/ non- responders
Hemmingsson et al. (2007)	Cohort	★	★	★		- ★	-		★
Howell et al. (2006)	Norm comparison	★	-			- ★	★		-
Ivanovic et al. (2000)	Norm comparison	★	-			★ ★	-		-
Johnson et al. (2010)	Norm comparison	★	★			- -	★		-
Kramer et al. (1995)	Cohort	★	★	★		- ★	★		★
Kobrosly et al. (2011)	Cohort	★	★	★		- ★	★		★
Lupien et al. (2001)	Case- control	★	-	★	★	★ ★	-	★	-
Myerson et al. (1998)	Cohort	★	★	★		- ★	★		-
Ornoy et al. (2010)	Case- control	★	-	-	-	- ★	★	★	-
Robey et al. (2014)	Norm comparison	-	-			- ★	★		★
Skoe et al. (2013)	Case- control	★	-	★	★	★ ★	★	★	-

Study	Design	Selection			Comparability		Outcome		
		Definition / ascertainment of exposure	Representativeness	Selection of non- exposed /controls	Definition of controls	Based on study design or analysis (max. 2 stars)	Assessment of outcome	Same method of ascertainment	Follow-up/ non- responders
Staiano et al. (2012)	Norm comparison	-	-			- -	★		-
Tine (2014)	Case- control	★	-	★	★	- -	★	★	-
Walker et al. (2005)	Norm comparison	-	-			- ★	★		★

*Note.* ★ denotes star awarded for item, - denotes star not awarded for item, grey denotes that the item was not applicable (dependent on design). The maximum number of stars that could be awarded differed by design: case-control = 9, cohort = 7, norm comparison = 6.

### ***Associations with Cognitive Functioning***

Eleven studies investigated relationships between experiences of poverty or foster care and cognitive functioning. The relationship between homelessness and cognitive functioning was not examined in any study. Higher levels of poverty were consistently associated with impairments in general cognitive functioning (Alaimo et al., 2001; Flouri et al., 2013; Goldberg et al., 2011; Johnson et al., 2010; Kramer et al., 1995; Myerson et al., 1998), working memory (Evans & Schamberg, 2009; Hackman et al., 2014), and language (Johnson et al., 2010), as well as executive function, attention, learning and memory (Kobrosly et al., 2011). One study reported a greater percentage of low SES young men in the lower IQ bands than in the higher IQ bands (Hemmingsson, Essen, Melin, Allebeck, & Lundberg, 2007). Neighbourhood SES was not found to be associated with working memory (Hackman et al., 2014). Results for foster care were mixed: while Kira and colleagues (2012) found an association between foster care and working memory with a small sample ( $n = 12$  with experience of foster care), Berger and colleagues (2009) found no relationship between having experienced out-of-home care and general cognitive functioning. Altogether, poverty was consistently associated with many aspects of cognitive functioning; evidence for a link between foster care and cognition was less clear.

### ***Comparisons Among Young People with Similar Experiences***

Two studies compared young people who had experienced homelessness to housed young people in low SES families (Dahlman et al., 2013; Rafferty et al., 2004). In both cases, no differences were observed between the two groups in terms of general cognitive functioning, though

both groups performed below average. Dahlman and colleagues' (2013) sample were also comparable on measures of executive function; yet the homeless group outperformed the low SES group on a measure of creativity. No other studies made direct comparisons between groups with similar experiences.

Looking across studies, all groups showed impairment on working memory tasks (Evans & Schamberg, 2009; Hackman et al., 2014; Kira et al., 2012; Robey et al., 2014; Saperstein et al., 2014; Skoe et al., 2013). Those who had experienced homelessness or poverty also demonstrated poorer performance on tasks assessing general cognitive functioning, attention, and executive function (Campbell et al., 2002; Howell et al., 2006; Kobrosly et al., 2011; Ornoy et al., 2010; Pluck et al., 2015; Saperstein et al., 2014).

### ***Relationships with Mental Health***

The majority of studies (88%) found cognitive functioning and mental health to be related (see Table 4). All but one study (Berger et al., 2009) found relationships between aspects of mental health and general cognitive functioning (7 of 8).

Table 4. Relations between cognitive functioning and mental health in young people who have experienced homelessness, foster care, or poverty.

Study	Cognitive domain	Aspect of mental health	Test or criteria used	Relationship
<i>Homelessness</i>				
Dahlman et al. (2013)	General cognitive functioning Executive function	Emotion symptoms (pain, worry, sadness, anxiety, fear)	Strengths and Difficulties Questionnaire	No differences between groups. Did not assess potential relationships between cognitive functioning and emotion symptoms.
Pluck et al. (2015)	General cognitive functioning	Post-Traumatic Stress Disorder (PTSD)	UCLA PTSD Index	Street youth with probable PTSD outperformed those without probable PTSD on tests of general cognitive functioning.
Rohde et al. (1999)	General cognitive functioning	Anxiety Depression Suicidal behaviour	State-Trait Anxiety Inventory Centre for Epidemiologic Studies Depression Scale Current, lifetime, and history of suicide	Verbal IQ was negatively related to current depressive symptoms, but not anxiety or suicidal behaviour. No association was found between performance IQ and any of the mental health measures.

Study	Cognitive domain	Aspect of mental health	Test or criteria used	Relationship
Saperstein et al. (2014)	General cognitive functioning Verbal memory Working memory Attention Executive function	Axis I disorders	Beck Depression Inventory Beck Anxiety Inventory Symptom Checklist-90 Revised	63.6% of homeless youth with mental health disorders screened for cognitive impairment. Cognitive impairment and mental health disorder predicted worse outcomes than either alone
<i>Foster care</i>				
Berger et al. (2009)	General cognitive functioning	Internalising / externalising behaviour	Child Behaviour Checklist	No relationship found between general cognitive functioning and internalising or externalising behaviour.
Kira et al. (2012)	General cognitive functioning Working memory	Post-Traumatic Stress Disorder (PTSD)	Clinician Administered PTSD Scale-2 Clinical interview	PTSD was negatively indirectly related to performance on tests of working memory and general cognitive functioning.
<i>Poverty</i>				



Study	Cognitive domain	Aspect of mental health	Test or criteria used	Relationship
Flouri et al. (2013)	General cognitive functioning	Emotional and behavioural problems	Strengths and Difficulties Questionnaire	General cognitive functioning was significantly negatively associated with emotional symptoms and conduct problems.
Goldberg et al. (2011)	General cognitive functioning	Schizophrenia	ICD-10	For those with average to high IQ, SES was not related to schizophrenia. For those with low IQ, high SES was associated with schizophrenia
Ornoy et al. (2010)	General cognitive functioning	Internalising/ Externalising problems  ADHD	Child Behaviour Checklist  Youth Self-Report  Conner's Rating Scales	General cognitive functioning scores were significantly negatively correlated with ADHD and parents' report of internalising and externalising problems. No relationship found between general cognitive functioning and self-reported internalising and externalising problems.

*Note.* ADHD = Attention Deficit Hyperactivity Disorder, ICD-10 = International Statistical Classification of Diseases and Related Health Problems - 10<sup>th</sup> Edition, PTSD = Post-Traumatic Stress Disorder, UCLA PTSD Index = University of California, Los Angeles PTSD Index, SES = socio-economic status.

In one study (Saperstein et al., 2014), 64% of homeless young people with a broad range of mental health disorders also scored one standard deviation or more below the normative mean in one or more cognitive domains, with particular difficulties in verbal and working memory. A negative relationship was found between depressive symptoms and verbal IQ in homeless youth (Rohde et al., 1999). While Kira and colleagues found a negative indirect relationship between PTSD and both working memory and general cognitive functioning in young people who had experienced foster care, Pluck and colleagues found a positive association between PTSD and general cognitive functioning in street youth (Kira et al., 2012; Pluck et al., 2015). Two studies found general cognitive functioning to be negatively associated with internalising symptoms and/or externalising problems in low SES young people, though one found this association for parent-reported problems only (Flouri et al., 2013; Ornoy et al., 2010). No relationship was found between general cognitive functioning and internalising symptoms and/or externalising problems in the foster care group (Berger et al., 2009). Finally, intelligence moderated the relationship between SES and hospitalisation for schizophrenia such that for those with average to high intelligence there was no relationship, but for those with low intelligence *high SES* was associated with schizophrenia (Goldberg et al., 2011). Generally, mental health and cognitive functioning were found to be associated in young people who had experienced homelessness, foster care, or poverty, but some of these relationships were more complex than expected.

## Discussion

This systematic review examined cognitive functioning in both young people who had experienced homelessness, foster care, or poverty, and those without such experience. Thirty-one studies were eligible for inclusion. The search strategy was deliberately broad in an attempt to access all of the relevant studies. By synthesising evidence across three literatures, this review was able to make comparisons both within groups who had experienced homelessness, foster care, and poverty, as well as between these groups and relatively advantaged young people, which has not been done before. In the foster care literature in particular, no reviews had included studies where cognitive functioning had been assessed using objective tests. Reviews in the poverty literature have tended to focus on predominantly child or adult studies (e.g., Bradley & Corwyn, 2002; Hackman & Farah, 2009). Finally, though Parks and colleagues (2007) systematically reviewed literature on cognitive functioning in homeless young people, only two studies were found in the adolescent age range using extremely broad criteria and comparisons with other relatively disadvantaged groups had not been made.

Overall, young people who had experienced homelessness, foster care, or poverty tended to demonstrate poorer performance on cognitive tasks than young people without these experiences, or were found to show below average performance compared to published norms. Poverty was consistently associated with poorer performance across a wide range of cognitive domains, while findings for foster care were mixed. Only two studies found potential strengths: better selective attention among young people who had experienced poverty (Lupien et al., 2001, though see Tine, 2014), and

enhanced creativity among young people living on the street (Dahlman et al., 2013). It could be the case that creativity, or divergent thinking, is more adaptive than convergent thinking (e.g., as assessed by set shifting) in deprived and risky environments such as the street (Cohen, 2012).

Alternatively, greater creativity could increase risk for homelessness through its relationship with greater impulsivity (Feist, 1998), via increased risk-taking behaviour, for example.

Working memory emerged as a likely impairment for all groups, with poorer performance on attention and executive function tasks apparent in young people who had experienced homelessness and poverty. General cognitive functioning was most consistently impaired in young people who had experienced poverty or homelessness, with conflicting findings for the foster care group. Where direct comparisons were made between disadvantaged groups, no differences in performance were found for low SES young people and homeless young people on tests of general cognitive functioning and executive function, though the performance of both groups was below average compared to norms. However, as the effect sizes were small, it is debatable as to whether the sample sizes used in these studies were large enough to have been able to detect a difference.

In the studies that assessed mental health in addition to cognitive functioning, relationships were identified between mental health and general cognitive functioning, attention, executive function, and memory. Generally, mental health problems (depression, PTSD, internalising symptoms, externalising problems) were associated with lower levels of cognitive

functioning, with two exceptions (Goldberg et al., 2011; Pluck et al., 2015; see Table 4). In homeless young people, 64% of those with one or more psychiatric disorders also demonstrated impaired cognitive functioning compared to norms, especially in verbal and working memory (Saperstein et al., 2014). However, this is only a preliminary examination of the relationship between cognition and mental health in young, disadvantaged populations. More research is required to understand the interplay between cognitive functioning and mental health in vulnerable young people.

The results suggest that at least some young people who have experienced homelessness, foster care, or poverty have less well-developed cognitive skills and abilities than those without such experiences. Whether cognitive difficulties precede or develop as a result of homelessness, foster care, or poverty experiences, or indeed both, is undetermined. However, what is clear is that these young people are likely to be especially vulnerable, particularly given the relationships found with mental health problems. Shared difficulties among groups with similar experiences, such as in working memory, suggest that there may be factors common to all disadvantaged groups that are related to cognitive functioning. When directly compared, homeless and poverty groups appeared not to differ in levels of cognitive functioning. However, in terms of stressful experiences and exposure to risk factors, the particular samples used could be argued to be similar, which would theoretically place them in fairly close proximity on the continuum of risk (Masten et al., 1993). Alternatively, as previously noted, the studies may not have had enough statistical power to detect any differences in cognitive functioning had they existed.

In practice, services for groups with adverse experiences (e.g., homeless young people) do not routinely assess cognitive functioning (Solliday-McRoy et al., 2004). Cognitive functioning also tends to be neglected in research in vulnerable young people, with most studies focusing on factors such as trauma, substance use, or mental health (e.g., Toro et al., 2007). The evidence presented here suggests that cognitive functioning may be associated with experiences of homelessness, foster care, or poverty. Two factors that have been identified as resilience-promoting factors are parental support and cognitive functioning (Cutuli & Herbers, 2014; Masten et al., 1999). Young people who have experienced homelessness or foster care are likely to have inadequate support from parents (e.g. Milburn, Rotheram-Borus, Batterham, Brumback, Rosenthal, & Mallett, 2005), and due to added pressures such as needing to work multiple jobs, young people in poverty may receive limited time with and support from parents compared to those who are not experiencing poverty.

In addition, some cognitive skills may show improvement with training (e.g., Løhaugen et al. 2011). Although this is still a controversial area of research (see Klingberg, 2010, Melby-Lorvåg & Hulme, 2012, Morrison & Chein, 2011, and Shipstead, Redick, & Engle, 2012, for discussion), cognitive skills training can be of particular benefit to low SES children (Jolles & Crone, 2012). Furthermore, there is recent evidence of some generalisation beyond trained tasks in a naturalistic setting; participants demonstrated some improvement in both working memory (on trained and untrained tasks) and academic performance in schools following teacher-delivered working memory training (Holmes & Gathercole, 2014). Although most research has focused on

working memory training, it may be that other types of cognitive skills training are more feasible and potentially more effective; further investigation is required. Aspects of cognitive functioning may therefore constitute a potentially promising target for intervention. Late adolescence and emerging adulthood could represent an opportunity to intervene to enhance or increase cognitive functioning among young people because this period encompasses a sensitive period of brain development (Steinberg, 2005). By improving their cognitive functioning, young people who have experienced homelessness, foster care, or poverty may be better able to adapt and subsequently experience more success not only in terms of education and employment, but also everyday living (Sternberg et al., 2000).

There are some limitations to note. Despite broad inclusion criteria, the searches yielded few studies, especially in the homeless and foster care literatures. The definitions and duration of experience of homelessness, experience of foster care, and poverty varied considerably between studies, making it difficult to draw firm conclusions. Related to this, the groups of interest in some studies may have included participants from other disadvantaged groups. For example, one study, which had a broad definition of out-of-home care, likely also included those that were homeless as well as those who had experience of foster care (Berger et al., 2009). The majority of included studies scored 50% or more when quality assessed, with 12 scoring more than 70% overall. Many studies scored poorly on representativeness, for example, using convenience sampling or the sampling methods were not fully described. Often, reporting quality was not sufficient to merit awarding a

star in a given category. Comparison groups were not used in a third of studies.

Attempts were made to reduce the risk of bias when conducting this review by cross-checking of several stages by other researchers, which were then compared and discussed. Possible sources of bias included limiting searches to those articles published in English, as well as including only journal articles. Although the majority of journal articles are peer-reviewed and thus meet many standards for quality, it could be argued that valuable information on the groups of interest was available in the grey literature, that is, research and reports by governments and organisations (such as charities) that are unlikely to have been peer-reviewed. Nevertheless, the focus of this review was objective cognitive tests, which were more likely to be found in journal articles. The markedly high initial return of more than 20,000 articles did raise some concerns, but the search strategy was deliberately broad due to attempting to bridge three separate literatures relating to cognitive functioning.

Considering the potential importance of cognitive skills for adaptation and the added vulnerability cognitive impairment may confer, the relative paucity of research on cognitive functioning in young people with experience of adversity needs to be addressed. In particular, there needs to be more investigation of cognitive functioning in young people who have experienced homelessness or foster care, making comparisons with both disadvantaged and non-disadvantaged groups. The relationship between cognitive difficulties and mental health issues in young people who have experienced



homelessness, foster care, or poverty also warrants examination, as the presence of both has been shown to predict worse outcomes than either in isolation (Saperstein et al., 2014). As most research among vulnerable young people focuses on impairment or negative outcomes, assessment of areas of strength is required to fully explore resilience and positive/adaptive development in this age group, and may offer valuable avenues for intervention. Studying cognition in young people whose cognitive development is likely disrupted is valuable for cognitive and developmental psychology more broadly, as it enables the discovery of potential risk and protective factors to typical cognitive development (Rutter & Sroufe, 2000).

### **How the Systematic Review Informed the Thesis**

This systematic review was completed in the first year of my doctoral research and provided the backbone of the literature available on cognitive functioning, encompassing the scant work on executive functioning in homeless young people already conducted, and offered comparisons with groups who had experienced similar adversity and were also at risk for homelessness. There were many gaps highlighted in the literature reviewed, and there is much more work to be done; the current thesis fills a number of these gaps, but still some remain. Homeless young people are at an important stage in development, they are at an age commonly associated with onset of depression and/or anxiety, EFs are still developing, brain areas managing emotions are still in their infancy, identity is still being explored, peers are an important part of their lives, they are experimenting with substances/sexual behaviour, not to mention the physical and hormonal changes that are still occurring (e.g., Arnett, 2000; Blakemore & Choudhury,

2006; Spear, 2000; Steinberg & Morris, 2001). On top of this, they are likely to also be contending with the impact of early adversity and homelessness itself (e.g., Buckner, 2008; Davies & Allen, 2017). There is some indication from this review that homeless young people may have difficulty with EFs, particularly working memory, potentially adding additional challenges to the large number already being experienced. However, the evidence was mixed and only three studies had considered EF in homeless young people. It is important to note, though, that while there is some work on the difficulties, impairments, and disorders of homeless young people, potentially positive attributes and skills tend to be ignored, except in the notable case of Dahlman and colleagues (2013).

Since 2015, there has been very little research published with homeless young people that would update the review. One study published since our review, by Pluck and colleagues (Pluck, Banda-Cruz, Andrade-Guimaraes, Trueba, 2017), found very low scores on tests of fluid intelligence (Wechsler Abbreviated Scales of Intelligence, WASI, Matrix Reasoning; Wechsler, 1999) and visuospatial ability (WASI Block Design; Wechsler, 1999), as well as poorer performance on two EF tasks in South American street youth compared to non-street youth. The EF tasks were from the Delis-Kaplan Executive Function System (D-KEFS) battery (Delis, Kaplan, & Kramer, 2001). Performance on one EF task (D-KEFS Design Fluency) was explained by fluid intelligence when entered as a covariate, while performance on the other two tasks (D-KEFS Tower and Block Design) remained significantly different to the comparison group. Medalia and colleagues recently conducted a feasibility study into cognitive intervention with homeless young people who had a psychiatric

diagnosis, evaluating cognitive performance at baseline, during intervention, and after intervention (Medalia, Saperstein, Huang, Lee, & Ronan, 2017). Participants were randomly assigned to receive general cognitive activation (learning to use Microsoft Office) or targeted cognitive skills training. At baseline, 56% of all participants scored 1SD or lower than the normative mean on working memory tests, 50% 1SD or below for verbal memory, and 29% 1SD or below for executive function (composite). Both types of intervention seemed to yield improvements in cognitive functioning, particularly in the domains of verbal memory, executive function, working memory, and processing speed. However, improvement findings were preliminary, due to the high drop-out rate. Together, these two studies reinforce the conclusions of the review; homeless young people appear to have difficulties across a range of cognitive domains, including executive functions and working memory specifically.

Following the review, it was still not known what the profile of EF across a range of tasks looked like in homeless young people, and how this compared to a group without experience of homelessness. Further exploration was needed of the hypothesis that homeless young people may excel at a more creative type of thinking, and how EF might be related to other challenges such as mental health in homeless young people required investigation. Of key importance, while EFs can seem like an abstract cognitive concept, it is likely they have real-world implications, both in everyday life and more specifically in obtaining and maintaining tenancies, successfully engaging in education / training / employment, and building support networks. As such, this thesis also examined whether EFs could

predict short-term housing outcome for homeless young people and whether this was influenced by poor mental health. This is, to the author's knowledge, the first study to explore these questions.

In some respects, the work presented in this thesis reflects aspects of a feasibility study (Craig et al., 2008; Medical Research Council, 2006), given the scant literature on EF in homeless young people. As such, qualitative methodological and practical observations, in addition to more formal pilot studies, are recorded with the aim of aiding researchers conducting future work in this area. A specific section reflecting on these observations in detail is included in Chapter 6. Although formal qualitative analyses were not conducted, qualitative information can be useful in assessing feasibility, and likely gives more insight into potential issues than piloting alone (O'Cathain et al., 2015). These observations may inform future recruitment and retention strategies when working with this vulnerable and often chaotic group, as well as highlighting the importance of consulting with and engaging staff within organisations that support homeless young people to gain an understanding of concerns from their point of view and maximise the likelihood of a successful project.

## **Conclusions**

This chapter provided a picture of the current state of the literature in the wider field. According to previous work, cognitive performance of young people who had experienced homelessness, foster care, or poverty tended to be below that of non-disadvantaged peers. The evidence presented in this chapter highlights the importance of cognitive functioning, which may be

neglected in vulnerable populations in favour of more immediate needs (e.g., Backer & Howard, 2007). Cognitive functioning has also, apparently, attracted less research attention among young people with adverse experiences, with a particular dearth of research on cognitive functioning in young people who are homeless or in foster care. Studies instead tend to focus on factors such as mental health, substance abuse, and trauma (e.g., Toro et al., 2007). While these factors are important, cognitive functioning and its potential for positive adaptation should not be ignored. More research is needed in this age range with well-defined groups to provide a clearer picture of cognitive profiles in disadvantaged young people, and investigate how cognitive functioning interacts with mental health, with implications for educational and occupational outcomes.

Based on the findings of this review, this thesis focused on executive functions in homeless young people, exploring the profile of functioning, how this compared to housed young people, whether homeless young people are capable of more creative thinking, how EFs were related to mental health, and how EFs predicted short-term housing outcomes, as well as exploring potential interaction with mental health difficulties. The next chapter explores the profile of EF in homeless young people, including potential areas of strength and average functioning, as well as areas of need or difficulty.



### CHAPTER 3: PROFILE

This chapter explores the profile of executive function in homeless young people. Executive functions can be thought of as distinct but related higher-order cognitive processes (e.g., Gilbert & Burgess, 2008; Miyake & Friedman, 2012). One theory suggests that there are two types of Executive Functions (EFs): hot and cool EFs (Zelazo & Carlson, 2012). Cool EFs are considered as more cognitive and related to prefrontal function, whereas hot EFs are influenced by motivation and emotion, associated more with orbitofrontal function (Happaney, Zelazo, & Stuss, 2004; Zelazo & Carlson, 2012). EFs are considered important for everyday functioning, particularly adapting to unfamiliar situations, and research has indicated experimental measures of EF are related to real-life applications of EF, such as successfully keeping to routines of diet and exercise (e.g., Hall, Fong, Epp, & Elias, 2008). Given executive functions are often thought to coordinate and control other cognitive functions, they are key to functioning in everyday life as well as successfully engaging in education and employment, and have the potential to contribute to building resilience. It is vital we know what the executive function profile looks like in homeless young people, as important barriers to obtaining and maintaining accommodation may be being overlooked by services. This may result in young people not receiving the complete range of support they need, as well as missing potential opportunities to enhance young people's resources and skills, which could impact on future outcomes. In addition, executive functions have been suggested to represent part of a set of 'tools' for positive development in vulnerable young people (e.g., Masten & Coatsworth, 1998). Increased knowledge about the EF profile of

young people with experiences of homelessness is intended to inform the development of effective programmes of support and education for this vulnerable group.

The aim of this chapter is to create an EF profile in homeless young people. As demonstrated in the systematic literature review in Chapter 2, little is known about EF in homeless young people; the evidence is mixed as to whether EF performance is worse than in housed young people, and studies that have considered EF have either covered limited EF domains or combined scores to give an EF composite score (Fry, Langley, & Shelton, 2017). This is a problem because EF domains, while related, are also separable (e.g., Miyake et al., 2000; Miyake & Friedman, 2012). This means important differences in performance between EF domains could be missed. Not understanding these difficulties could be problematic for implementing effective interventions or adaptations to services for young people's specific EF-related needs. To summarise the findings of the review, working memory and selective attention (auditory) emerged as difficulties, whereas overall EF performance and IQ differed between included studies of homeless young people (Fry et al., 2017). In addition, a pilot study with homeless youth as part of a previous collaboration with Llamau found low IQ, in particular verbal IQ (Hodgson, 2014).

In order to fulfil the aim of the chapter to create a profile of EF, it was necessary to have some indication of executive functioning level within the population of late adolescents and emerging adults to assess whether homeless young people performed within the average range of the population.



Normative data is typically used for this purpose. However, because EFs are at a critical stage of development during these age periods, it is not meaningful to compare to either norms for adults or for children from the general population (e.g., Blakemore & Choudhury, 2006; Selemon, 2013). Therefore, the strategy I decided to adopt was to seek comparison papers that matched key characteristics of our sample as closely as possible. Though it is recommended that normative samples contain more than 150 participants (Strauss, Sherman, & Spreen, 2006), it is often the case that smaller samples are used, and even larger samples can become small once stratified by age and sex (Strauss et al., 2006). The sheer variation in administration and measures used even for the same task throughout the neuropsychological literature makes it difficult to find appropriate normative data for comparison purposes (e.g., Lezak, Howieson, Bigler, & Tranel, 2012). The aim for the analysis contained within this chapter, therefore, was to find the most appropriate comparison papers, closely matching both task administration / measures used and participants' age, with a reasonable number of participants.

Based on the results of previous work, predictions for the current study were as follows:

1. Looking across tasks, homeless young people would have lower levels of performance on EF tasks compared to published comparative data.
2. Homeless young people would demonstrate poorer than comparative data performance specifically in the domains of selective attention and working memory.

3. Below average IQ driven by poorer than average performance in the verbal subtest would be expected.
4. As there is a dearth of research into cognitive functioning, and specifically EF, in homeless young people, an additional aim of this chapter was to explore associations between individual factors, such as regular substance use, and EF performance in homeless young people.

## **Methods**

This study was approved by the Cardiff University School of Psychology Research Ethics Committee. The research process comprised a pilot phase (two studies) and the main study phase. Data collection in the main study phase spanned three sites to enable access to two groups: homeless and housed young people. The focus of this chapter is the homeless group. Chapter 4 presents comparison data between the homeless and housed groups.

### ***Pilot studies***

Prior to the main phase of the study, it was important to establish: (1) which EF tasks would be appropriate and inexpensive to use given the range of tests available, (2) how best to engage young people, (3) the feasibility of testing using a laptop with this population, and (4) approximate timings and practice-runs of the procedure. Two pilot studies were conducted, one with young people from Llamau's alternative education project (Learning 4 Life) and one with University undergraduates. Figure 3 summarises the pilot process.

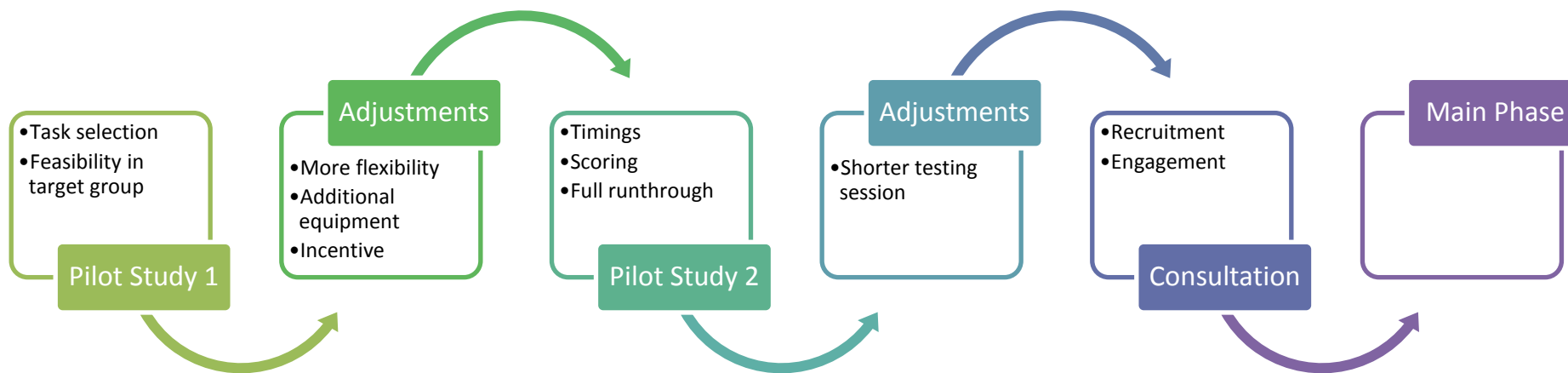


Figure 3. The pilot process.

### *Pilot study 1*

Having identified two batteries of tasks assessing a broad range of executive functions that were free to use, we recruited ten young people currently attending Llamau's Learning 4 Life centre in Cardiff. All of our pilot participants confirmed that they had experiences of homelessness, though this is not a requirement of attending the centre. Learning 4 Life is a series of alternative education centres across South East Wales, provided by Llamau. The aim of Learning 4 Life is to engage those who find it difficult to engage in mainstream education. Young people attending Learning 4 Life are not necessarily homeless; they may be young offenders, or other young people who cannot function in traditional school settings. Basic qualifications in key skills, such as budgeting, are offered, as well as more advanced vocational qualifications certified by Agored (Welsh awarding body). There are also opportunities to get involved with work-based activities and opportunities, such as visits to local companies and interview practice.

The Psychology Experiment Building Language (PEBL) battery consists of over 70 implementations of common cognitive tests (Mueller & Piper, 2014), allowing great flexibility in terms of choice and coverage of EF domains. For the pilot, from the PEBL battery, I chose the Berg Card Sort Test (BCST) an implementation of the Wisconsin Card Sort Test (WCST; Grant & Berg, 1948), the Backwards version of the Corsi Block Tapping Test (Kessels, van den Berg, Ruis, & Brands, 2008), the Hungry Donkey Test (Crone & van der Molen, 2004) a children's version of Bechara's Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994), the Color-Word Stroop task (Stroop, 1935), an implementation of the Tower of Hanoi (ToH; Kotovsky, Hayes, &

Simon, 1985), an implementation of the Tower of London (ToL; Shallice, 1982), and an implementation of the Trail-Making Test (Reitan, 1958) to represent a broad range of executive functions. The EF domain that each of these tasks assesses can be seen in Table 5.

I also chose tasks from the EXAMINER battery. The EXAMINER battery (Kramer et al., 2014) has a limited number of tasks and less flexibility but focuses specifically on executive function. The EXAMINER battery and manual were kindly sent by Kramer's team. The tasks piloted from EXAMINER were Flanker (Eriksen & Schultz, 1979), N-back (Gevins & Cutillo, 1993), and the Unstructured Task. Two sets of tasks were constructed with the aim of comparing tasks that tapped similar executive function abilities. For example, EXAMINER N-back and PEBL Corsi Backwards both measured working memory and were therefore allocated to different task sets to see which was most appropriate to use with this sample. The PEBL Hungry Donkey and EXAMINER Unstructured tasks were completed by all participants. Participants were asked to rate each task in terms of enjoyment, difficulty, boredom, duration, and how easy the instructions were to understand. They were also asked to give an indication at the end of how they found completing the session on the laptop. Questions and rating scales given to pilot participants can be found in Appendix 2. Each participant received a large bar of chocolate as a thank you for participating.

Table 5. Pilot tasks and EF domains.

EF Domain	PEBL battery	EXAMINER battery	Comparisons
Shifting / flexibility	BCST Trail Making	No equivalent	BCST vs. Trail Making
Working memory	Corsi Backwards	N-back	Corsi vs. N-back
Impulsivity / Risky decision making	Hungry Donkey (children's version of IGT)	No equivalent	All participants completed
Selective Attention / Inhibition	Colour-Word Stroop	Flanker	Stroop vs. Flanker
Planning / Problem Solving	Tower of London (ToL) Tower of Hanoi (ToH)	Unstructured Task (pen and paper)	ToL vs. ToH vs. Unstructured Task (all participants completed Unstructured Task)

### *Lessons from piloting*

All bar one participant enjoyed completing the tasks. However, it was apparent we would need to offer strong incentives for participation and be very flexible in the testing session, including offering regular breaks due to the length of the session. An external keyboard and mouse were also essential, as the laptop trackpad was difficult to use and the keyboard was too far away from participants when allowing reasonable distance from the screen. Based on participants' ratings of how enjoyable, difficult, and boring they found the tasks, PEBL Corsi Backwards was preferable to EXAMINER N-back, and PEBL BCST was preferable to PEBL Trail Making, with other tasks

receiving similar ratings to their counterparts. Figures illustrating participants' ratings for each task can be found in Appendix 2. PEBL Hungry Donkey was popular with some participants but felt to be too childish by others, and has not been widely used with youth in the literature. This prompted my decision to use the PEBL implementation of the Iowa Gambling Task (IGT, Bechara et al., 1994) instead. While the EXAMINER Unstructured Task (a pen and paper test of planning) was rated overall as moderately enjoyable, not too difficult, and not too boring, the computer-based Tower of London and Tower of Hanoi tasks were also rated at these levels. It was felt that, as there was no advantage to using the EXAMINER Unstructured over the ToL or ToH, the computer-based tasks should be retained. The final set of tasks for the main study was therefore PEBL BCST, PEBL Corsi Backwards, PEBL IGT, PEBL Stroop, and PEBL ToL. Verbal Fluency, both categorical and phonemic, was also included. The creativity task was not piloted in the first pilot study, as it had been used in one of the studies included in the systematic review with street youth (Dahlman et al., 2013). Similarly, most of the demographic questions were adapted from questions used in a previous project with homeless young people (Hodgson, 2014), so were also not included in the pilot.

### *Pilot study 2*

Once the procedure and tasks were determined, another pilot study was conducted to test the procedure, timings, scoring, and highlight any potential technical difficulties. Five undergraduates from the School of Psychology at Cardiff University (four aged 18 to 21, with one outlier) participated in return for course credit. All participants completed the full

procedure, including questionnaires (detailed in Chapters 4 and 5). Presenting tasks such as Verbal Fluency using Microsoft PowerPoint worked well. On average, participants took one and a half hours to complete the session, ranging from one hour 15 minutes to two hours. As these were participants who routinely used laptops and were likely to have participated in similar experiments, in contrast to homeless young people, it was important to consider ways to reduce the time taken as much as possible. To this end, I decided that, as the 64-card version of the BCST had been found to yield similar results to the full 128-card version (Fox, Mueller, Gray, Raber, & Piper, 2013), this was a sensible switch to make. However, there was extra work involved to be able to report the perseverative errors as defined in Heaton, Chelune, Talley, Kay, and Curtiss (1993), as though calculated automatically in the full BCST in PEBL, this function was not available for the 64-card version.

The plan for the main study was presented at one of Llamau's quarterly Full Team Meetings to get feedback from staff on how best to engage the young people Llamau supported. Ideas from staff included providing food (unhealthy was suggested to be very popular) and vouchers as incentives, being flexible and working around young people's college and training commitments, and not conducting sessions too early in the morning. Staff also suggested that there might be a cascade effect, whereby other young people would want to take part after talking to a participant and hearing about their vouchers. I also consulted the Deputy Chief Executive of Llamau on potential methods of recruitment, ways to foster staff support for the project, and the most effective ways to advertise the project within the



organisation. After consultation and making final changes, the main study phase began.

## ***Participants***

### *Homeless group*

We recruited 76 homeless young people through Llamau. All participants were living in temporary accommodation provided by Llamau in South East Wales at the time of testing. All of the housing projects and staff were contacted to see if they had any potentially interested service users on a rolling basis between February 2016 and November 2016. As staff encouragement was one of the key factors contributing to young people's willingness to participate, it was crucial to take time to build relationships with staff and allay any concerns that sessions might be 'exam-like', as well as keeping in regular communication. For the young people, being flexible in arranging sessions, coming to them (usually at the housing project in which they were currently residing), and being reliable, that is, turning up when arranged to turn up, were crucial to successful recruitment. This is likely because young people had some control over when and where the sessions would be, and had often been let down by the people in their life - arriving at the time and place that was mutually arranged was one way of showing young people that they were important and deserved respect. One additional participant was originally recruited from the comparison group (discussed in Chapter 4), but was living in supported accommodation similar to that provided by Llamau at the time of testing, and was transferred to this group. One participant was excluded as the session was terminated due to illness, three participants were excluded due to heavy consumption of substances 24

hours prior to testing (i.e., either a substantial amount / mix of substances or exceeding their normal use), three participants were excluded due to consuming more than three alcoholic drinks (roughly equivalent to a ‘binge’; Office for National Statistics, 2013) in the 24 hours preceding testing, and one participant was excluded due to having both colour-blindness and dyslexia. This brought the total sample to 69 homeless young people.

*Table 6. Demographic profile of the homeless group.*

		N	%
Age	16	5	7.2
	17	33	47.8
	18	22	31.9
	19	9	13.0
Sex	Male	43	62.3
	Female	25	36.2
	Other/Prefer not to say	1	1.4
Ethnicity	White	61	88.4
	Mixed	2	2.9
	Asian	1	1.4
	Black	3	4.3
	Other	2	2.9
Nationality	British	37	53.6
	Welsh	23	33.3
	African	1	1.4
	Pakistani	1	1.4
	Caribbean	1	1.4
	Other	6	8.7
First language	English	64	92.8
	Filipino	1	1.4
	Oromo (Ethiopia)	1	1.4
	Polish	1	1.4
	Romanian	1	1.4
	Spanish	1	1.4
Handedness	Right-handed	58	84.1
	Left-handed	11	15.9
Substance past 24 hours (light/regular) <sup>1</sup>	Yes	14	20.3
	No	55	79.7
Alcohol past 24 hours (less than 3 drinks) <sup>2</sup>	Yes	3	4.3
	No	66	95.7

*Note.* <sup>1</sup>Anyone with heavier than regular use and/or polysubstance use within the 24 hours prior to testing was excluded. <sup>2</sup>Anyone who had consumed more than 3 alcoholic drinks within the 24 hours prior to testing was excluded.

Participants were aged between 16 and 19 years, with a mean age of 17.5 ( $SD = 0.82$ ). There were more males than females (62% male), with one participant identifying their sex as 'Other'. The majority of participants (93%) indicated they had mostly been living in the housing projects in the month preceding testing. Housing projects for young people supported by Llamau are a mixture of shared houses and individual flats located in urban areas of South East Wales, from Newport to Porthcawl and up to Merthyr Tydfil, accommodating between two and nine people at a time. Most projects are staffed on a 24 hour basis and the majority are mixed sex, with the exception of those falling under women-only services. In most areas, young people are referred to supported accommodation via the Local Authority Gateway referral mechanism, having presented to advice services such as those provided by Llamau or the Local Authority Housing Options team. In the first instance, if it is safe and appropriate to do so, family mediation is offered; if this is inappropriate / unsafe or unsuccessful then a homelessness application is taken. If a young person is under 18 or a care leaver younger than 21, they will also be assessed by a Social Worker. Referral into supported accommodation depends on services' vacancies and young people's needs; Llamau tend to take those with more complex support needs. Young people living in supported accommodation are still considered homeless as the accommodation is classed as temporary and all housing options are considered when a young person is ready to move on, including returning to their family with mediation support. Other responses to main living situation in the past month included two participants living with family or friends, one on the streets, one in foster care, and one in a night shelter/hostel.

Eighty four percent of participants were right handed, and the vast majority (93%) had English as a first language. Although almost two thirds (61%) of participants had not achieved five or more GCSEs (grades A\* to C) or equivalent qualifications, 32% had met or exceeded this standard. Out of the five 16 year olds, two had already achieved GCSEs, two were able to give their predicted attainment which has been included here, and one was yet to sit exams and unsure of predicted grades. Just under half of the sample (48%) had been in foster care at some point in their lives, most of those having more than one placement (73% of those who had experienced foster care). Almost 60% had had contact with the Criminal Justice System in some capacity. Just under a third (30%) reported taking substances (including legal highs) regularly - cannabis was the most commonly used substance - and 13% reported drinking alcohol regularly. More details and raw figures can be found in Table 6 and Table 7.

Initially, all young people who had reported taking substances in the 24 hours prior to testing were going to be excluded, however, this approach quickly became infeasible due to many participants using cannabis regularly. It was also felt that it would be unfair on the young people, who had engaged with the study and were keen to take part, to refuse them the opportunity to participate. As such, the strategy was adjusted so that those who reported heavier than usual substance use and those who reported polysubstance use during the preceding 24 hours were excluded, with those reporting their 'normal' use (all cannabis) remaining.

### *Missing data*

There was one participant with missing data on half of the tasks and missing questionnaires due to refusing to complete the session. Two further participants had missing data on individual tasks due to technical problems. On the self-report mental health questionnaire (discussed in a subsequent chapter), two participants had missing data due to incomplete questions (page missing). There were no more than 5% missing data on any one variable. Little's MCAR test (Little, 1988) indicated that it was highly unlikely that data were systematically missing, and could be treated as if missing completely at random,  $\chi^2(86, N = 69) = 10.51, p = 1.00$ .

*Table 7. Background characteristics of the homeless group.*

		N	%
Past month main Accommodation	Llamau / Other supported housing	64	92.8
	Family or friends' place	2	2.9
	Night shelter / hostel	1	1.4
	On the streets	1	1.4
	Foster care	1	1.4
Remembered having one-to-one support and/or extra time at school	Yes	25	36.2
	Unsure	6	8.7
	No	38	55.1
Age left school (n = 3 still in school)	12	1	1.5
	14	5	7.6
	15	16	24.2
	16	36	54.5
	17	5	7.6
	18	3	4.5
Highest level of education (n = 1 yet to sit exams)	Left school before completing any qualifications	10	14.5
	1-4 GCSEs any grades or equivalent	32	46.4
	5+ GCSEs grades A*-C or equivalent	22	31.9
	2+ A levels or equivalent	3	4.3
	Other	1	1.4
Experience of ever living in residential Care	Yes	11	15.9
	Unsure	1	1.4
	No	57	82.6
Experience of ever living in foster care	Yes	33	47.8
	Unsure	1	1.4
	No	35	50.7
Contact with Criminal Justice System	Yes	39	56.5
	Unsure	1	1.4
	No	29	42.0
Regular substance use (at least once a week)	Yes	21	30.4
	No	48	69.6
Regular alcohol use (at least once a week)	Yes	9	13.0
	No	60	87.0

### ***Materials and Procedure***

We asked participants about themselves and their experiences, including school, foster care, criminality, substance use, and any diagnoses they remembered receiving from a doctor. This interview section was developed with advice from the Deputy Chief Executive of Llamau, and included sections from questions previously used with homeless young people,

some of which were also used in the National Adolescent Health Study (Harris et al., 2009; Hodgson, 2014). We also asked about handedness, vision, and screened for colour-blindness to assess potential barriers to and/or differences in participants' performance. Feedback from a colleague in Optometry and Vision Sciences indicated that using the full Ishihara plates to assess colour-blindness (as was originally planned) was unnecessary and that a simple screen would suffice. This also helped to make the sessions shorter. Screening for colour-blindness involved asking participants to name coloured PowerPoint slides in four standard colours: red, blue, green, and yellow. There were two presentations of each colour, with colours presented in a different order during the second cycle of presentation to the first. Colour-blind participants completed only tasks that did not require discriminating colours. Both colour-blind participants were ultimately excluded completely for other reasons, one due to comorbid dyslexia and the other due to polysubstance use within the 24 hour period prior to testing. One participant did not pass the colour screening but this was interpreted to be a problem with language (i.e., not knowing the different colour names, but could tell they were different) rather than vision, as they did not appear to have difficulty with tasks involving colour in particular. Despite their potential language difficulties, this participant's performance fell within 2SDs of the mean in all tasks and they were therefore not considered an outlier. This participant is included in this chapter, as analyses are mostly descriptive, but is excluded in subsequent chapters where the majority of analyses are inferential so as not to unduly influence the results. Therefore, at this descriptive stage of analysis, all 69 participants have been included.

To assess executive function, we used tests from the Psychology Experiment Building Language (PEBL) battery of tests (Mueller & Piper, 2014), specifically implementations of: Berg Card Sort Test-64 card version (BCST-64), Corsi Blocks Backwards (Corsi), Iowa Gambling Task (IGT), Stroop, and Tower of London (ToL). In addition, we used Letter and Category Fluency (Tombaugh, Kozak, & Rees, 1999), which were not in the PEBL battery. To assess creative potential, or divergent thinking, we used Guilford's Alternate Uses Test (Guilford 1967, as implemented in Dahlman et al., 2013). As appropriate comparison data could not be sourced for the creativity task, it is not included in this chapter. Mental health was assessed with the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), and participants also completed a resource-based measure of socioeconomic status (SES; Currie et al., 2008). These measures are discussed in subsequent chapters. Each test lasted between 3 and 15 minutes. Tasks were given in one of seven different orders to avoid fatigue and order effects. Figure 4 summarises the EF tests and corresponding domains.



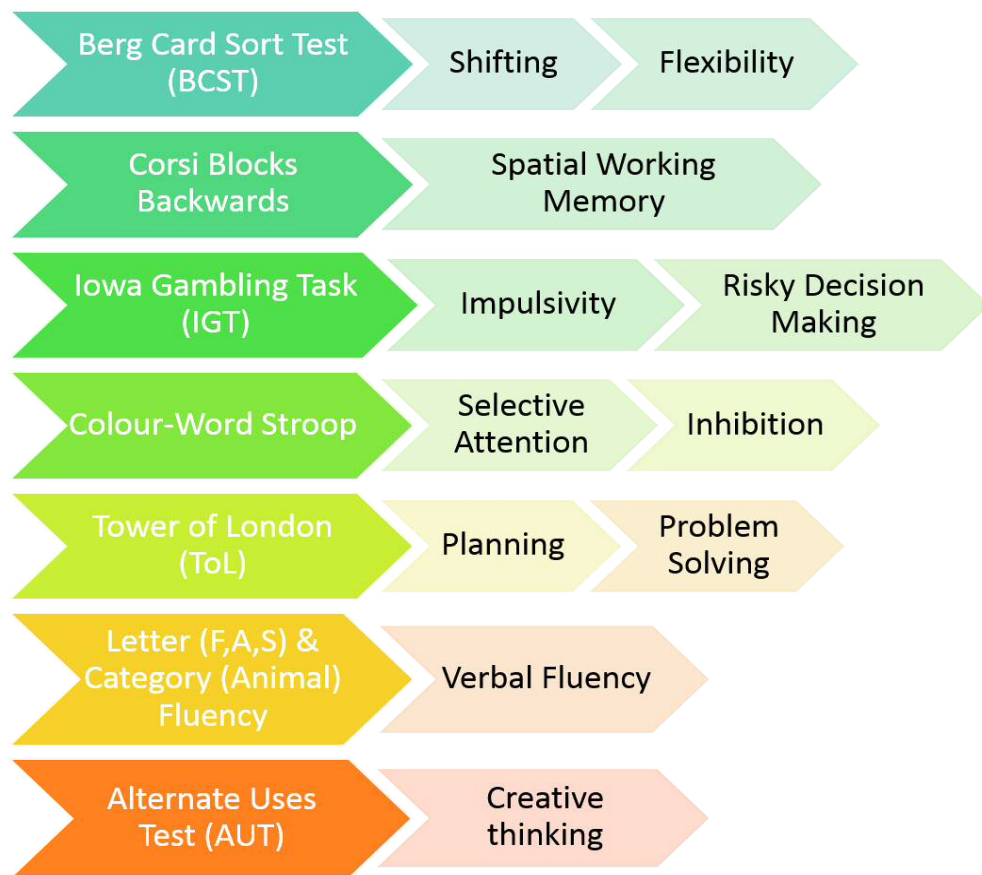


Figure 4. EF tasks and corresponding domains.

(N.B. The Alternate Uses Test is discussed in Chapter 4)

## Tasks

### BCST-64

The Berg Card Sort Test was identical to the well-known Wisconsin Card Sort Test™ (Grant & Berg, 1948). The short 64-card version was used, which has been shown to yield similar results to the full 128-card version - strong correlations were found on all performance measures between the 64 card and 128 card version of the PEBL BCST in a recent study ( $r = .77$  to  $.87$ ; Fox et al., 2013). This test assesses shifting and flexibility. Four stimulus cards represented four piles, each differing in colour, shape, or number.

Participants sorted cards into one of the piles depending on the picture on it and were informed whether their choice was correct or incorrect based on the current rule. Participants were not explicitly told the current rule, the aim was to work out the rule, work out when the rule had changed and adapt their responses as soon as they realised it had changed. The rule changed after ten consecutive correct sorts, with 64 trials in total. The measure of interest was the number of perseverative errors made, that is, the number of times participants continued to sort according to the previous rule. This was calculated manually, using the decision tree provided by Berry (1996) as the basis for creating a scoring spreadsheet in Microsoft Excel. In order to compare with comparative data, the number of perseverative errors was converted into percentage of perseverative errors out of total trials. The original WCST is considered to be a 'gold standard' neuropsychological test, is the most widely used, and has been found to be able to detect frontal lobe damage (Demakis, 2003). Strong correlations between measures on the WCST and WCST-64 ( $r(52) = .82$  to  $.85$ ; Robinson, Kester, Saykin, Kaplan, & Gur, 1991) suggest the short form closely approximates full version performance.

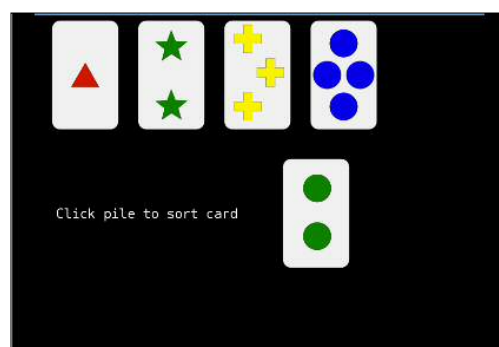


Figure 5. Screenshot of BCST-64.

### *Corsi*

This implementation of Corsi Blocks (Backwards) used the rules and set-up proposed by Kessels (Kessels, van den Berg, Ruis, & Brands, 2008; Kessels, van Zandvoort, Postma, Kappelle, & de Haan, 2000) to assess spatial working memory. Nine blue squares in a set arrangement appeared on the screen. The squares would light up one at a time in a particular sequence, ranging from two to nine blocks in length. After each sequence had finished, participants clicked on the squares in the reverse order to the order in which they were presented. The inter-stimulus and inter-trial intervals were 1000ms. Each length had two sequences: if both were incorrect, the test was terminated. There were three practice trials that were three blocks in length. The measure used was block span (length of the last correct sequence). Corsi Blocks was originally developed by Corsi (1972), and has been widely used since. Split-half reliability has been estimated around  $r = .79$  across the forward and backward versions (Park et al., 2002). Vandierendonck and colleagues found that both visuospatial and executive attention tasks disrupted performance on Corsi Blocks backwards, lending support to its use as a measure of visuospatial working memory (Vandierendonck, Kemps, Fastame, & Szmalec, 2004). Comparisons between a computerised version of Corsi Blocks and the standard version revealed no significant difference in backward span (Claessen, Van Der Ham, Van Zandvoort, 2015).

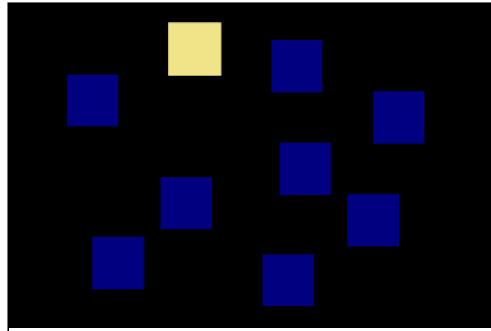


Figure 6. Screenshot of Corsi Backwards.

### *Iowa Gambling Task*

This test was an implementation of Bechara's Iowa Gambling Task (IGT; Bechara, et al., 1994) to assess impulsivity and risky decision making. Participants started with \$2000 of 'borrowed' money and were told the aim was to try to win as much money as possible by selecting decks of cards. Every time a deck was selected, money was won and sometimes lost. The only 'hint' was that some of the decks were worse than others and that avoiding the bad decks was the best way to win. The game ended after 100 trials. The 'safe' decks (C and D) gave less in winnings (\$50) but losses were also small, that is, they yielded a net gain. The 'risky' decks (A and B), however, gave more in winnings (\$100) but losses were also greater, that is, they yielded a net loss. The measure used was response preference (i.e., the number of times participants selected from 'safe' minus 'risky' decks). The link between frontal functioning and IGT performance has been supported by both lesion studies and studies utilising functional neuroimaging (Buelow & Suhr, 2009). Moderate correlations with other EF tasks have also been reported (Buelow & Suhr, 2009). In addition, IGT performance in pathological gamblers has been shown to be substantially worse than controls, suggesting IGT performance is associated with 'real-life' impulsivity and risky decision

making (e.g., Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2005; Dunn, Dalgleish, & Lawrence, 2006).

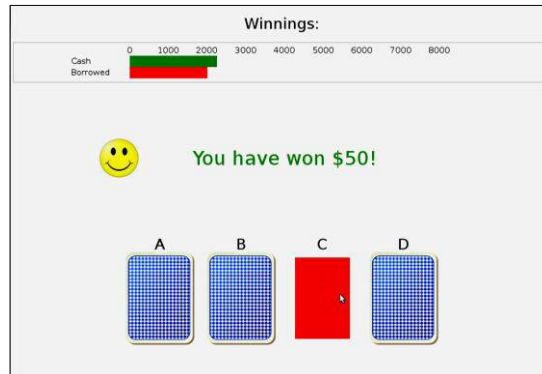
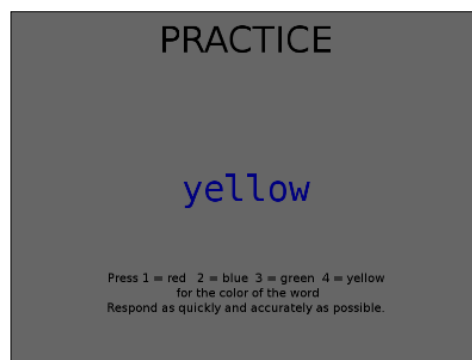


Figure 7. Screenshot of IGT.

### *Stroop*

Selective attention and inhibition were assessed using a colour-word Stroop paradigm. A fixation cross was present for 1000ms, then words appeared on the screen (for a maximum of 3000ms) in different colours: red, blue, green, and yellow. The words could also be the words 'red', 'blue', 'green', or 'yellow'. Participants had to press buttons (1-2-3-4 on the keyboard, marked with coloured stickers) corresponding to the colour the word was written in, ignoring the word itself, as quickly and accurately as they could. It is a well-replicated effect that reaction times are slower when the colours and words are incongruent than when the colours and words match, as there is interference (e.g., MacLeod, 1991). There were 24 practice trials, and 144 trials in total with a break halfway through. The measure of interest was interference (congruent - incongruent RTs, ms), though this was reversed (i.e., incongruent - congruent RTs, ms) for comparison with comparative data. We also checked the proportion correct

for congruent, incongruent, and neutral trials to ensure participants were able to do the task. Stroop performance has been shown to be impaired in patients with frontal damage, and not those with damage in other areas, compared to controls (Demakis, 2004; Stuss, Floden, Alexander, Levine, & Katz, 2001), suggesting some specificity. This was echoed by Homack and Riccio's (2004) conclusion that the Stroop was sensitive to EF difficulties of several disorders in their meta-analysis of Stroop performance in children. MacLeod synthesised 50 years of research on the Stroop paradigm and the well-replicated interference effects, concluding that the reliability and validity of the Colour Word Stroop were reasonable (MacLeod, 1991).



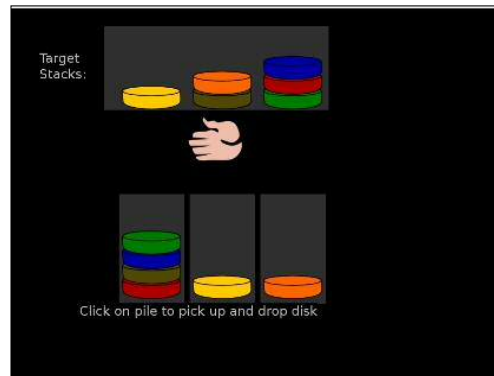
*Figure 8. Screenshot of Stroop.*

### *Tower of London*

The implementation of the Tower of London (ToL) task was that used in Phillips, Wynn, Gilhooly, Della Sala, & Logie (1999) Set A. It is often used to index planning and problem solving ability. There were three rods and five coloured disks presented in an arrangement which participants had to replicate in as few moves as possible. There were eight trials in total; the minimum number of moves required to solve the problem increased over the trials, from three for Trial 1 to ten for Trial 8 (comprising 3, 5, 5, 7, 7, 9, 9,

10, respectively). Trial 5 did not exactly match trial 5 of Phillips and colleagues (Phillips et al., 1999); this trial was excluded, leaving seven trials. The task would not move on to the next trial until the current trial was complete. The measure used to index planning was average time before first move (ms). We also looked at the correlation between average time before first move (planning time, ms) and total number of moves made over the minimum possible moves (48 for seven trials). The number of moves over the minimum gives an indication of problem solving ability and is reported separately as it was not included in the comparative paper. For the first 10 participants, planning time was an average of time taken before first move on trials 2-8 (excluding trial 5, see above), as it included instruction time. While this was not a problem thereafter (an example sheet was created to use for explaining the task), time taken before first move on trial 1 for four further participants was also not valid due to experimenter error, that is, clicking through before instructions were complete. Overall, for a total of 14 participants, the calculation of planning time (average time taken before first move) did not include the first trial. This potentially has implications for the interpretation of the results, as the first trial required the least moves to complete (i.e., was the 'easiest'), so it is likely that the planning time for these participants was slightly longer than for participants whose planning time was averaged across all trials (bar Trial 5). In contrast to Phillips and colleagues (1999), participants were not explicitly instructed to plan; instructions were to try to match the target display in as few moves as possible. The version of the ToL used here resembles that used originally by Ward and Allport (1997), who considered Shallice's (1982) version not suitable

for use in non-clinical populations due to its relative simplicity. Performance on the ToL has been shown to correlate with performance on other EF tasks (e.g. Welsh, Satterlee-Cartmell, & Stine, 1999), and planning ability as assessed by the ToL has regularly been associated with frontal activation and/or damage (see Unterrainer & Owen, 2006, for a review).



*Figure 9. Screenshot of ToL.*

### *Fluency*

We assessed verbal fluency using a letter fluency task (F, A, S) and a category fluency task (animal naming). Participants had one minute to say as many words as they could think of beginning with the letter F (then A and S, respectively). Proper nouns were not permitted, and both repetitions and attempts to use words that had the same stem scored only for the first instance of the word. Any word, including colloquial words, which appeared in the Oxford English Dictionary that did not violate these rules was accepted. For the category fluency task, participants had one minute to name as many animals as they could think of. Any animal was accepted, including those that were magical / imaginary or extinct (Strauss et al., 2006). These tasks were not part of the PEBL battery. For consistency of presentation and accurate



timings, the instructions and letters / category were presented using Microsoft PowerPoint and participants' verbal responses were written down by the experimenter. In case any were missed, responses were also captured on an audio recording. We used both types of verbal fluency, as education and age have been found to have differential effects on each type of fluency; education had greater influence on letter fluency than age, whereas the opposite was true for category fluency (Tombaugh, Kozak, & Rees, 1999). Test-retest reliability has been found to be reasonable:  $r(88) = .82$  for letter fluency;  $r(88) = .68$  for category fluency (Harrison, Buxton, Husain, & Wise, 2000). Internal consistency reported for letter fluency was  $r(893) = .83$ , and category fluency was found to correlate positively with letter fluency ( $r(733) = .52$ ; Tombaugh et al., 1999).

#### *Intelligence Quotient*

To assess IQ, we chose to use the two-subtest version of the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) as it is well-validated, brief and gives an indication of full scale IQ (FSIQ; Psychological Corporation, 1999; Canivez, Konold, Collins, & Wilson, 2009). The two subtests used were Vocabulary, where participants had to define words of increasing difficulty, and Matrix Reasoning, where participants had to identify the missing piece of a pattern. Vocabulary provided the verbal component, and Matrix Reasoning the performance component, to yield an estimate of FSIQ. According to the test manual, all measures including FSIQ-2 have good reliability, ranging from  $r = .86$  to  $.94$  for 16 year olds and 17-19 year olds. Correlations with the more extensive Wechsler Adult Intelligence Scales-III (WAIS-III; Wechsler, 1997) were reported to be moderate ( $r = .66$  to  $.88$ ), and

correlations within the WASI between subtest T scores and FSIQ-2 were reported to be high ( $r = .86$  to  $.91$ ; Psychological Corporation, 1999). As the WASI was predicted to be one of the most challenging and least enjoyable tasks in the session, a break was scheduled directly afterwards in all seven orders (the WASI was always at the halfway point in terms of the number of tasks).

### ***Analysis***

All analyses were carried out using SPSS version 20 (IBM Corp, 2011) and Microsoft Excel 2013. In order to compare performance between tasks, scores on the measures of interest were transformed into z scores. To calculate z scores, the population mean and standard deviation were required for each measure. Many of the tasks did not have appropriate normative data, either because of differences in administration/version/measures reported/age, or the published norms were more than 15 years old. Tulskey and colleagues (2003) suggested that normative data for neuropsychological tests has a maximum lifespan of 15 to 20 years (shorter if items become irrelevant). Papers with appropriate comparison data were therefore sought (see Table 8 for details). Given that executive functions are still developing during late adolescence/emerging adulthood, the priority was to find papers with as many participants as possible in as close an age range as possible, that used a comparable version and administration of the task, rather than focus on samples approximating the general population. This is one of the approaches recommended by Strauss and colleagues (2006).

Exploratory analyses were also conducted to explore differences in performance within the homeless group. First, point-biserial correlations were conducted to test for the effects of potential confounding variables: recent substance use (previous 24 hours), recent alcohol use (previous 24 hours), and reported one-to-one help and/or extra time at school (possible learning difficulties). Each EF measure was then entered into a multiple regression as a criterion variable with the predictors: age, sex, regular substance and/or regular alcohol use, any experience of foster care, any contact with the Criminal Justice System, and level of education. Any non-continuous variables were dichotomised. As age had restricted range (16-19 years), it was dichotomised into '16-17' (coded 0) and '18-19' (coded 1). Level of education was dichotomised into those with 'less than 5+ GCSEs grades A\*-C or equivalent' and those with '5+ GCSEs grades A\*-C or higher'. All other variables were dichotomous with the responses 'Yes' or 'No'. All variables were entered with equal priority. As the aim of these analyses was to investigate predictors of EF, taking into account the other predictors, the main statistic of interest was the semi-partial correlation squared, as this quantifies the unique contribution of a predictor to EF performance (Cohen & Cohen, 1983; Tabachnick & Fidell, 2014). It should be noted that these analyses were purely exploratory, and no corrections for multiple testing were applied. A conservative approach is therefore taken with interpretation of the results.

Table 8. Comparison papers providing comparative data.

Task in current study	Comparison paper	Comparison Sample	Version of task used in comparison	Administration	Quality notes
PEBL BCST-64	Piper et al. (2015)	<i>N</i> = 173 Age: 18-22 years Students	PEBL BCST-64	Computer, using PEBL battery	<ul style="list-style-type: none"> <li>• Task match</li> <li>• Overlapping age range, though slightly older</li> <li>• Participants may be used to doing similar tasks</li> <li>• Large sample</li> </ul>
PEBL Corsi Backwards	Brunetti, Del Gatto, & Delogu (2014)	<i>N</i> = 73 young adults Age: 18-30 years, Mean = 21.6 ( <i>SD</i> = 1.7)	eCorsi using Kessels rules (Kessels et al., 2000, 2008)	Tablet with touch response	<ul style="list-style-type: none"> <li>• Used same rules (Kessels) and got similar results to the original</li> <li>• Different method of response (touch rather than mouse), though same modality</li> <li>• Slightly older participants</li> </ul>
PEBL IGT	Hooper, Luciana, Conklin, & Yarger (2004)	<i>N</i> = 42 adolescents Age: 14-17 years	Bechara's version (Bechara et al., 1994) with amounts scaled down as participants could actually earn their winnings (max. \$5)	Computer	<ul style="list-style-type: none"> <li>• Computerised version of Bechara's task</li> <li>• Overlapping age range, though slightly younger</li> <li>• Motivated to do well on task with reward, however performance variable despite this</li> <li>• Small sample (part of larger sample)</li> </ul>
PEBL Colour-Word Stroop	Zook, Davalos, DeLosh, & Davis (2004)	<i>N</i> = 85 Age: Mean = 18.8 ( <i>SD</i> )	Colour-Word Stroop with 3 colours and congruent as well as incongruent trials	Computer, using key response	<ul style="list-style-type: none"> <li>• Most similar task and administration out of all found</li> <li>• Restricted age range, but similar</li> </ul>

Task in current study	Comparison paper	Comparison Sample	Version of task used in comparison	Administration	Quality notes
		= 1.0) Students			<ul style="list-style-type: none"> <li>• Participants may be used to doing similar tasks</li> </ul>
PEBL ToL	Luciana, Collins, Olson, & Schissel (2009)	N = 81 adolescents Age: 15-17 years	Stockings of Cambridge (based on Shallice, 1982)	Computer with touch screen	<ul style="list-style-type: none"> <li>• Different version of task, PEBL ToL version used in current study (Set A from Phillips et al., 1999) was based on original by Ward &amp; Allport (1997)</li> <li>• Limited number of balls in pockets (compared to no limits)</li> <li>• Did not explicitly tell participants to plan which was a confound of other studies using more similar version of task</li> <li>• Overlapping age range, though slightly younger</li> </ul>
Letter Fluency	Portocarrero, Burright, & Donovanick (2007)	N = 39 monolingual Age: Mean = 19 (not given exactly) Students	F, A, S	Verbal, 1 minute for each letter, no other details given	<ul style="list-style-type: none"> <li>• Task match</li> <li>• Likely overlapping age range, though slightly older</li> <li>• Participants may be used to doing similar tasks</li> <li>• Similar results to Tombaugh et al. (1999), an older normative study</li> </ul>

Task in current study	Comparison paper	Comparison Sample	Version of task used in comparison	Administration	Quality notes
					<ul style="list-style-type: none"> <li>• Small sample, though more than in the relevant age bracket in Tombaugh's study</li> </ul>
Category Fluency	Portocarrero, Burright, & Donovanick (2007)	N = 39 monolingual Age: Mean = 19 (not given exactly) Students	Animal	Verbal, 1 minute allowed, no other details given	<ul style="list-style-type: none"> <li>• Task match</li> <li>• Likely overlapping age range, though slightly older</li> <li>• Participants may be used to doing similar tasks</li> <li>• Similar results to Tombaugh et al. (1999), an older normative study</li> <li>• Small sample, though more than in the relevant age bracket in Tombaugh's study</li> </ul>

## Results

EF performance in homeless young people tended to be worse than comparison data across domains, with only a few exceptions. Homeless young people demonstrated better than comparison sample performance on both selective attention / inhibition (Stroop) and planning (ToL). Visuospatial working memory (Corsi Back) was also around average, contrary to predictions. The biggest difference between the comparative data and the homeless group appeared to be on the verbal fluency tasks, letter and category fluency, with the homeless group producing fewer words in each task than the comparative sample. These results are illustrated in Figure 10. For all tasks, positive z scores correspond to better than comparison sample performance, as scores have been reversed for BCST-64 Percentage Perseverative Errors and Stroop (Reverse) Interference.

The number of moves made over the minimum required to complete the trials on the ToL had no equivalent in the comparative paper. Scores ranged from zero (perfect) to 48 moves (double) made over the minimum required over the seven valid trials (48 moves). Looking at average performance, the mean number of moves made over the minimum required for the homeless group was 13.5, with a standard deviation of 10.1, indicating that performance was variable.

Homeless young people had IQs substantially lower than average ( $M = 82.3$ ,  $SD = 13.1$ , Range = 55-115), with significantly worse performance on the verbal subtest (Vocabulary T score;  $M = 36.5$ ,  $SD = 10.1$ ) than the non-verbal subtest (Matrix Reasoning T score;  $M = 39.9$ ,  $SD = 10.7$ ,  $t(68) = -2.78$ ,  $p =$

.007). This is illustrated in Figure 11. As the homeless group seemed to be demonstrating worse performance on verbal tasks particularly, analyses were re-run without those participants whose first language was not English ( $n = 5$ ) to ensure this minority were not driving the low performance levels. There was negligible difference between the results with and without these participants, including for IQ, suggesting that the low levels of performance on verbal tasks were reflective of the majority sample.

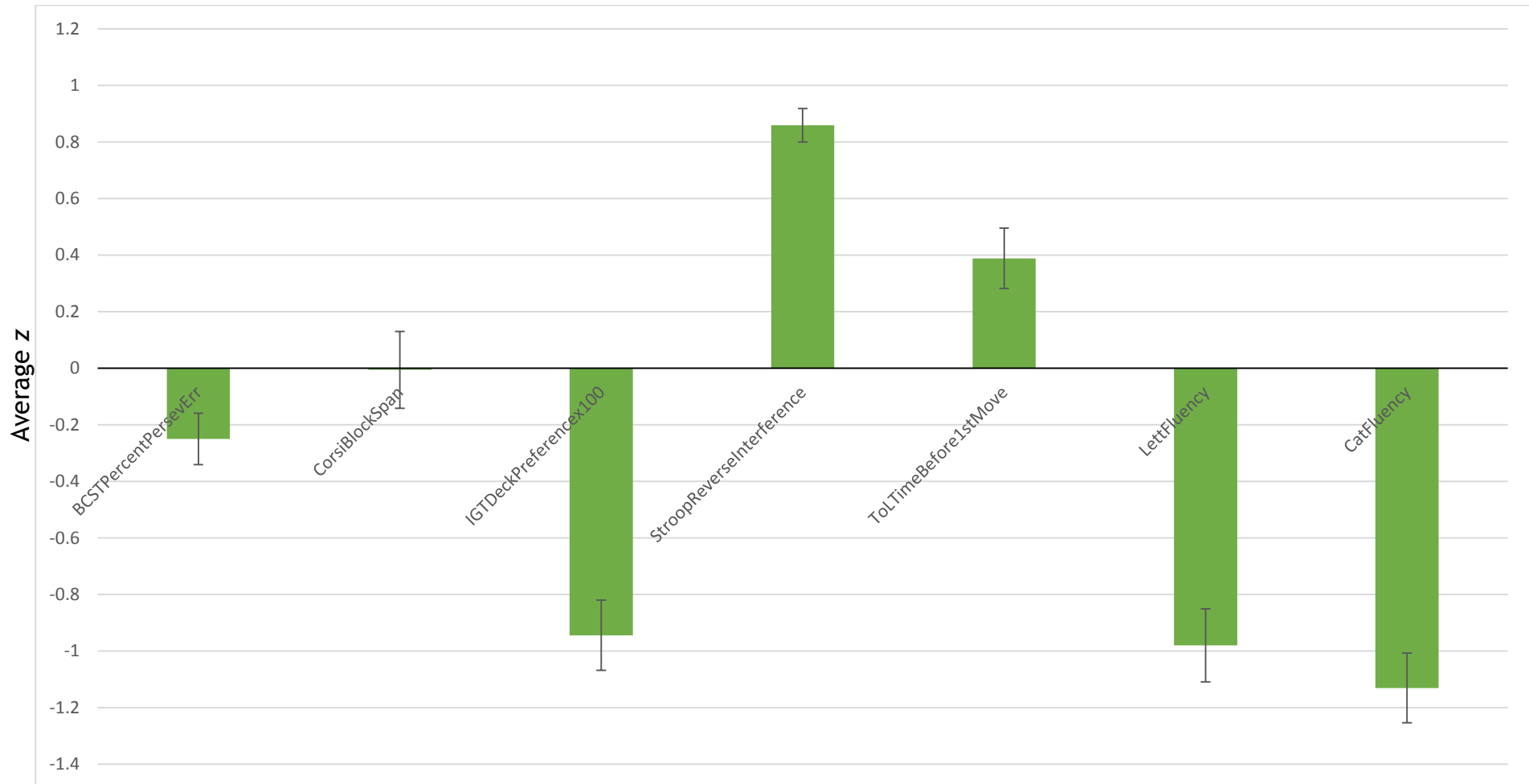
There are caveats to the apparent better planning performance because the measure used to index planning on the ToL was average time before first move with no correction for time taken overall (i.e., general slowness). Further, the specific measure used in Luciana et al. (2009) was a difference measure, so would be expected to be smaller. The average time before first move also did not correlate with the performance measure (number of moves made over the minimum necessary to solve the problem),  $r_s(66) = -.071, p = .564$ .



Table 9. Descriptive statistics for EF performance in the homeless group and corresponding comparison papers.

EF domain	Task	Measure	Homeless group Mean (SD)	Comparison paper Mean (SD)	Corresponding z score
Shifting / Flexibility	BCST-64	Percent Perseverative Errors (%)	12.6 (4.8)	11.0 (6.4)	-0.250 <sup>a</sup>
Spatial Working Memory	Corsi Back	Backwards Block Span	5.28 (1.35)	5.29 (1.20)	-0.006
Risky Decision Making / Impulsivity	IGT	Deck Preference	-6.93 (22.0)	13.2 (21.3)	-0.944
Selective Attention / Inhibition	Stroop	Stroop Reverse Interference (ms)	92.2 (66.1)	209.2 (136.2)	0.859 <sup>b</sup>
Planning / Problem Solving	ToL	Average Planning Time (ms)	6168.6 (2173.8)	5178.9 (2549.6)	0.388
Letter Fluency	F,A,S	Total number of words produced in 1 minute	27.0 (10.7)	36.9 (10.1)	-0.980
Category Fluency	Animal	Number of words produced in 1 minute	<b>16.7 (4.66)</b>	<b>21.9 (4.6)</b>	<b>-1.130</b>

*Note.* <sup>a, b</sup> These have been reversed in z score calculations so that the direction matches that of the other tasks, i.e. that higher scores = better performance - the data in the Homeless group column are the original data on the specified measure. Bold indicates the homeless group scored 1SD greater than or less than the comparison average. Number of participants included in the analysis for the homeless group ranged from 67-69 due to missing data. More details on the comparison samples can be found in Table 8.



*Figure 10. Profile of EF performance in homeless young people.*

Error bars represent  $\pm 1SE$ , 0 represents the comparative mean. BCSTPercentPersevErr = the percentage of perseverative errors on the BCST-64, comparative data from Piper et al. (2015). CorsiBlockSpan = backwards block span, comparative data from Brunetti, Del Gatto, & Delogu (2014). IGTDeckPreferencex100 = net preference for safe or risky decks (number of cards), comparative data from Hooper, Luciana, Conklin, & Yarger (2004). StroopReverseInterference = incongruent minus congruent interference, comparative data from Zook, Davalos, DeLosh, & Davis (2004). ToLTimeBefore1stMove = 'planning' time, comparative data from Luciana, Collins, Olson, & Schissel (2009). LettFluency = letter fluency (F,A,S), comparative data from Portocarrero, Burright, & Donovanick (2007). CatFluency = category fluency (animals), comparative data from Portocarrero et al. (2007).

In addition, the most appropriate comparison data that was found for this measure on the ToL in the age group of interest actually used a different version of the task (Luciana, Collins, Olson, & Schissel, 2009). Indeed, the exact measure used to index planning was the *difference* in the time taken to follow moves and the time taken before making a move, which would be expected to be smaller than the simple planning time used here. Hence, the comparison data used was not entirely appropriate, though arguably the best available. Collectively, this means that this finding should be interpreted with caution.

The ratio of average time taken before first move (planning time) out of the total time taken was negatively related to the number of moves made over the minimum (an indicator of performance) in the homeless group,  $r(66) = -.534, p < .001$ . This indicates that accounting for total time taken to complete the task when examining planning time in the homeless group is important. Planning time *per se* was not related to performance, however, the proportion of the total time that a participant spent planning was related to performance, meaning overall slower processing and/or responding could be masking differences in planning time. The ratio of planning time out of total time is therefore used as an index of planning on the ToL in subsequent chapters.

Exploratory analyses were also conducted to investigate potential effects of individual differences on EF performance. First, point-biserial correlations were carried out to check for potential influences of any reported substance or alcohol use in the 24 hours preceding testing, as well as any

reported one-to-one help and/or extra time at school (which could indicate learning difficulties), on EF performance. There were no significant associations between any of the variables and performance on the EF tasks: substance use within 24 hours ( $r_{pbs}$  (65-67) = -.038 to .116,  $ps$  = .348 to .925), alcohol use within 24 hours ( $r_{pbs}$  (65-67) = -.098 to .126,  $ps$  = .302 to .944), one-to-one support and/or extra time ( $r_{pbs}$  (65-67) = -.141 to .004,  $ps$  = .250 to .972). This suggests that the influence of these potentially confounding variables was minimal.

Error bars represent  $\pm 1SE$ , 0 represents the normative mean (100). FSIQ = Full-

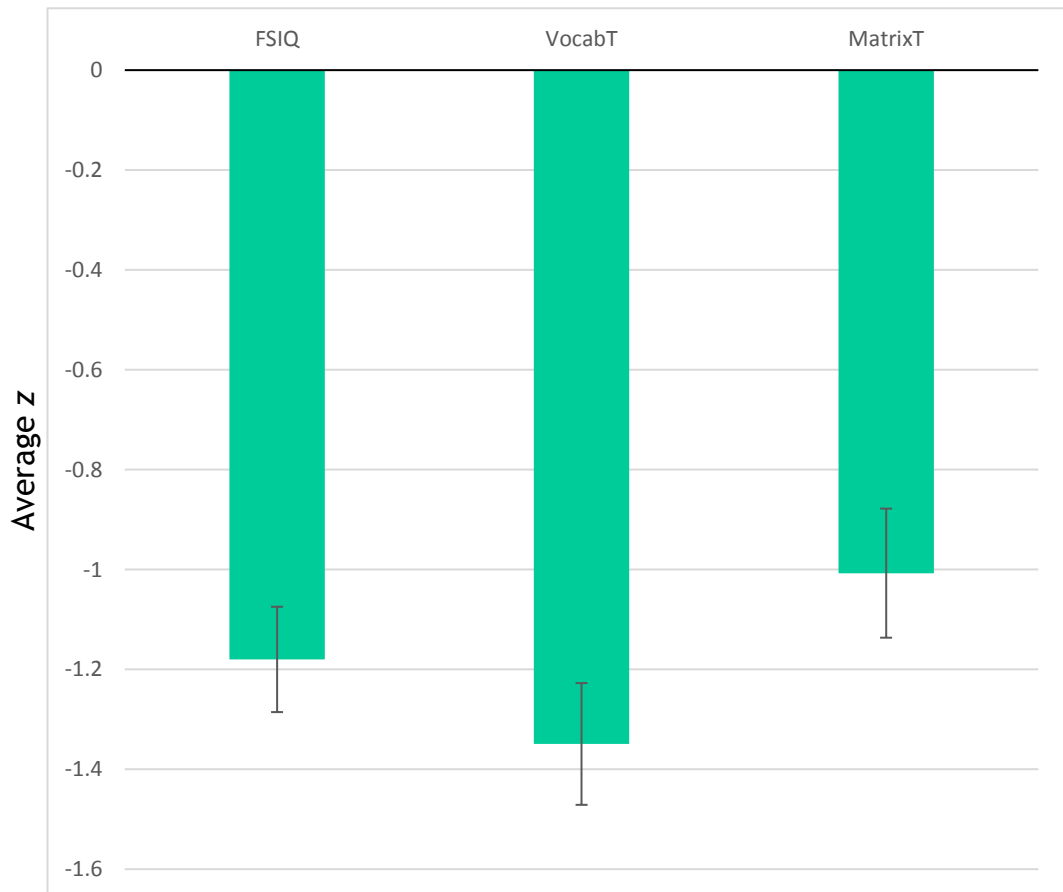


Figure 11. Performance on an abbreviated measure of IQ.

Scale IQ, 2 subtest version. Performance on the Vocabulary subtest (represented by VocabT) was significantly poorer than performance on the Matrix Reasoning subtest (represented by MatrixT; see text for details).

Multiple regression analysis explored potential individual differences, including age, sex, regular substance use, regular alcohol use, any experience of foster care, any contact with the Criminal Justice System, and level of education. Any non-continuous variables were dichotomised. The main aim of the exploratory analysis was to determine which variables emerged as predictors of performance on EF tasks, over and above the contribution of other predictors. For this reason, the focus was on the semi-partial (part) correlations and the semi-partial correlation squared, which indicates the unique contribution of the predictor to predicting the total variance of each EF measure (Cohen & Cohen, 1983; Tabachnick & Fidell, 2014), and not the overall regression model. Zero-order correlations between variables can be found in Table 10, while Table 11 presents a summary of the regression analyses and is provided for reference.

None of the regression models were significant. Nevertheless, there were indications of potential relationships between the following characteristics and task performance in the homeless group, taking into consideration the other potential predictors: level of education and shifting/flexibility, with less educated participants tending to have more perseverative errors; sex and working memory, with males appearing to tend towards having larger visuospatial working memory spans; foster care experience and letter fluency, with those who had experience of foster care seeming to generate more words beginning with a specific letter (see Table 11). These results must be interpreted with caution, however, considering the multiple tests conducted and the non-significant overall models.

Nevertheless, the findings suggest some interesting patterns that warrant further exploration.

Table 10. Zero-order correlations between predictor and criterion variables entered into multiple regression analyses.

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Sex														
2. Age	-.060													
3. Regular substance use <sup>a</sup>	.180	-.028												
4. Regular alcohol use <sup>a</sup>	-.062	-.004	.118											
5. Any experience of foster care	-.014	.243*	.060	-.026										
6. Any contact with the CJS	.292*	-.175	.436**	-.019	.051									
7. Level of Education	-.221	.060	-.378**	-.118	.075	-.540**								
8. BCST-64 Percent Perseverative Errors <sup>b</sup>	.112	-.124	.176	-.037	-.067	.036	-.284*							
9. Corsi Block Span (Backwards)	.269*	.007	.010	.048	-.093	-.064	-.048	-.076						
10. IGT Deck Preference	-.126	-.018	-.024	.032	-.177	-.020	.025	.032	-.044					
11. Stroop Interference <sup>b</sup>	.052	-.138	.013	-.241*	-.141	.142	.010	.012	.049	.048				
12. ToL Average Time Before 1 <sup>st</sup> Move	.287*	-.055	.098	-.094	-.073	.041	-.123	.018	.063	-.094	-.131			
13. Letter Fluency	-.066	-.144	.060	-.017	.204	.017	.076	-.359**	.134	-.006	.022	-.263*		
14. Category Fluency	.006	-.007	.148	.070	-.008	.049	.099	-.359**	.233	.144	.109	-.321**	.511**	

Note. \*\* =  $p < .01$ , \* =  $p < .05$ . <sup>a</sup> Regular use is defined as at least once a week. <sup>b</sup> For this analysis, BCST-64 Percent Perseverative Errors and Stroop Interference are the original variables (not reversed). CJS = Criminal Justice System. As all predictor variables are dichotomous, the point-biserial correlations are reported. The predictor variables are listed first (1-7), followed by the criterion variables (8-14). Each criterion variable was entered into a separate regression analysis, making seven regressions in total (see Table 11).



Table 11. Summary of multiple regressions exploring individual contributions of potential predictors of EF performance, taking account of the contributions of the other predictors in the model.

Predictor variable	Criterion variable																				
	BCST-64 Percent Perseverative Errors <sup>a</sup>			Corsi Block Span (Backwards)			IGT Deck Preference			Stroop Interference <sup>a</sup>			ToL Average Time Before 1 <sup>st</sup> Move			Letter Fluency			Category Fluency		
	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>P</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>	<i>sr</i>	<i>sr</i> <sup>2</sup>	<i>p</i>
Sex	.093	.009	.443	<b>.289</b>	<b>.084</b>	<b>.023</b>	-.121	.015	.343	-.022	.000	.862	.232	.054	.066	-.104	.011	.401	-.008	.000	.950
Age	-.155	.024	.202	.007	.000	.955	.018	.000	.886	-.074	.005	.559	-.056	.003	.651	-.189	.036	.130	.033	.001	.795
Regular substance use <sup>b</sup>	.144	.021	.235	.013	.000	.916	.003	.000	.980	.012	.000	.921	.072	.005	.560	.078	.006	.528	.163	.027	.207
Regular alcohol use <sup>b</sup>	-.069	.005	.566	.053	.003	.672	.029	.001	.817	-.239	.057	.061	-.091	.008	.463	-.059	.003	.634	.051	.003	.693
Any experience of foster care	-.042	.002	.731	-.082	.007	.509	-.192	.037	.135	-.103	.011	.413	-.066	.004	.593	<b>.275</b>	<b>.076</b>	<b>.030</b>	-.007	.000	.958

Any contact with the CJS	-.170 .029 .162	-.134 .018 .284	.052 .003 .681	.144 .021 .256	-.108 .012 .386	-.024 .001 .848	.051 .003 .691
Level of education	<b>-.265</b> <b>.070</b> <b>.032</b>	-.056 .003 .651	.035 .001 .783	.074 .005 .558	-.138 .019 .269	.060 .004 .628	.194 .038 .133
Overall model	$R^2 = .161$ $N = 66$	$R^2 = .107$ $N = 66$	$R^2 = .054$ $N = 67$	$R^2 = .107$ $N = 65$	$R^2 = .116$ $N = 66$	$R^2 = .116$ $N = 66$	$R^2 = .060$ $N = 66$

Note. <sup>a</sup> For this analysis, BCST-64 Percent Perseverative Errors and Stroop Interference are the original variables (not reversed). <sup>b</sup> Regular use is defined as at least once a week. Bold indicates significant at  $p < .05$ . However, this should be interpreted with caution as multiple tests have been conducted. CJS = Criminal Justice System,  $sr$  = semi-partial (part) correlation,  $sr^2$  = semi-partial correlation squared. Age was dichotomised into '16-17' and '18-19', as the range was restricted for the continuous variable. Level of education was dichotomised into 'Less than 5+ GCSEs grades A\*-C or equivalent' and '5+ GCSEs grades A\*-C or higher'. Sex was dichotomised into Male and Female. Any experience of foster care and Any contact with the CJS were dichotomised into Yes and No. Regular substance use and Regular alcohol use were also dichotomous variables (Yes or No).

## Discussion

The EF profile of homeless young people emerged largely as predicted. Generally, performance on EF tasks was at a lower level than that of samples from comparison datasets but working memory performance was comparable. This contrast with previous findings (see Fry et al., 2017) could be due to differences in modality; visuospatial working memory was assessed in the current study, whereas verbal working memory was assessed previously (e.g., using Digit Span). This may have accounted for the poorer performance found in previous studies with homeless young people, given the apparent difficulty with verbal tasks. IQ was found to fall in the 'Low Average' range (Psychological Corporation, 1999), with poorer performance on the verbal subtest than the non-verbal subtest. A potential area of strength, however, was selective attention (less interference) on the Stroop, contrary to the findings for auditory selective attention in Borges-Murphy and colleagues' (2012) paper. This finding should be treated with caution, though, as lower interference could be influenced by stronger visual than verbal skills suggested by performance on other tasks. In other words, it may have been easier to inhibit the word and name the colour for homeless youth than for those in the comparative sample. Interestingly, there was a discrepancy between the ability to inhibit the pre-potent response in the Stroop and the ability to inhibit the impulse to choose risky decks in the IGT: while homeless young people appeared to be good at inhibition in the Stroop (though note caveat), performance on the IGT was substantially worse than the comparative sample. This could be related to the concept of contrasting types of EF: hot EF and cool EF. The IGT is likely a measure of hot EF, as it

taps into emotions and reward, whereas Stroop is likely a measure of cool EF that is more rational in nature (Zelazo & Carlson, 2012).

Looking at other studies with homeless young people, the current findings were similar to Dahlman, Backström, Bohlin, and Frans (2013) in that shifting / flexibility performance was almost comparable to normative data. However, findings of average working memory and above average selective attention were not consistent with previous studies (Saperstein et al., 2014; Borges-Murphy et al., 2012), though generally lower than average EF performance did reflect Saperstein's findings. There was a contrast with Pluck's latest study (Pluck et al., 2017), as planning on the ToL appeared, if anything, to be better than comparative data, whereas Pluck found impairments in former street youth compared to controls. However, this finding may not constitute a true reflection as different variables were compared - a difference score in the comparative paper and simple planning time on the task used here. Low IQ and T scores for the Vocabulary and Matrix Reasoning subtests were broadly consistent with other studies of homeless young people (Pluck et al., 2017; Pluck et al., 2015; Saperstein et al., 2014), with the exception of Rohde, Noell, and Ochs (1999), as well as other research that recruited participants from a similar source (Hodgson, 2014).

Exploring individual differences in performance, having a higher level of education emerged as a potential predictor of better shifting / flexibility performance, being male emerged as a potential predictor of larger working memory span, and having any experience of foster care emerged as a

potential predictor of better letter fluency, after adjusting for covariates. These findings are very preliminary, however, due to multiple testing and non-significant overall models, but provide some indication of interesting directions for future research.

Homeless young people, even this sample recruited from the same source, are a heterogeneous group. The variability in EF performance not just between but also within tasks suggests that there may be factors related to their heterogeneity that could have affected EF development in different ways. For example, those who are care leavers have almost certainly experienced maltreatment when younger, which is linked to attachment problems, and as such their ability to self-regulate and regulate their emotions (e.g., Lind, Raby, Caron, Roben, & Dozier, 2017). Homeless young people who are not care leavers therefore may not have such problems or experience different factors contributing to differential EF performance. The heterogeneity of the group should be borne in mind when interpreting the results, and is discussed further in Chapter 6.

It is becoming apparent that in addition to a plethora of other challenges, homeless young people may also demonstrate EF difficulties, and may have particular difficulties in the verbal domain, with some of the largest differences in verbal fluency performance. Risky decision making was also highlighted as an area of concern. However, visuospatial working memory and set shifting / flexibility appeared to be relatively intact, and a possible strength emerged in the form of selective attention / response inhibition. That said, the 'quality' of comparative data should be considered here. Using

published data from disparate sources meant that not only were there differences in the tasks used, the comparison samples themselves were heterogeneous. If substantiated, the ability to focus on the relevant task and ignore distractions is important for many situations in everyday life, and could stem from having to adapt to chaotic home or foster home lives from an early age (e.g., Bakker, Ormel, Verhulst, & Oldehinkel, 2011). Flexibility has also been associated with positive adaptation, and together these could represent internal resources for resilience (e.g., Masten et al., 1999). As working memory contributes to performance in many domains, having a good working memory span could indicate that there is potential to improve in other domains, with appropriate training and support.

### ***Limitations***

There are limitations to note. Broadly, these fall into two areas: (1) the characteristics of the sample that, while possibly typical for this particular group, were not optimal for neuropsychological testing and (2) difficulty in obtaining appropriate normative, comparison data.

### ***Reading ability***

Nearly 40% of the participants had reported having one-to-one support in the classroom and/or extra time in exams while at school. Anecdotally, staff at Llamau felt that many young people they supported had some degree of learning and/or reading difficulty. We attempted to overcome this by way of the experimenter reading out all instructions and interview questions, as well as offering to read out the questionnaires. One task that may have been particularly affected was the Stroop. Although the evidence is inconsistent,

more studies have found greater interference for those with poorer reading ability or dyslexia, than have found no difference or reduced interference (e.g., Mano, Williamson, Pae, & Osmon, 2016; Kapoula et al., 2010; Reiter, Tucha, & Lange, 2005). However, there was variation in what was operationalised as ‘interference’, ranging from just the incongruent RT to the difference between naming colour patches and incongruent RTs, and still others using various formulae. In the current study, Stroop interference was calculated as the difference in RTs between the congruent (word and colour match) and incongruent (word and colour do not match) trials. In this respect, it could be argued that there was an element of involuntary reading in both types of trial, meaning both were affected by reading ability, with minimal effect on the difference between them (i.e., the interference). Therefore, it follows that RTs in both conditions could have been slower than those without reading difficulties, but the interference would have been broadly similar. In fact, as suggested earlier, it could have been the case that participants with reading difficulties found the incongruent trials easier and hence showed reduced effect of interference, as has been found in some studies (e.g., Golden & Golden, 2002; Johnson, Bouchard Jr, Segal, Keyes, & Samuels, 2003). As many of the studies that have investigated reading ability and Stroop performance have used a different ‘interference’ measure, coupled with the fact we did not independently verify any dyslexia diagnoses, it is difficult to estimate the effect on our Stroop interference data. However, exploratory analyses suggest that there were no relationships between reporting having had one-to-one support and/or extra time in school

(which could be argued to be a potential proxy for reading and/or learning difficulties) and EF performance, including in the Stroop task.

### *Substance use*

Many participants in this sample, like other homeless young people, were regular users of substances. Cannabis was the drug of choice. Unless participants had consumed more than usual, or used cannabis with other substances, they were included in the study, as use consistent with their regular use would be indicative of the 'usual' performance for that individual. There has been mixed evidence as to the effect of cannabis use on cognition, and particularly EF. Overall, use of cannabis appears to be associated with poorer EF, but often via early onset and/or frequency of use (e.g., Broyd, van Hell, Beale, Yücel, & Solowij, 2016; Crane, Schuster, Fusar-Poli, & Gonzalez, 2013; Crean, Crane, & Mason, 2011; Lorenzetti, Yücel, & Solowij, 2015). In the short term (up to six hours after taking), impaired inhibition and working memory has been demonstrated, but these deficits were not present in the residual period (7 hours to 20 days after taking) nor in the long-term (Crean et al., 2011). This was argued to indicate recovery, though a new deficit emerged in decision making and risk-taking in the residual and long-term periods (Crean et al., 2011), which suggests cannabis use could have contributed to the worse than comparison performance demonstrated by the homeless group in the current study. However, the exploratory analyses indicated that both substance use during the 24 hours prior to testing and regular substance use were not related to performance on any of the EF tasks in the homeless group. It should be noted, though, that the measure used was dichotomous and thus relatively crude, stemming from its initial purpose



as a screening item. Continuous measures such as the Drug Use Disorders Identification Test (DUDIT; Berman, Bergman, Palmstierna, & Schlyter, 2005), which complements the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), would have been more informative and made it possible to get a better understanding of the frequency and severity of use (Berman et al., 2005; Hildebrand, 2015), and this is an important point with regards to feasibility and informing future research. Further discussion of this issue as a general limitation can be found in Chapter 6.

## *IQ*

Empirical studies tend to exclude participants with IQs of 80 or less, as it is assumed participants do not have the capacity to complete cognitive tasks, even though the commonly considered threshold of intellectual disability is an IQ of 70 or less, or 2SDs below the mean (e.g., Nishio et al., 2015; Schalock et al., 2007, Siegel & Himel, 1998). While IQ has been found to be moderately associated with EF performance on various tasks, it does not account for all of the variance and its use in the criteria for learning disability has been criticised (e.g., Ardila, Pineda, & Rosselli, 2000; Siegel 1988, 1989). As the aim of this study was to profile EFs in a sample of homeless young people, and there is some evidence that low average IQ may be part of the characteristics of the sample (e.g. Barwick & Siegel, 1996), it was important to investigate EFs in the whole sample, not just the 'more able' individuals. Further, IQ is strongly related to indicators of socioeconomic status, such as low income and parental education, in that having a poorer background in childhood is associated with lower IQ later on, partly due to associations with

other factors that affect education and school achievement, for example, dropping out of school and parenting behaviour (Bradley & Corwyn, 2002). There is also evidence from the neuroscience literature that poverty affects brain development, impacting on cognitive development (Hackman & Farah, 2009). Together, this means those from disadvantaged backgrounds would be expected to score lower on IQ tests; therefore, automatically excluding homeless young people on the basis of their IQ scores would have resulted in the findings not providing a true reflection of executive functioning in homeless young people. It has also been suggested that IQ tests merely measure the capacity of the individual to complete IQ tests, generally questioning their value (e.g. Lezak et al., 2012; Siegel, 1989).

#### *Normative data*

As alluded to earlier, the 'normative' data used to calculate z scores for comparison in this chapter were far from ideal. Although every effort was made to find recent data (less than 15 years old) that was as close a match as possible for age, test version, administration, and measures used, there was great variation in these criteria within the neuropsychological literature. One comparison paper (Luciana et al., 2009) not only used a different version of the ToL task, but also calculated planning time as a difference score rather than simple planning time which was used here. Sample sizes were also smaller (smallest used  $N = 39$ ) than what is considered to be adequate for normative data ( $N > 150$ ; Strauss et al., 2006), and some studies recruited undergraduate psychology students who are likely to be very familiar with the testing situation and types of tests used (particularly the Stroop test). As such, the next chapter focuses on comparing the homeless sample to a sample

of age-matched young people who were recruited from either a local urban college or a diverse sixth form. These institutions were similar to those accessed by participants in the homeless group currently enrolled in some form of formal education.

## **Conclusion**

The aim of this chapter was largely descriptive: to explore executive functioning in homeless young people and construct a profile of their performance across EF domains. To achieve this, the homeless group's performance across several EF domains was plotted against published comparative data to produce a visual profile of EF (see Figure 10). This analysis highlighted potential areas of difficulty, such as verbal fluency and risky decision making / impulsivity, and notably potential areas of strength, particularly in selective attention. Around average performance in working memory and shifting / flexibility was also identified and may be regarded as promising. There was some indication that verbal tasks may present more of a challenge for homeless young people than non-verbal tasks, but this would need to be further explored across a range of neurocognitive tasks, which is beyond the scope of the thesis. Findings were mostly congruent with predictions, with some differences likely explained by differences in task modality. Exploratory analyses revealed some interesting patterns within the group, including that those with higher levels of education seemed to demonstrate better shifting / flexibility, males tended to have larger visuospatial working memory spans, and that those with experience of foster care appeared to show better performance on letter fluency, which could be indicative of resilience. Further exploration is needed. One important

limitation of this chapter was the appropriateness of the comparative data and corresponding lack of suitable normative data. As such, the next chapter focuses on comparing the homeless group to an age-matched sample recruited for my doctoral research, using identical tasks and procedures, to establish whether a similar pattern of results emerges.

## **CHAPTER 4: COMPARISON**

This chapter builds on the work presented in Chapter 3 by comparing executive functioning in homeless young people to a group of housed peers. A limitation of the previous chapter was that good quality normative data was not available across EF tasks for the late adolescent / emerging adult age range. As emerging adulthood is considered a critical period for EF development and EFs are not fully developed until mid-adulthood (Selemon, 2013; Best & Miller, 2010), a comparison group of a similar age was required to achieve a sample of young people at a comparable stage of EF development. Protracted EF development is likely to reflect the pattern of brain development through adolescence and emerging adulthood more generally, in that the frontal lobes are last to develop fully, well into adulthood, and EFs are strongly related to frontal lobe function (e.g., Blakemore & Choudhury, 2006).

Previous studies in homeless youth have mixed findings with regard to EF performance, with working memory and auditory selective attention emerging as potential areas of difficulty (see Fry et al., 2017). Some studies did not use comparison groups, limiting interpretation, and often only few EF domains were represented or scores were combined into a composite EF score. Findings from Chapter 3 did not necessarily fit with this wider pattern of findings, as working memory performance in the homeless group was found to be comparable to the comparative ('normative') published data and selective attention was found to be better than the comparative sample. Differences in task modality may have accounted for these discrepancies. However, although every effort was made to find comparative data that

matched the tasks used in this thesis as closely as possible, differences in task procedure may have had an effect and the comparative data was far from ideal. The aim of this chapter, therefore, was to compare the EF task performance of a housed group using the same tasks and procedure as the homeless group to get a better picture of how homeless young people might differ on EF compared to housed young people.

A particularly interesting finding from Chapter 2 was that homeless young people may perform better at creativity tasks than housed youth (Dahlman et al., 2013). Creativity is something that has been historically challenging to adequately define (Sternberg & Lubart, 1999; Runco & Jaeger, 2012), but most researchers in the field agree that it combines originality or novelty and appropriateness, that is, thinking of something that is unusual but also useful (Stein 1953; Barron, 1955; Runco & Jaeger, 2012). The ability to think creatively, or outside of the box, is likely to be especially important for young people who have often found themselves in challenging and dangerous situations (Damian & Simonton, 2015), such as young people with experience of homelessness. It may be that regular exposure to adverse situations could encourage the development of skills for creative thinking in order to facilitate adaptation to hostile environments (Runco, 2007; Damian & Simonton, 2015). If some areas of EF are less well developed in homeless young people, creative thinking may compensate, at least to some extent, for these difficulties. For this reason, it is important to investigate creative thinking in homeless young people as, if found to be substantiated, these findings could have implications for how services engage and support vulnerable young people.

The predictions for this chapter, informed in part by the mixed evidence from the two previous chapters, were:

1. Homeless young people will demonstrate poorer performance across EF tasks than the housed group.
2. For the homeless group specifically, some areas of EF are likely to be intact and there may also be areas of strength. From the previous chapter, we would predict that working memory would be intact and selective attention may be a strength. In line with the findings of the review, we would also predict that homeless young people will score more highly on the creativity task than housed young people.
3. IQ in the homeless group will be lower than IQ in the housed group, driven by poorer performance in the verbal subtest.

## **Methods**

### ***Participants***

#### ***Housed group***

The homeless group and the pilot procedures to identify and implement the tasks were described in detail in Chapter 3, so the focus of this section is the housed group. Table 12 and Table 13 illustrate the similarities and differences between the groups in terms of characteristics and background. We recruited 38 young people without experience of homelessness. Twenty five participants were recruited from a local further education college that served a range of areas, both inner city and out-of-town, and offered a broad spectrum of qualifications from traditional A-Levels to vocational courses.

The college had several campuses; we recruited from the main campus in the centre of Cardiff and another campus in the neighbouring town of Barry, in the Vale of Glamorgan. Recruitment was supported by the Enrichment Team at the college, who helped with advertising and coordinating participants. We had stalls in the common areas, flyers, and walked around cafeterias at lunchtimes to advertise the study and give young people the opportunity to sign up. Text and email reminders were used to try and maximise attendance. Despite our best efforts, recruitment was not as successful as we had hoped, and the decision was taken to expand into another source. The main issues seemed to include vouchers not being enough of an incentive, college students going off-site for breaks, and heavy workloads meaning students felt they did not have time to participate. One participant in this group had just turned 20 years old in the week before testing, but as it was such a short period of time and unlikely to have had any major developmental implications, they were included in the sample.

The other recruitment source for the housed group was a diverse sixth form at a local high school, whose catchment area included more deprived areas of Cardiff. We recruited 13 participants from the high school originally; however, one participant reported that they were currently living in a hostel for young people, similar to accommodation provided by Llamau. Due to the likely similarity to the homeless participants in living situation and levels of support experienced, this participant was transferred to the homeless group, leaving 12 in the housed group from the high school sixth form. Recruitment at the school was managed by one of the sixth form teachers, who contacted tutors and booked interested students into timeslots, and chased up any non-



attendance. Times were limited to two days a week, clashing only with subjects that the teachers had permitted students to miss. Pupils whose first language was not English seemed particularly keen to participate, due to a supportive form tutor and wanting to practise their English. In total, there were 37 young people (16-19 years, bar one just turned 20 years old) in the housed group. Demographic data on the housed group compared to the homeless group can be found in Table 12 and Table 13.

### *Missing data*

In addition to the missing data described in Chapter 3 for the homeless group, one participant from the housed group had missing data on Corsi Blocks as they reported that they did not understand the task after instructions had been given and they had completed practice trials. For one further participant to those described in Chapter 3, the average planning time out of total time on the Tower of London did not include the first trial, due to experimenter error (clicking through to the first trial before the instructions were complete), so was calculated based on the remaining six trials. There were no more than 5% missing data on any one variable. As for the homeless group data, Little's MCAR test (Little, 1988) indicated that it was highly unlikely that data from the full dataset were systematically missing, and could be treated as if missing completely at random,  $\chi^2(56, N = 105) = 57.14$ ,  $p = .43$ .

### *Materials and Procedure*

The materials and procedure were almost identical to that detailed in Chapter 3. This section will therefore give a brief summary of measures

already described in the previous chapter, and expand on those that have not yet been introduced, with the exception of the HADS (anxiety and depression scale) which is described in Chapter 5. The participant that did not pass colour screening, mentioned in Chapter 3, was excluded from the analyses presented in this and further chapters, as it was not clear whether this was a difficulty with colour vision or language, as discussed in Chapter 3. This brought the total sample for analysis to 105, with 68 (64.8%) in the homeless group.

Table 12. Demographic profiles of the homeless and housed groups.

		Homeless Group <sup>1</sup> N (%)	Housed Group N (%)
Age	16	5 (7.4)	15 (40.5)
	17	32 (47.1) <sup>1</sup>	11 (29.7)
	18	22 (32.4)	5 (13.5)
	19	9 (13.2)	5 (13.5)
	20 <sup>2</sup>	0 (0.0)	1 (2.7)
Sex	Male	42 (61.8) <sup>1</sup>	16 (43.2)
	Female	25 (36.8)	20 (54.1)
	Other/Prefer not to say	1 (1.5)	1 (2.7)
Ethnicity	White	61 (89.7)	28 (75.7)
	Mixed	2 (2.9)	1 (2.7)
	Asian	1 (1.5)	3 (8.1)
	Black	2 (2.9) <sup>1</sup>	4 (10.8)
	Other	2 (2.9)	1 (2.7)
Nationality	British	37 (54.4)	15 (40.5)
	Welsh	23 (33.8)	14 (37.8)
	African	0 (0.0) <sup>1</sup>	3 (8.1)
	Pakistani	1 (1.5)	0 (0.0)
	Caribbean	1 (1.5)	0 (0.0)
	Other	6 (8.8)	5 (13.5)
First language	English	64 (94.1)	28 (75.7) <sup>3</sup>
	Filipino	1 (1.5)	0 (0.0)
	Oromo (Ethiopia)	0 (0.0) <sup>1</sup>	1 (2.7)
	Polish	1 (1.5)	1 (2.7)
	Portuguese	0 (0.0)	1 (2.7)
	Romanian	1 (1.5)	0 (0.0)
	Spanish	1 (1.5)	0 (0.0)
	Tigrinya (Eritrea)	0 (0.0)	2 (5.4)
	Turkish	0 (0.0)	1 (2.7)
	Welsh	0 (0.0)	2 (5.4)
	Arabic & Kurdish	0 (0.0)	1 (2.7)
Handedness	Right-handed	57 (83.8) <sup>1</sup>	32 (86.5)
	Left-handed	11 (16.2)	5 (13.5)
Substance past 24 hours (light/regular) <sup>4</sup>	Yes	14 (20.6)	0 (0.0)
	No	54 (79.4) <sup>1</sup>	37 (100.0)
Alcohol past 24 hours (less than 3 drinks) <sup>5</sup>	Yes	3 (4.4)	0 (0.0)
	No	65 (95.6) <sup>1</sup>	37 (100.0)
Total N		68 <sup>1</sup>	37

*Note.* <sup>1</sup>As one participant is excluded from the analyses in this chapter (see text for details), their demographic data is not included here; any differences from the corresponding table in Chapter 3 reflect this. <sup>2</sup>Participant had turned 20 years old in the week preceding testing. <sup>3</sup>One participant had English and Somali as joint first languages. <sup>4</sup>Anyone with heavier than regular use and/or polysubstance use within the 24 hours prior to testing was excluded. <sup>5</sup>Anyone who had consumed more than 3 alcoholic drinks within the 24 hours prior to testing was excluded.

Table 13. Background characteristics of the homeless and housed groups.

		Homeless Group <sup>1</sup> N (%)	Housed Group N (%)
Past month main accommodation (n = 1 Night shelter /hostel excluded) <sup>1</sup>	Llamau / Other supported housing	64 (94.1)	0 (0.0)
	Family or friends' place	2 (2.9)	1 (2.7)
	On the streets	1 (1.5)	0 (0.0)
	Foster care	1 (1.5)	1 (2.7)
	Private rented	0 (0.0)	1 (2.7)
	At home	0 (0.0)	34 (91.9)
Remembered having one-to-one support and /or extra time at school	Yes	24 (35.3) <sup>1</sup>	17 (45.9)
	Unsure	6 (8.8)	0 (0.0)
	No	38 (55.9)	20 (54.1)
Highest level of education (n = 1 yet to sit exams) <sup>2</sup>	Left school before completing any qualifications	9 (13.2) <sup>1</sup>	2 (5.4)
	1-4 GCSEs any grades or equivalent	32 (47.1)	11 (29.7)
	5+ GCSEs grades A*-C or equivalent	22 (32.4)	22 (59.5)
	2+ A levels or equivalent	3 (4.4)	2 (5.4)
	Other	1 (1.5)	0 (0.0)
Experience of ever living in residential Care	Yes	11 (16.2)	0 (0.0)
	Unsure	1 (1.5)	0 (0.0)
	No	56 (82.4) <sup>1</sup>	37 (100.0)
Experience of ever living in foster care	Yes	32 (47.1) <sup>1</sup>	5 (13.5)
	Unsure	1 (1.5)	0 (0.0)
	No	35 (51.5)	32 (86.5)
Contact with Criminal Justice System	Yes	39 (57.4)	1 (2.7)
	Unsure	1 (1.5)	0 (0.0)
	No	28 (41.2) <sup>1</sup>	36 (97.3)
Regular substance use (at least once a week)	Yes	21 (30.9)	1 (2.7)
	No	47 (69.1) <sup>1</sup>	36 (97.3)
Regular alcohol use (at least once a week)	Yes	9 (13.2)	2 (5.4)
	No	59 (86.8) <sup>1</sup>	35 (94.6)
FAS-II score	Mean (SD)	4.4 (2.3)	5.4 (1.9)
Total N		68 <sup>1</sup>	37

Note. <sup>1</sup>As one participant has been excluded from the analyses in this chapter (see text for details), their demographic data is not included here; any differences from the corresponding table in Chapter 3 reflect this. <sup>2</sup>In the homeless group; all of the 16 year olds in the housed group had attained some GCSEs or equivalent qualifications. FAS-II = the Family Affluence Scale 2<sup>nd</sup> edition (Currie et al., 2008).

Tests were selected from the Psychology Experiment Building Language (PEBL) battery developed by Mueller and Piper (2014) to assess EF. The battery provides researchers with easy access to a range of cognitive tests. The tests used in the current study were: Berg Card Sort Test - 64 card version (BCST-64), Corsi Blocks Backwards (Corsi), Iowa Gambling Task (IGT), Colour-Word Stroop, and Tower of London (ToL). These tasks tapped the following EF domains: shifting / flexibility, visuospatial working memory, impulsivity / risky decision making, selective attention / inhibition, and planning. The variable used in the previous chapter to index problem solving ability (number of moves over the minimum required to solve the problem) was not included here or in subsequent chapters as planning time was adjusted for total time, and this adjusted planning time was negatively correlated with the number of moves over the minimum required to solve the problem in both groups (Homeless:  $r(66) = -.534, p < .001$ ; Housed:  $r(35) = -.633, p < .001$ ). Verbal fluency was also assessed using letter and category fluency (Tombaugh, Kozak, & Rees, 1999), and creative thinking via the Alternate Uses Test (AUT; Guilford, 1950, 1967), which were not part of the PEBL battery. IQ was assessed by the two-subtest Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). All tests lasted between 3 and 15 minutes. Full details about each of these tests can be found in Chapter 3; the Alternate Uses Test is described below. Figure 12 outlines the procedure. The order of tasks was counterbalanced around the IQ task, which always appeared in the middle (as it was anticipated to be particularly challenging for participants, it was strategically placed before the midway break). There were seven orders in total to minimise potential order and fatigue effects.

### *Alternate Uses Test (AUT)*

The Alternate Uses Test (AUT) was developed by Guilford (1950, 1967) to assess divergent thinking and generativity. Divergent thinking refers to generating ideas or possibilities from a starting point or prompt, and contrasts with convergent thinking which involves working out the correct answer or following a specific rule (e.g., Plucker & Renzulli, 1999). The AUT is also considered to assess creative potential with executive components (e.g., Gilhooly, Fioratou, Anthony, & Wynn, 2007; Runco, 2007). Participants completing the AUT are tasked with thinking of as many uses as possible for everyday objects. The version used in the current study was the same as that used in Dahlman's study with street youth: participants had 2 minutes (for each object) to come up with as many uses as they could think of for a newspaper, a shoe, and a key (Dahlman et al., 2013).

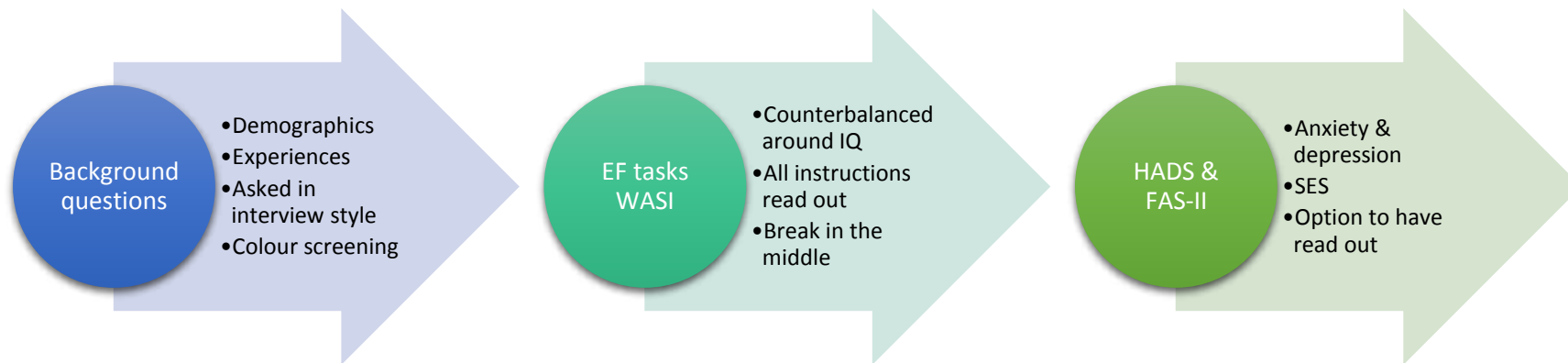


Figure 12. Procedure.

The AUT yields 4 different scores: fluency, flexibility, originality, and elaboration. Fluency scores reflect how many uses in total participants come up with in the allotted time (6 minutes for all 3 objects) and can be thought of as representing ideational fluency / generativity, i.e. how easily participants can generate ideas. Flexibility refers to how many different categories participants' responses fit into, indicating how easily they can move between different types of ideas. The categories were pre-determined. Both fluency and flexibility were reported in Dahlman and colleagues' (2013) study. Elaboration was scored in terms of how much detail was given by participants in each response. For each response, if participants just gave a single use for the object with no other detail they scored zero points for elaboration, if they gave one extra detail they scored one point, and if they gave two or more extra details they scored two points.

Aside from comparing fluency and flexibility scores with those reported by Dahlman and colleagues (2013), the main focus for the current study was on the originality scores, as these are considered to give an indication of creativity (e.g., Runco & Jaeger, 2012). The unusualness of each response is scored relative to all of the other responses given by the sample. Responses that were given by less than 5% of participants were considered 'unusual' and scored one point for originality; responses that were given by less than 1% of participants were considered 'unique' and scored two points. Participants who scored higher were more original relative to the sample, which likely indicates that they were more creative. It should be noted, though, that those who generated more responses in total (higher fluency) were more likely to have had higher originality scores (Hocevar, 1979). This was



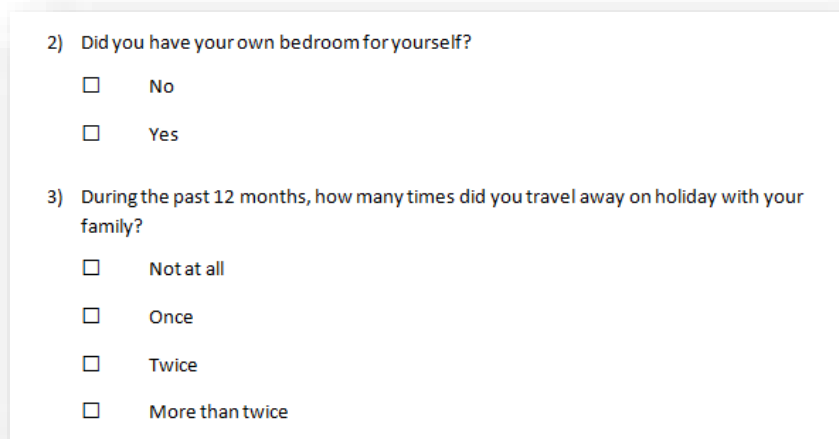
mitigated by dividing the originality score by the fluency score for each participant to give the proportion of a participant's total responses that were unusual. There was some indication of validity, in that the version of the task used for my study matched that used previously to investigate creativity in a similar population (street youth), without issue (Dahlman et al., 2013).

Internal consistency across items was high for the measures of interest: fluency (Cronbach's  $\alpha = .916$ ), flexibility (Cronbach's  $\alpha = .850$ ), and originality (Cronbach's  $\alpha = .846$ ). For the flexibility score, a list of pre-determined categories was compiled by two researchers; the primary researcher scored all responses, while a second researcher independently scored 20% of the sample. There was strong agreement between the researchers as to which responses fell into which categories,  $\kappa = .832$ ,  $p < .001$ , indicating good interrater reliability.

#### *Family Affluence Scale version II (FAS-II)*

The Family Affluence Scale (FAS-II) is a brief, resource-based measure of socioeconomic status that can be completed by participants, in this case young people, themselves without requiring information from parents (Currie et al., 2008). FAS-II focuses on material objects and experiences that young people may or may not have had depending on their background (see Figure 13 for sample items). For example, the family household having had two or more vehicles is likely to indicate a more wealthy background than having one or none. Socioeconomic status has been assessed in many ways, usually including one or more of the following: parental income, parental education, and parental occupation, though there seems to be little consensus on what represents a gold standard measure (Bradley & Corwyn, 2002). Using a

method of assessing socioeconomic status that relied on information from parents would not have been suitable for the homeless young people, as many were estranged from parents and relationship breakdown was the main reason cited for becoming homeless for nearly half of the group.



2) Did you have your own bedroom for yourself?

No

Yes

3) During the past 12 months, how many times did you travel away on holiday with your family?

Not at all

Once

Twice

More than twice

*Figure 13. Sample items from the FAS-II (Currie et al., 2008).*

The FAS-II was developed for use in a study of adolescent health across several countries, meaning the items had to apply to a wide range of countries and cultures, and represent indicators of relative wealth internationally (Currie et al., 2008). FAS-II has been found to correlate with self-reported parental occupation, and child and parent agreement on the FAS-II has been found to be high (Currie, Elton, Todd, & Platt, 1997; Currie et al., 2008). Across countries, the country-level FAS-II was found to be strongly associated with Gross Domestic Product (GDP),  $r_s = .87$ , as well as health outcomes (Boyce, Torsheim, Currie, & Zambon, 2006). UNICEF adopted the FAS-II as an indicator of child material well-being (UNICEF, 2007).

The PEBL EF tests, letter and category fluency, AUT, and WASI were administered on a laptop using PEBL and Microsoft PowerPoint, respectively. Responses and scoring for the non-PEBL tasks were recorded using pen and paper. Audio recordings were also used for letter and category fluency, WASI Vocab, and AUT in case of missed / unclear responses, and proved very helpful when it came to scoring the tasks. The FAS-II was completed using pen and paper by the participants themselves, unless they had indicated they wanted the researcher to read the questions out and record responses for them. All participants were given this option in case of reading difficulty.

### ***Statistical Analysis***

The main technique used to analyse data in this chapter was Multivariate Analysis of Variance (MANOVA). MANOVA was chosen as it enabled consideration of all of the EF measures in one analysis, and its use fits with the notion that EFs are related but also distinguishable. If DVs are related, MANOVA is a more appropriate technique to use than univariate analyses, as MANOVA can accommodate relationships between DVs (Tabachnick & Fidell, 2014). The creativity variables could not be included in the main MANOVA, as they were highly inter-correlated and would have introduced multicollinearity, so were analysed separately. Sensitivity analyses were conducted using Multivariate Analysis of Covariance (MANCOVA) after the main analysis to check for the effects of potential contributing factors, such as differences in IQ. IQ was not included in the main analysis because it is unclear what the relationship between IQ and EFs looks like, and therefore it is not known exactly what would be 'accounted for' by including it as a covariate (Dennis et al., 2009). In addition, due to consistent reports

of moderate to strong associations between socioeconomic status and IQ (Bradley & Corwyn, 2002), lower IQ in the homeless group would be expected; if IQ was then controlled for, the analysis would not reflect the true nature of the groups. However, as it is very common to control or match for IQ, especially in the neurodevelopmental literature, IQ was included as a covariate in the subsequent sensitivity analysis. Each MANCOVA contained one covariate: IQ, socioeconomic status (as assessed by the FAS-II), and highest level of education so far.

Several variables violated assumptions of parametric tests and a handful of univariate outliers were also identified. Outliers were defined as those scores that fell more than 3 standard deviations away from the mean ( $z$  greater than or equal to  $\pm 3.29$ ), which were adjusted to fall at the score corresponding to 3 standard deviations away from the mean ( $z = 3.29$ ) by rearranging the equation used to calculate  $z$  scores to instead find the score that fell at  $z = 3.29$ , i.e.  $(3.29 \times SD) + \text{Mean} = x$  rearranged from the original  $z = (x - \text{Mean}) / SD$ . This meant that their position as data points far from the mean was maintained but that their influence was reduced. Variables that had violated parametric assumptions were transformed according to the violation, as recommended by Tabachnick and Fidell (2014). Most had moderate positive skew so a square-root transformation was applied, some had more severe positive skew and were thus log-transformed, and one variable was negatively skewed to a moderate degree so was reflected, then square-root transformed. Skew and kurtosis were within  $1SD$  of the mean ( $z = 0, z = 3$ , respectively, for normal distributions) after transformation.

Linearity was inspected using scatterplot matrices - all pairs of variables appeared to have a linear relationship.

Assumptions about the data that are specific to MANOVA were broadly met. There were more cases than DVs in every cell ( $n = 35$  in the smallest cell), any issues of non-normality or heterogeneity of variance were minimised by the transformations, and there were no problems with singularity or multicollinearity (all  $r_s < .70$ ). Mahalanobis distance indicated no multivariate outliers in the data, as it did not exceed the critical chi square value of 24.32 for 7 DVs ( $p > .001$ ). Box's M test indicated homogeneity of variance-covariance matrices ( $F(28, 18744.3) = 0.971, p = .508$ ) and Levene's test indicated homogeneity of variance ( $F(1, 99) = 0.006$  to  $4.70$ , all  $p_s > .01$ ). A One-Way MANOVA was conducted to investigate whether the homeless and housed groups differed in their performance on tests of EF, the DVs in this analysis were: BCST64PersevErrors (sqrt), CorsiBlockSpan, IGTDeckPreference, StroopInterference (reflect and sqrt), ToLTBFMOutofTotal (sqrt), LetterFluency (sqrt), and CatFluency. No post-hoc comparisons were conducted as there were only two groups in the IV. Pillai's Trace ( $V$ ) is the statistic quoted for all MANOVA and MANCOVA analyses due to its relative robustness and the discrepancy in group sizes (Field, 2009; Tabachnick & Fidell, 2014). Follow-up univariate ANOVAs were used to assess group differences on each DV. In order to assess any group differences on a combination of DVs (representing the underlying dimension of EF), discriminant function analysis was also used to follow-up the omnibus MANOVA, as recommended by Field (2009) and others (e.g., Barton, Yeatts, Henson, & Martin, 2016). Discriminant analysis, like MANOVA, is a

multivariate technique that can accommodate relationships between DVs. It is statistically identical to MANOVA but in reverse, the DVs in MANOVA become IVs in discriminant analysis and the IVs become DVs. The aim was to see how the DVs from the omnibus MANOVA were able to discriminate the groups (Field, 2009).

To investigate potential group differences in creativity, separate ANOVAs were conducted for each AUT variable. The main reason for using this approach rather than multivariate analysis was that the AUT variables were highly correlated with each other ( $r_s > .80$ ), and it was therefore inappropriate to enter them in the same analysis. Originality corrected for fluency was the DV of interest, with fluency and flexibility included as DVs for comparison with Dahlman's results (Dahlman et al., 2013). Although transformations (sqrt and log) were applied to minimise issues with normality and heterogeneity of variance, it should be noted that AUT fluency displayed slight positive kurtosis after log transformation. Levene's test indicated homogeneity of variance for all ANOVAs ( $F(1, 103) = 0.889$  to  $4.435$ , all  $p_s > .01$ ).

## Results

Overall, the housed group had better mean scores on EF tasks than the homeless group. Mean scores and their corresponding standard deviations can be found in Table 14. There was no significant association between group and sex ( $\chi^2(1) = 2.469$ ,  $p = .116$ ), and participants in the two groups were of a similar age ( $t(55.9) = 2.011$ ,  $p = .049$ ), but the groups did differ in terms of their socioeconomic status ( $t(102) = -2.185$ ,  $p = .031$ ). However, the

magnitude of the difference was small (Homeless group:  $M = 4.39$ ,  $SD = 2.30$ ; Housed group:  $M = 5.35$ ,  $SD = 1.86$ ). The housed group also demonstrated better performance on the IQ measure than the homeless group ( $t(103) = -3.045$ ,  $p = .003$ ), and tended to have achieved a higher level of education ( $\chi^2(1) = 6.198$ ,  $p = .013$ ). There were more young people whose first language was not English in the housed group, likely as a result of the diverse student populations within the education establishments we targeted for recruitment ( $\chi^2(1) = 5.909$ ,  $p = .015$ ). Yates' continuity correction was applied to all 2x2 chi-square analyses. These differences between the groups could have affected EF performance and thus the variables in question were included as covariates in sensitivity analyses after the main analysis to examine their potential effects. First language other than English could not be entered into the analyses as it was a nominal variable with a category split of greater than 90/10 in the homeless group. Mean scores adjusted for IQ, SES, and highest level of education can be found in Table 15, Table 16, and Table 17, respectively.

### ***Main Analysis***

An overall significant difference between the groups in EF performance was found using Pillai's Trace ( $V = .241$ ,  $F(7, 93) = 4.224$ ,  $p < .001$ ). Follow-up univariate ANOVAs indicated that the housed group outperformed the homeless group on several EF tasks, including: shifting / flexibility (BCST64PersevErrors;  $F(1, 99) = 4.939$ ,  $p = .029$ , partial  $\eta^2 = .048$ ), working memory (CorsiBlockSpan;  $F(1, 99) = 8.220$ ,  $p = .005$ , partial  $\eta^2 = .077$ ), impulsivity / risky decision making (IGTDeckPreference;  $F(1, 99) = 9.806$ ,  $p = .002$ , partial  $\eta^2 = .090$ ), selective attention / inhibition (StroopInterference;

$F(1, 99) = 5.379, p = .022, \text{partial } \eta^2 = .052$ ), and planning (ToLTBFMOutOfTotal;  $F(1, 99) = 5.109, p = .026, \text{partial } \eta^2 = .049$ ). However, while MANOVA controls the familywise error rate for the omnibus analysis, this does not apply to the univariate ANOVAs also produced by SPSS, as these are equivalent to running several univariate ANOVAs separately (Field, 2009). With Bonferroni correction for the number of ANOVAs conducted, significant differences remained between the groups on working memory and impulsivity / risky decision making ( $p < .007$ ), though the correction is likely to be overly conservative.

Table 14. Descriptive statistics for EF performance and IQ by group.

EF measure	Group	
	Homeless M (SD)	Housed M (SD)
BCST64PersevError	8.0 (3.1)	7.1 (4.0)
CorsiBlockSpan	5.27 (1.35)	6.14 (1.59)
IGTDeckPreference	-0.064 (0.218)	0.067 (0.196)
StroopInterference (ms)	-90.8 (65.6)	-60.2 (44.7)
ToLTBFMOutOfTotal	0.044 (0.010)	0.049 (0.014)
LetterFluency	27.0 (10.8)	29.7 (10.6)
CatFluency	16.9 (4.6)	16.9 (5.8)
IQ		
WASI 2FSIQ	82.4 (13.2) Range: 55 to 115	91.6 (17.4) Range: 55 to 118

*Note.* BCST64PersevError is an indicator of shifting / flexibility, CorsiBlockSpan is an indicator of visuospatial working memory, IGTDeckPreference is an indicator of risky decision making / impulsivity, StroopInterference is an indicator of selective attention / inhibition, ToLTBFMOutOfTotal is an indicator of planning time. Any discrepancies with Table 9 reflect differences in variables used for comparison and the exclusion of one participant from the Homeless group.



Table 15. Descriptive statistics (transformed) for EF performance by group with IQ as a covariate.

EF measure	Group			
	Homeless N = 65		Housed N = 36	
	M (SD)	M <sub>adj</sub> (SE)	M (SD)	M <sub>adj</sub> (SE)
BCST64PersevError (sqrt)	2.79 (0.54)	2.73 (0.07)	2.52 (0.65)	2.63 (0.09)
CorsiBlockSpan	5.28 (1.36)	5.39 (0.17)	6.14 (1.59)	5.94 (0.24)
IGTDeckPreference	-0.07 (0.22)	-0.06 (0.03)	0.07 (0.20)	0.06 (0.04)
StroopInterference (reflect & sqrt)	10.24 (3.25)	10.24 (0.38)	8.81 (2.38)	8.81 (0.52)
ToLTBFMOutOfTotal (sqrt)	0.21 (0.02)	0.21 (0.00)	0.22 (0.03)	0.22 (0.00)
LetterFluency (sqrt)	5.11 (1.07)	5.23 (0.11)	5.40 (0.94)	5.17 (0.15)
CatFluency	16.94 (4.60)	17.51 (0.56)	17.14 (5.70)	16.10 (0.76)

Note. BCST64PersevError is an indicator of shifting / flexibility, CorsiBlockSpan is an indicator of visuospatial working memory, IGTDeckPreference is an indicator of risky decision making / impulsivity, StroopInterference is an indicator of selective attention / inhibition, ToLTBFMOutOfTotal is an indicator of planning time.

Table 16. Descriptive statistics (transformed) for EF performance by group with SES as a covariate.

EF measure	Group			
	Homeless N = 65		Housed N = 36	
	M(SD)	M <sub>adj</sub> (SE)	M(SD)	M <sub>adj</sub> (SE)
BCST64PersevError (sqrt)	2.79 (0.54)	2.78 (0.07)	2.52 (0.65)	2.54 (0.10)
CorsiBlockSpan	5.28 (1.36)	5.28 (0.18)	6.14 (1.59)	6.13 (0.25)
IGTDeckPreference	-0.07 (0.22)	-0.07 (0.03)	0.07 (0.20)	0.07 (0.04)
StroopInterference (reflect & sqrt)	10.24 (3.25)	10.18 (0.37)	8.81 (2.38)	8.92 (0.50)
ToLTBFMOutOfTotal (sqrt)	0.21 (0.02)	0.21 (0.00)	0.22 (0.03)	0.22 (0.01)
LetterFluency (sqrt)	5.11 (1.07)	5.13 (0.13)	5.40 (0.94)	5.35 (0.17)
CatFluency	16.94 (4.60)	17.06 (0.62)	17.14 (5.70)	16.92 (0.85)

Note. BCST64PersevError is an indicator of shifting / flexibility, CorsiBlockSpan is an indicator of visuospatial working memory, IGTDeckPreference is an indicator of risky decision making / impulsivity, StroopInterference is an indicator of selective attention / inhibition, ToLTBFMOutOfTotal is an indicator of planning time.

Table 17. Descriptive statistics (transformed) for EF performance by group with highest level of education as a covariate.

EF measure	Group			
	Homeless N = 64		Housed N = 36	
	M(SD)	M <sub>adj</sub> (SE)	M(SD)	M <sub>adj</sub> (SE)
BCST64PersevError (sqrt)	2.78 (0.53)	2.75 (0.07)	2.52 (0.65)	2.58 (0.10)
CorsiBlockSpan	5.28 (1.37)	5.31 (0.19)	6.14 (1.59)	6.10 (0.25)
IGTDeckPreference	-0.07 (0.22)	-0.07 (0.03)	0.07 (0.20)	0.07 (0.04)
StroopInterference (reflect & sqrt)	10.19 (3.25)	10.21 (0.38)	8.81 (2.38)	8.76 (0.51)
ToLTBFMOutOfTotal (sqrt)	0.21 (0.02)	0.21 (0.00)	0.22 (0.03)	0.22 (0.01)
LetterFluency (sqrt)	5.13 (1.05)	5.16 (0.13)	5.40 (0.94)	5.36 (0.17)
CatFluency	17.02 (4.60)	17.14 (0.63)	17.14 (5.70)	16.92 (0.85)

Note. BCST64PersevError is an indicator of shifting / flexibility, CorsiBlockSpan is an indicator of visuospatial working memory, IGTDeckPreference is an indicator of risky decision making / impulsivity, StroopInterference is an indicator of selective attention / inhibition, ToLTBFMOutOfTotal is an indicator of planning time.

Follow-up discriminant function analysis revealed one discriminant function that explained 100% of the variance, canonical  $R^2 = .241$ , and significantly differentiated the homeless and housed groups,  $\Lambda = 0.759$ ,  $\chi^2(7) = 26.363$ ,  $p < .001$ . The frequency distribution of discriminant scores is presented in Figure 14. Examining the structure coefficients (similar in nature to factor loadings), which indicate the correlation between each EF variable and the composite variable, it seems that neither type of verbal fluency, and particularly category fluency ( $r = .034$ ), were related as strongly as the other EF variables to the composite variable (Table 18). Given category fluency seemed to contribute highly to the creation of the composite variable, according to its standardised function coefficient (similar to beta weights in regression), it may have been important to the composite through its relationship(s) with other EF variables. Performance on the IGT ( $r = .558$ ) and visuospatial working memory span ( $r = .511$ ) were the highest loading variables on the discriminant function, accounting for 31% and 26% of the variance in the composite variable, respectively. An independent samples  $t$ -test on the centroid mean discriminant function scores confirmed that they were significantly different for the homeless and housed groups,  $t(99) = -5.610$ ,  $p < .001$ . These results were consistent with those of the omnibus MANOVA.

Table 18. Structure coefficients, squared structure coefficients, and standardised discriminant function coefficients from discriminant analysis.

EF measure	Standardised Coefficient	Structure Coefficient ( $r_s$ )	Squared Structure Coefficient ( $r_s^2$ )
BCST64PersevError (sqrt)	-.342	-.396	.157
CorsiBlockSpan	.423	.511	.261
IGTDeckPreference	.599	.558	.311
StroopInterference (reflect & sqrt)	-.398	-.413	.171
ToLTBFMOutOfTotal (sqrt)	.230	.403	.162
LetterFluency (sqrt)	.303	.247	.061
CatFluency	-.528	.034	.001

*Note.* Standardised Coefficient refers to the standardised canonical discriminant function coefficients, which indicate how much the variables contribute to the composite variable. Structure Coefficient refers to the structure coefficients, which indicate how strong the relationship is between individual variables and the composite variable. The Squared Structure Coefficients act as an indicator of effect size. BCST64PersevErr (sqrt) and StroopInterference (reflect & sqrt) have negative coefficients because this reflects better performance by the housed group on these variables, the opposite direction to the other variables (i.e. positive = better performance by housed group). The standardised coefficient for CatFluency indicates better performance by the homeless group.

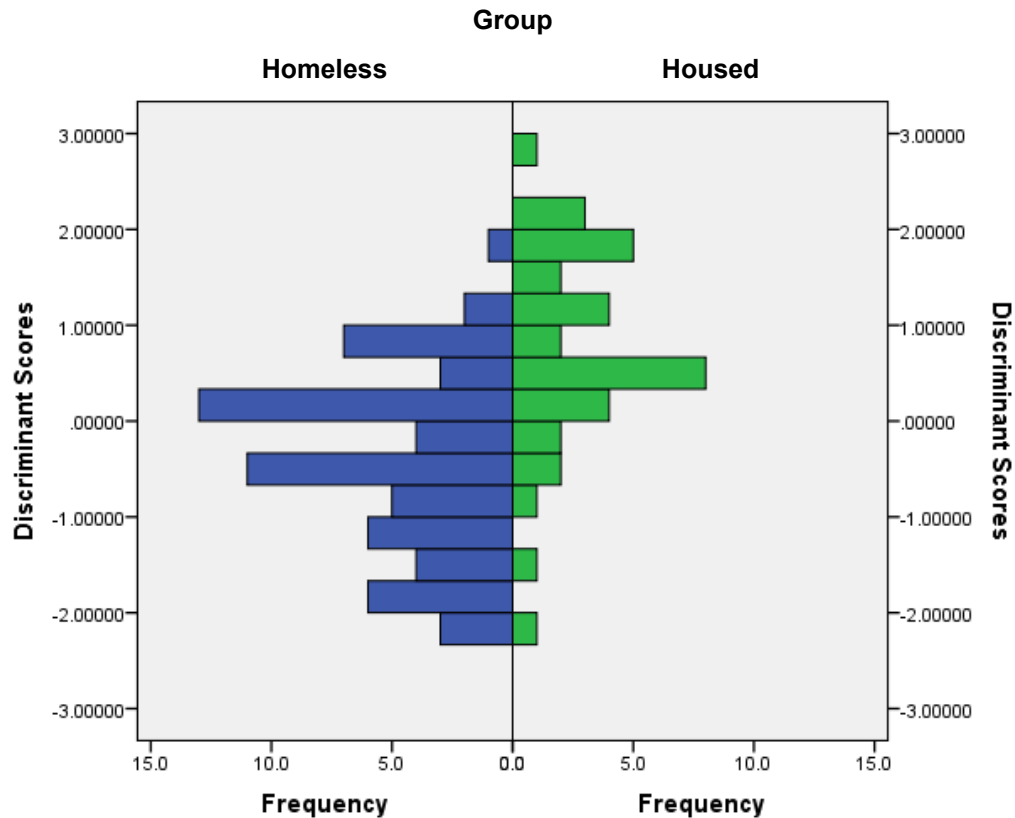


Figure 14. Frequency distribution of discriminant scores across the homeless and housed groups.

This illustrates that for the homeless group the majority of discriminant scores are negative and for the housed group they are mostly positive, meaning the analysis was able to discriminate fairly well between the two participant groups based solely on their EF performance.

### Sensitivity Analysis

To explore how potential contributory factors may have affected the results, the analyses were re-run including these factors as covariates in separate MANCOVAs. IQ was the only significant covariate; SES and highest level of education so far were not significantly affecting the combined DV (EF performance).

## *IQ*

With IQ included in the analyses, there was still a significant difference between the groups on EF (see Table 19), though a moderate reduction in effect size,  $V = .183$ ,  $F(7, 92) = 2.947$ ,  $p = .008$ . Follow-up ANCOVAs indicated that differences in impulsivity / risky decision making (IGTDeckPreference;  $F(1, 98) = 7.063$ ,  $p = .009$ , partial  $\eta^2 = .067$ ) and selective attention / inhibition (StroopInterference;  $F(1, 98) = 4.817$ ,  $p = .031$ , partial  $\eta^2 = .047$ ) remained significant. Differences between groups in shifting / flexibility (BCST64PersevErrors;  $F(1, 98) = 0.778$ ,  $p = .380$ , partial  $\eta^2 = .008$ ), working memory (CorsiBlockSpan;  $F(1, 98) = 3.324$ ,  $p = .071$ , partial  $\eta^2 = .033$ ), and planning (ToLTBFMOutOfTotal;  $F(1, 98) = 1.323$ ,  $p = .253$ , partial  $\eta^2 = .013$ ) were no longer significant when IQ was included as a covariate. Effect sizes were also reduced across the board. However, these findings should be interpreted with caution, given the reasons cited above and discussed further in the next section. It should be noted that, with a Bonferroni correction applied ( $p < .007$ ), while the omnibus MANCOVA is unaffected the remaining differences in impulsivity / risky decision making and selective attention / inhibition would not have been significant with IQ included in the analyses.

## *SES*

When SES was included as a covariate, group differences were still apparent in EF but with a slight reduction in effect size,  $F(7, 92) = 3.838$ ,  $p = .001$ ,  $V = .226$ . Follow-up ANCOVAs indicated differences in shifting / flexibility (BCST64PersevErrors;  $F(1, 98) = 3.677$ ,  $p = .058$ , partial  $\eta^2 = .036$ ) were no longer significant with all other differences remaining significant (see Table 19). It should be noted that the assumption of homogeneity of

regression slopes was not met for the MANCOVA with SES as a covariate, as there was a significant interaction between SES and Group, which would perhaps be expected but limits interpretability. In addition, had a Bonferroni correction been applied ( $p < .007$ ), differences in impulsivity / risky decision making would have held, working memory would have been borderline ( $p = .007$ ), but all other differences would not have survived correction.

### *Education*

Including highest level of education in the analyses yielded a reduction in effect size but significant differences between groups in EF remained,  $F(7, 91) = 3.393$ ,  $p = .003$ ,  $V = .207$ . Follow-up ANCOVAs showed differences were no longer significant in shifting / flexibility (BCST64PersevErrors;  $F(1, 97) = 1.924$ ,  $p = .169$ , partial  $\eta^2 = .019$ ) and planning (ToLTBFMOutOfTotal;  $F(1, 97) = 3.556$ ,  $p = .062$ , partial  $\eta^2 = .035$ ), though all other results remained significant with reduced effect size (see Table 19). It should be noted that applying a Bonferroni correction ( $p < .007$ ) would have resulted in differences in impulsivity / risky decision making remaining significant, but differences in selective attention / inhibition and working memory would not have held.



Table 19. MANOVA and Sensitivity Analyses.

	Pillai's Trace	<i>F</i>	<i>df</i> (hypothesis, error)	<i>p</i>	Partial $\eta^2$
MANOVA					
Group	.241	4.224	7, 93	.000	.241
MANCOVA					
Group (IQ covaried)	.183	2.947	7, 92	.008	.183
IQ	.462	11.276	7, 92	.000	.462
Group (SES covaried)	.226	3.838	7, 92	.001	.226
SES	.053	0.738	7, 92	.641	.053
Group (Education covaried)	.207	3.393	7, 91	.003	.207
Education	.082	1.155	7, 91	.336	.082

## Creativity Analysis

Although scores were similar for both groups on many of the creativity variables, and were generally variable, there was greater variation in the homeless group (see Table 20). In terms of uncorrected originality, homeless young people ( $M = 25.4$ ,  $SD = 20.0$ ) scored more highly than housed young people ( $M = 24.0$ ,  $SD = 11.4$ ), but scores were similar in both groups when originality was corrected for the total number of responses generated (fluency).

Table 20. Descriptive statistics for the AUT.

Creativity measure	Group			
	Homeless $N = 68$		Housed $N = 37$	
	$M$ ( $SD$ )	Min., Max.	$M$ ( $SD$ )	Min., Max.
AUT Fluency	21.7 (15.4)	2, 67	21.2 (8.4)	5, 40
AUT Flexibility	14.7 (7.3)	2, 35	15.6 (5.8)	4, 25
AUT Originality (uncorrected)	25.4 (20.0)	1, 84	24.0 (11.4)	4, 47
AUT Originality (corrected)	1.12 (0.22)	0.50, 1.56	1.11 (0.21)	0.67, 1.50
AUT Elaboration	4.51 (5.04)	0, 23	4.14 (4.58)	0, 18

Univariate ANOVAs revealed no significant differences between the homeless and housed groups on any of the creativity variables: AUT fluency (log),  $F(1, 103) = 0.795$ ,  $p = .375$ , partial  $\eta^2 = .008$ ; AUT flexibility (sqrt),  $F(1, 103) = 0.738$ ,  $p = .392$ , partial  $\eta^2 = .007$ ; AUT originality corrected for fluency,  $F(1, 103) = 0.053$ ,  $p = .818$ , partial  $\eta^2 = .001$ . The finding for AUT fluency (log) should be interpreted with caution, as slight positive kurtosis remained after transformation.

## Discussion

Homeless young people tended to demonstrate poorer performance on EF tasks than their housed peers, as hypothesised. Impulsivity / risky decision making and visuospatial working memory were two key areas of difficulty, but there was also evidence of problems with shifting / flexibility, selective attention / inhibition, and planning. Contrary to what may have been expected, neither type of verbal fluency seemed to pose difficulties for the homeless group compared to housed peers.

Although the groups were similar in age and sex, there were differences in IQ, SES, and highest level of education so far. In terms of SES, the difference was minimal and, through choosing educational institutions that were also accessed by homeless young people, we attempted to minimise the discrepancy between groups as best we could. IQ in both groups was low, but particularly low in the homeless group. The changes to results were minimal when these variables were included as covariates, with IQ having the only real impact on significance and effect size. This is difficult to interpret, however, as it is not known how EFs and IQ relate to each other and what exactly is being removed when IQ is entered as a covariate (Dennis et al., 2009). The impact of including IQ, SES, and highest level of education so far as covariates was smaller than expected, considering the difference between groups on these variables and their associations with EF development. Perhaps their influence was diminished by our attempt to match the comparison group as closely as was practicable to the homeless group. Alternatively, it could be that meaningful differences in EF performance exist over and above these demographic factors.

Follow-up discriminant function analysis revealed that the EF variables could be combined to create a function that significantly differentiated the homeless and housed groups, suggesting the groups are distinguishable using EF performance. Impulsivity / risky decision making and visuospatial working memory were the variables most highly related to the discriminant function, which is consistent with the findings from the main analysis.

Although there were some areas of EF that were intact, these were different EF domains to those found in Chapter 3. To recap, compared to the comparative data, working memory was similar in both samples and selective attention was actually found to be better in the homeless young people. On the other hand, compared to the housed group using the same tasks and procedure, no differences in performance were detected on the verbal fluency tasks (letter and category fluency), but performance on working memory and selective attention / inhibition was worse. Despite some differences in task modality, the findings in this chapter are consistent with those of other studies with homeless young people, in terms of poorer performance on working memory, selective attention, and planning (Saperstein, Lee, Ronan, Seeman, & Medalia, 2014; Borges-Murphy, Pontes, Stivanin, Picoli, and Schochat 2012; Pluck, Banda-Cruz, Andrade-Guimaraes, & Trueba, 2017). The results also lend support to an overall difficulty in EF performance (Saperstein et al., 2014), but are inconsistent with studies that found no differences in shifting or IQ performance (Dahlman et al., 2013; Rohde, Noell, & Ochs, 1999; Rafferty, Shinn, & Weitzman, 2004). The results link in well with the unity and diversity theory of executive functions, in that overall EF performance tended to be poorer in homeless young people, but

there were also differences in performance across EF domains and performance in certain EF domains was particularly important in discriminating between the two groups (Miyake et al., 2000; Miyake & Friedman, 2012). Although EFs were likely still developing in the homeless group, use of an age-matched comparison enabled us to assess EF performance relative to young people who were also likely to be experiencing a critical stage of EF development (e.g., Selemon, 2013).

No significant differences in creativity between the groups were found, contrary to predictions. There are several potential explanations for this result. The AUT version implemented by Dahlman and colleagues (2013) is a timed task. Despite trying to reduce participant stress as much as possible, it could have been that the timed nature of the task induced anxiety and that performance was therefore not as good in the present study as it could have been. It could also be that a battery of tasks with a broad range of creativity tests would have been better able to assess creativity, such as Torrance's Test of Creative Thinking (e.g. Torrance, 1965; Runco, Millar, Acar, & Cramond, 2010). Dahlman and colleagues (2013) used only fluency and flexibility in their study, not originality, so the differences in their work could reflect differences in general generativity and flexibility, rather than creativity *per se*, explaining inconsistencies with the results presented here. Or, as the participants in Dahlman's study were street youth of South America (Dahlman et al., 2013), who are often engaged in findings ways of making money on the streets, it may just be that there is a genuine difference in creativity between those street youth and the young people in South Wales living in supported accommodation, who may be less frequently involved in

street enterprise. It could also be that experiences of street youth are more 'diversifying' than those of young people living in supported accommodation, leading to greater creativity in this group (e.g., Damian & Simonton, 2015). The variation in scores for the homeless group suggests there may be some homeless young people who are particularly creative, and it could be the case that these young people are able to move on into their own accommodation more often than those who are less creative. This is something that will be explored in Chapter 5.

### ***Limitations***

There are some limitations that should be noted. Firstly, although every effort was made to recruit as many housed young people as possible across two campuses of a college and in a diverse sixth form, there were still substantially fewer participants in the housed group than the homeless group. It may have been that the incentives offered for participation (£10 in high street vouchers) were not as attractive or that this group had less spare time to be able to have taken part. Additionally, due in part to the diverse sixth form targeted, there were more participants that had English as a second language in the housed group than the homeless group. This could potentially explain the lack of differences found between groups on verbal fluency, although it was still a minority of participants who had English as a second language, and no differences were found in verbal fluency upon running the analysis without these participants. The nature of some of the tests could have affected results - timed tests may have induced anxiety, resulting in poorer performance. Stroop, letter and category fluency, and the AUT were all timed tasks. As problems with anxiety are common in homeless young

people (e.g., Hodgson et al., 2013), it may have been the case that they were affected more than the housed group on the relevant tasks. Relationships between anxiety, depression, and EFs will be explored in the next chapter. The creativity measure used, the AUT, may not have been the best way to assess creativity. There are other batteries of creativity that contain several tasks that are likely more able to fully capture creativity performance (e.g. the Torrance Tests of Creativity). The AUT was chosen because one of the aims of this chapter was to investigate whether findings of greater creativity in street youth applied to homeless youth living in temporary accommodation, and because it was the measure used in Dahlman's study (Dahlman et al., 2013), which highlighted this as an area of study when identified in the systematic review. This enabled a direct comparison of results. Finally, as mentioned in Chapter 3, there was great variability in EF performance, including creative thinking, within the homeless group. It may be that the diverse backgrounds and experiences within the group differentially impact on EF development, resulting in heterogeneity in EF. Further discussion of this point can be found in Chapter 6.

## **Conclusion**

The aim of this chapter was to compare EF and creativity in homeless and housed groups. Overall, homeless young people demonstrated worse performance on EF tasks than housed young people, with particular difficulties in visuospatial working memory and impulsivity / risky decision making. This was inconsistent with findings from the previous chapter, using 'normative' data of questionable quality, but was largely consistent with previous studies in the homelessness literature. However, comparative data

in the previous chapter was published in different studies, meaning the comparison samples varied by test and that there were some discrepancies between the tests used in the comparative studies and the tests used with homeless young people in the current study (see Chapter 3 for discussion). Contrary to expectations, no differences in verbal fluency were detected. Although predicted by a previous study with street youth, there were also no detected differences in creative thinking between the homeless and housed groups. It would be interesting to explore this in future using a more comprehensive test of creativity. The findings presented here suggest EF difficulties in homeless young people, but how these might impact on everyday life and capacity to exit homelessness is still to be determined. As such, the next chapter examines whether EF performance is related to short-term outcomes for homeless young people, such as moving into their own tenancy, and how EFs may be related to other challenges in their lives, such as symptoms of anxiety and depression.



## **CHAPTER 5: MENTAL HEALTH AND HOUSING OUTCOME**

The focus of this chapter is the application of findings from Chapters 3 and 4 to explore the potential impact of EF difficulties on aspects of homeless young people's lives. To summarise the findings to this point, homeless young people appear to have a varied profile of EF yet tend to demonstrate poorer performance on a range of EF tasks than housed young people. Working memory and impulsivity / risky decision making appear to be areas of particular difficulty. No differences were found between the groups on creativity. This leaves important questions about potential impacts, which will now be investigated.

The analyses presented in this chapter address three aims. The first aim was to compare the occurrence of anxiety and depression in homeless and housed young people. The second aim was to investigate the relationships between EFs and symptoms of anxiety and depression. The third aim was to consider whether EFs predict short-term housing outcomes among young people with experience of homelessness. The hypothesised moderating role of symptoms of anxiety and depression on this relationship were also explored.

The prevalence of a wide range of psychiatric disorders in homeless young people has been found to be considerably higher than that in young people from the general population (e.g., Edidin, Ganim, Hunter, & Karnik, 2012; Hodgson, Shelton, van den Bree, & Los, 2013). As many as 88% of homeless young people in a recent study screened positive for a current mental health disorder, with 93% screening positive for any lifetime

psychiatric disorders and 73% identified as having two or more (Hodgson, Shelton, & van den Bree, 2014). Rates of anxiety and depression in homeless young people have been reported to range from 22% to 32% for anxiety (not including Post-Traumatic Stress Disorder), and 12% to 33% for depression (e.g., Cauce et al., 2000; Hodgson et al., 2013; Saperstein, Lee, Ronan, Seeman, & Medalia, 2014). It is likely that poor mental health in this vulnerable group impacts on everyday functioning, and may create additional barriers to exiting homelessness, as well as compounding other difficulties (Hodgson et al., 2013; Shelton, Taylor, Bonner, & van den Bree, 2009).

Among individuals in the general population with diagnoses of major depressive disorder and/or anxiety disorders, the evidence generally points towards concurrent EF impairments in a range of EF domains (e.g., Airaksinen, Larsson, & Forsell, 2005; Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008; Fossati, Ergis, & Allilaire, 2002; Snyder, 2013; Wagner, Müller, Helmreich, Huss, & Tadić, 2015). For example, Castaneda and colleagues, in their review of young adults with major depressive disorder consistently found difficulties with executive function and working memory that could persist after recovery (Castaneda et al., 2008). Drilling down into individual EF domains, Wagner and colleagues noted that the most profound deficits in children and adolescents with major depressive disorder were in inhibition, planning, and verbal fluency, according to the studies included in their meta analysis (Wagner et al., 2015). In one of the only studies examining EFs across several anxiety disorders, Airaksinen and colleagues found EF difficulties in their anxious participants as a whole group, pinpointing panic disorder with and without agoraphobia and obsessive

compulsive disorder as specific disorders with EF impairments (Airaksinen et al., 2005). As rates of anxiety and depression are high in homeless young people, it would follow that those with such problems may also experience deficits in EF. Indeed, Saperstein and colleagues (2014) found that, among those who screened positive for psychiatric disorder, 64% also met criteria for cognitive impairment, including impairments in EF. There was no indication as to rates of cognitive and EF impairment in homeless young people *without* psychiatric disorders, as this was not assessed in Saperstein's study (Saperstein et al., 2014). No other studies have considered the potential relationship between EF and mental health in homeless young people. The current study builds on Saperstein's work by assessing EFs in a sample of homeless young people who vary widely in their experience of symptoms of common mental health problems, namely anxiety and depression, and by including a comparison group of housed young people. In addition, the potential moderating influences of anxiety and depression symptoms on the predicted relationship between EFs and housing outcome are explored.

There are some indications that cognitive difficulties, and EF difficulties in particular, could impact on housing-related outcomes for homeless young people. Cognitive impairments, including EFs such as planning, can adversely affect independent living, presenting barriers to accessing services and exiting homelessness (Backer & Howard, 2007). These difficulties can be perceived by services and landlords as non-compliant behaviours and lead to problems maintaining suitable accommodation, as well as increase vulnerability to using substances and compound risk for homelessness in care leavers (Backer & Howard, 2007). Despite the potential

impact on outcomes for homeless groups, cognitive impairment is not often assessed by services, as the focus tends to fall on more immediate needs, such as problematic substance use, likely because these needs present more obviously and staff may feel that they are more open to intervention (Solliday-McRoy et al., 2004). In homeless young people, a recent study found that having cognitive difficulties in addition to psychiatric disorder(s) was associated with being less likely to earn enough money to live independently (Saperstein et al., 2014). Schutt and colleagues found that, in homeless adults who also had severe mental health issues, EF predicted community functioning 18 months later when they had progressed into either supported or independent accommodation. Better EF was associated with better self-care regardless of accommodation type, but for those in supported group accommodation, better EF was also related to less turbulent behaviour (e.g., being able to control anger), which seems to indicate that supportive group housing can potentially compensate for some of the effects of EF difficulties on community functioning (Schutt, Seidman, Caplan, Martsinkiv, & Goldfinger, 2007).

Contexts in which young people live and grow up, for example the resources and opportunities available to them, interact with individual characteristics to help or hinder development and consequently outcomes (e.g., Bronfenbrenner, 1977, 1994; Tudge, Gray, & Hogan, 1997). Homeless young people are likely to have experienced economic hardship and instability growing up, and some researchers even conceptualise homelessness as a chronic lack of resources (e.g., Haber & Toro, 2004). As EF development continues into adulthood, there are likely to be reciprocal relationships

between EFs and interacting contexts across all levels, which vary over time; it is likely that economic, social, and internal environments can both influence and to some extent be influenced by a young person's EF skills and abilities (e.g., Bronfenbrenner 1977, 1994; Tudge et al., 1997). For example, internal environments may include the experience of symptoms of anxiety and/or depression, which are both associated with EF performance, likely to interact with other external contexts (e.g., limiting social support), and could either dampen positive effects of EF strengths or, conversely, exacerbate negative effects of EF needs on a young person's outcomes. Availability of affordable housing and changes to the welfare system represent macrosystem factors that could also interact with more proximal processes to impact on a young person's housing-related outcomes (e.g., Mackie, 2016; Stephens & Blenkinsopp, 2015).

Despite considerable adversity, many homeless young people are able to either maintain their supported accommodation or move on to more independent accommodation. EF skills and abilities may represent one set of resources that enable homeless young people to demonstrate resilience and live with increased stability and independence, in the face of challenges they are likely to have endured and continue to face (e.g., Masten, 2014). In turn, it is probable that moving towards independent living develops EFs, which further increases the likelihood of positive adaptation and development (e.g., Masten & Cicchetti, 2010). Recent research has highlighted promise in the feasibility of training EFs, both in terms of the generalisability of the training and its use in homeless young people (e.g., Holmes & Gathercole, 2014; Medalia et al., 2017). This suggests there could be scope to improve the

housing outcomes of homeless young people via augmentation of their EF skills.

Following on from the previous work in this area, and the findings presented in the preceding chapters, the predictions for this chapter were:

1. There would be a higher incidence of anxiety and depression ‘caseness’ in the homeless group compared to the housed group, which would replicate previous findings.
2. There would be associations between EFs and symptoms of anxiety and/or depression, in that higher anxiety or depression scores would be related to worse EF performance across a range of domains in both groups, which would also be consistent with previous findings.
3. That EFs would predict housing outcome in the homeless group, that is, whether they stayed in accommodation with a similar level of support (‘maintained’) or moved on to accommodation with less support (‘progressed’). Further, anxiety and/or depression symptoms would interact with EFs to predict housing outcome.
4. Those with negative outcomes would be expected to demonstrate the poorest EF performance and the highest levels of anxiety and/or depression symptoms.

## **Method**

### ***Materials and Procedure***

This chapter is mainly focused on the homeless group, though the housed group is included in analyses relating to the first two aims. The groups are as described in Chapters 3 and 4. The EF tests and procedure were also detailed in these chapters.

### ***Anxiety and Depression***

One measure that has not already been described is the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), which was used to give an indication of symptoms of anxiety and depression in both groups. The HADS is a well-validated and widely used screening tool (Bjelland, Dahl, Haug, & Neckelmann, 2002; Brennan, Worrall-Davies, McMillan, Gilbody, & House, 2010) that has also been used with adolescent age groups (White, Leach, Sims, Atkinson, & Cottrell, 1999). The scale consists of 14 items in total, seven relating to anxiety and seven relating to depression. For each item, there are four possible responses scored from 0-3, making 21 the total possible score for each subscale. It has been suggested that a score of 11 or greater on each subscale should be considered a 'case' (i.e., likely to screen positive for anxiety or depression), a score between eight and 10 is 'borderline' (i.e., a possible case of anxiety or depression), and a score less than seven would be a 'non-case' (Bjelland et al., 2002; Zigmond & Snaith, 1983). For the purposes of this thesis, 'case' scores of 11 or greater will be referred to as 'above threshold', scores of 7 or less as 'below threshold', and the term 'borderline' will be retained for scores between eight and 10.

In the homeless group, the anxiety subscale showed good internal consistency (Cronbach's  $\alpha = .78$ ), but the depression subscale had a lower internal consistency score than is typically considered to be adequate (Cronbach's  $\alpha = .58$ ). One item on the depression subscale (item 14) was verbally queried by participants more often than any other item. The item read, "I can enjoy a good book or radio or TV programme: Often, Sometimes, Not often, or Very Seldom" (Zigmond & Snaith, 1983, pp. 370). The item may have been frequently queried because the suggested activities (book, radio or TV programme) were not relevant to young people living in shared, temporary accommodation, as many homeless young people do not have regular access to a TV over which they can control the programming. It is also likely that experiences growing up may have changed since the publication of the scale in 1983. In addition, one of the response options, 'Seldom' is a word that is not likely to be in common usage today. To see if this item was contributing to the low internal consistency of the subscale, alpha was calculated for the subscale with that item removed. The internal consistency estimate was greatly improved without this item included, nearing adequate levels (Cronbach's  $\alpha = .67$ ). Reliability of the composite scale (anxiety and depression) was also enhanced when the item was removed, from  $\alpha = .79$  to  $\alpha = .81$ . In the housed group, reliability of the anxiety subscale was also good (Cronbach's  $\alpha = .81$ ), and the internal consistency of the depression subscale was improved by removing the aforementioned item, from  $\alpha = .65$  to  $\alpha = .69$ . The composite score internal consistency estimate was also slightly improved, from  $\alpha = .74$  to  $\alpha = .75$ . Analyses using the HADS were therefore completed without this item where anxiety and depression scores were used. However, it



was not clear how the thresholds would be affected by the removal of the item, and what would constitute appropriate adjusted thresholds, so for analyses using threshold cut-offs, the item was retained.

### *Housing Outcome*

One of the main aims of this chapter was to investigate relationships between EFs and short-term housing outcomes in the homeless group. In order to accomplish this aim, we accessed the data held for participants by Llamau's monitoring database. All of the homeless participants gave us permission to access their records. The Database for Evaluation and Monitoring (DEMon), updated regularly by staff, enabled us to see the main reason participants were referred to Llamau, when they were referred, whether they had changed accommodation and what this was, how well they progressed with their support plan goals, how well they engaged with support, and the overall impact of support. Monitoring staff entered data into DEMon according to the paperwork submitted by support staff, and outcomes were recorded for evidence for funding purposes.

Data collection for the last participant was completed in November 2016 and DEMon was searched for information to July 2017, with data up-to-date to the end of May 2017. This meant that data was retrieved for all participants at least 6 months between cognitive testing and identification of outcomes. Possible housing outcomes were split into three categories: those that had undesirable outcomes or had regressed to less stable accommodation, those that had stayed at the same level (i.e., 'maintained' or 'not progressed'), and those that had moved on (progressed). Outcomes

within the 'maintained' category included: remained in tenancy, moved to another Llamau housing project, and moved to a different provider with a similar level of support. Outcomes that were coded as 'progressed' were: secured new tenancy, moved to University, moved to a different provider with a lower level of support, moved in with family, moved to Llamau project with a lower level of support, and relinquished to family, friends, or private rented. Outcomes categorised as 'negative' included: in custody, evicted, no fixed abode, and in Local Authority emergency accommodation (considered less stable as Bed and Breakfasts were often used for this purpose). As there were only a minority of participants who were coded as having a 'negative' outcome ( $n = 6$ ), these young people were profiled separately in terms of their EFs and mental health. Decisions regarding coding of outcomes were discussed with Llamau to establish how they would consider participants' outcomes, and any queries were resolved on a case-by-case basis by consulting further information given upon changing between, or exiting, Llamau's services, recorded in the database.

### ***Statistical Analysis***

Chi square analysis was used to compare rates of homeless and housed young people meeting threshold for anxiety and depression. Pearson and Point-Biserial correlations were used to investigate relationships between EFs and housing outcome, as well as mental health. Correlations between EFs and anxiety and depression scores were also compared for the homeless and housed groups by converting correlation coefficients into z scores to see if stronger relationships existed in the homeless group. Whether EFs were associated with later housing outcomes was examined using binomial logistic

regression, and interaction terms added to the model to explore potential moderation of any relationships by anxiety or depression scores. All continuous variables were checked for normality. No outliers were found (greater than 3SDs from the mean). Variables entered into the logistic regression were checked for their linear relationship with the logit of the outcome variable by the Box Tidwell method, described by Field (2009), which requires examining significance of interactions of the predictor variables and their natural logarithms. No significant interactions were found, indicating linearity could be assumed. For the logistic regression analysis, all variables were mean-centred prior to analysis, as recommended by Aiken & West (1991). The model building procedure outlined in Hosmer, Lemeshow, and Sturdivant (2013) was followed, entering predictors and their interaction at different stages to allow for comparison between models, and to get an accurate result of the predictive power of one predictor without the other variables in the analysis. Participants with negative outcomes ( $n = 6$ ) were not included in the analysis, and four additional participants were missing data on one or more variables, so were also excluded from the logistic regression analysis. The total number of participants included in the logistic regression analysis was 58.

## **Results**

### ***Anxiety, Depression, and Executive Functions***

Chi-square analyses revealed a significant association between group and above-threshold anxiety scores, whereby those in the homeless group were more likely to meet threshold for anxiety, ( $\chi^2(2) = 6.16, p = .046$ ). 39% of the homeless group met threshold for anxiety compared to 27% of the

housed group, whereas just 6% of homeless group and 11% of housed group met threshold for depression, though borderline scores were more prevalent in the homeless group (28% vs. 19%). There were no sex differences found in the homeless group in either anxiety or depression. In the housed group, women had significantly higher anxiety than men ( $t(34) = -2.69, p = .011$ ), but no differences were found for depression.

Regarding associations with EFs, no significant relationships between anxiety score and any EF tasks were found in the homeless group. Depression scores were negatively associated with category fluency ( $r(63) = -.268, p = .031$ ). For the housed group, there were also no significant associations between anxiety score and the EF tasks, nor for depression score.. Comparing correlations, the relationship between category fluency and depression score was not significantly stronger in the homeless group ( $z = -0.62, p = .267$ ). Neither anxiety nor depression scores were related to housing outcome in the homeless group.

### ***Executive Functions and Housing Outcome***

Working memory was positively related to housing outcome in the homeless group, that is, those with larger working memory spans were more likely to have progressed ( $r_{pb}(59) = .281, p = .028$ ). To test whether working memory predicted housing outcome and whether the relationship was influenced by anxiety or depression scores, predictors and interaction terms were entered hierarchically into logistic regression. This entailed first testing whether working memory predicted housing outcome, then adding anxiety or depression scores, and further whether there was an interaction between

working memory and anxiety or depression scores in predicting housing outcome. The results can be found in Table 21 and Table 22. Working memory significantly predicted housing outcome and that those who had longer working memory spans were twice as likely to have progressed rather than maintained. Adding anxiety or depression scores to the models did not seem to have a significant effect in the prediction of housing outcome. Performing a median split on the working memory variable divided working memory span between those with spans of five or less, and those with spans greater than five. The Odds Ratio was then calculated with housing outcome. Those with working memory spans of greater than five (i.e., six or more) were 2.5 times more likely to have progressed than maintained. There were no significant relationships between the creativity variables and housing outcome.

Table 21. Logistic regression models for the predictors working memory, anxiety score, and their interaction on housing outcome.

Variable	Model 1			Model 2			Model 3		
	B	SE	OR [95% CI]	B	SE	OR [95% CI]	B	SE	OR [95% CI]
Constant	.677*	.302	1.97	.709*	.310	2.03	.674*	.308	1.96
Corsi Block Span	.698*	.275	2.01 [1.17, 3.45]	.741*	.290	2.10 [1.19, 3.71]	.826**	.314	2.28 [1.23, 4.23]
HADS Anxiety				.070	.072	1.07 [0.93, 1.24]	.053	.072	1.05 [0.92, 1.21]
Corsi Block Span * HADS Anxiety							-.103	.082	0.90 [0.77, 1.06]
-2Log-Likelihood		67.348			66.354			64.638	
		Model: $\chi^2(1) = 8.59^{**}$			Model: $\chi^2(2) = 9.58^{**}$			Model: $\chi^2(3) = 11.3^*$	
					Block: $\chi^2(1) = 0.99, p = .319$			Block: $\chi^2(1) = 1.72, p = .190$	
Nagelkerke R <sup>2</sup>		18.8%			20.9%			24.2%	
Hosmer & Lemeshow test		$\chi^2(3) = 1.12, p = .754$			$\chi^2(7) = 15.7^*$			$\chi^2(8) = 10.6, p = .228$	
Classification accuracy		67.2%			70.7%			72.4%	

Note. \* $p < .05$ , \*\* $p < .01$ .

Table 22. Logistic regression models for the predictors working memory, depression score, and their interaction on housing outcome.

Variable	Model 1			Model 2			Model 3		
	B	SE	OR [95% CI]	B	SE	OR [95% CI]	B	SE	OR [95% CI]
Constant	.677*	.302	1.97	.678*	.303	1.97	.680*	.304	1.97
Corsi Block Span	.698*	.275	2.01 [1.17, 3.45]	.698*	.276	2.01 [1.17, 3.46]	.740*	.294	2.10 [1.18, 3.73]
HADS Depression (Item Removed)				.003	.092	1.00 [0.84, 1.20]	-.005	.093	1.00 [0.83, 1.20]
Corsi Block Span * HADS Depression							-.036	.083	0.96 [0.82, 1.14]
-2Log-Likelihood		67.348	Model: $\chi^2(1) = 8.59^{**}$		67.347	Model: $\chi^2(2) = 8.59^*$ Block: $\chi^2(1) = 0.00, p = .974$		67.154	Model: $\chi^2(3) = 8.78^*$ Block: $\chi^2(1) = 0.19, p = .661$
Nagelkerke R <sup>2</sup>		18.8%			18.9%			19.2%	
Hosmer & Lemeshow test		$\chi^2(3) = 1.12, p = .754$			$\chi^2(7) = 3.29, p = .857$			$\chi^2(7) = 3.57, p = .828$	
Classification accuracy		67.2%			67.2 %			65.5%	

Note. \* $p < .05$ , \*\* $p < .01$ .

The six participants who had negative housing outcomes showed a diverse profile which is shown in Table 23, and Figure 21 (located in Appendix 3). In terms of working memory, as a group they seemed to perform similarly to the wider homeless group. They did, however, have higher anxiety scores than the other outcome groups, but lower depression scores. There was a higher proportion of men than in any other outcome group, the majority were care leavers, and all but one had had contact with the Criminal Justice System at some point in their lives. All six participants in the negative outcomes group had been suspended from school, and all were regular cannabis users (at least once a week, some almost every day); all except one participant had been using cannabis for over a year, with some having used for several years. Although there are some interesting patterns to note here, the size of the subgroup sample and the discrepancies between subgroup sizes require these to be interpreted with caution.



Table 23. Profile of participants with negative outcomes, those who maintained, and those who progressed.

Variable	Negative Outcome						Summary (n = 6) Mean (SD) or %	Maintained Summary (n = 39) Mean (SD) or %	Progressed Summary (n = 23) Mean (SD) or %
	1 Custody	2 Custody	3 Evicted	4 Evicted	5 No Fixed Abode	6 LA emergency accomm <sup>1</sup>			
Sex (% Male)	M	M	M	M	M	F	83.3%	69.6%	53.8%
Age (years)	18	17	17	17	18	17	17.3 (0.5)	17.3 (0.9)	17.6 (0.8)
Suspended from school (% Yes)	Y	Y	Y	Y	Y	Y	100%	69.6%	53.8%
Highest level of education	1-4 GCSEs	5+ GCSEs A*-C	No quals yet	1-4 GCSEs	1-4 GCSEs	1-4 GCSEs	66.7% 1-4 GCSEs any grade	17.4% No qualifications yet 52.2% 1-4 GCSEs any grade 26.1% 5+ GCSEs A*-C 4.3% 2+ A Levels	12.8% No qualifications yet 41.0% 1-4 GCSEs any grade 38.5% 5+ GCSEs A*-C 5.1% 2+ A Levels
Ever been in foster care (% Yes)	Y	N	N	Y	Y	Y	66.7%	43.5%	46.2%
Any contact with CJS (% Yes)	Y	Y	Y	Y	N	Y	83.3%	65.2%	48.7%
Regular substance use (% Yes)	Y	Y	Y	Y	Y	Y	100%	39.1%	23.1%
Reason for referral	Leaving care	R/ship break- down	Leaving care	Leaving care	Other	Leaving care	66.7% Leaving care	52.2% Leaving care 39.1% Relationship breakdown	33.3% Leaving care 53.8% Relationship breakdown

Variable	Negative Outcome						Summary (n = 6) Mean (SD) or %	Maintained Summary (n = 39) Mean (SD) or %	Progressed Summary (n = 23) Mean (SD) or %
	1 Custody	2 Custody	3 Evicted	4 Evicted	5 No Fixed Abode	6 LA emergency accomm <sup>1</sup>			
WASI 2FSIQ	65	101	97	83	82	86	85.7 (12.7)	79.2 (13.5)	83.8 (13.0)
Letter Fluency	12	27	19	37	11	50	26.0 (15.3)	25.6 (9.8)	28.0 (10.9)
Category Fluency	16	15	18	16	10	23	16.3 (4.2)	15.9 (4.1)	17.6 (4.8)
BCST64PersevErr	10	5	9	5	13	6	8.0 (3.2)	8.5 (3.0)	7.7 (3.2)
CorsiBlockSpan	6	6	4	5	6	6	5.5 (0.8)	4.7 (1.5)	5.5 (1.3)
IGTDeckPreference	-.30	.04	.08	.02	-.36	-.28	-.133 (.200)	-.063 (.203)	-.054 (.232)
StroopInterference (ms)	-130	-82	-91	-85	23	-113	-79.7 (53.5)	-96.0 (77.8)	-89.3 (60.2)
TolTBFMoutofTotal	.04	.05	.05	.06	.05	.03	.048 (.011)	.041 (.008)	.045 (.011)
HADS Anx score	10	4	11	12	8	14	9.8 (3.5)	8.0 (4.1)	8.6 (4.4)
HADS Anx Threshold (% Met threshold)	B/line	Non case	Case	Case	B/line	Case	50% Case, 33% Borderline	26% Case 9% Borderline	41% Case 10% Borderline
HADS Dep score (item removed)	4	7	6	6	8	2	5.5 (2.2)	5.2 (3.2)	5.0 (3.3)
HADS Dep Threshold (% Met threshold)	Non case	Non case	B/line	Non case	B/line	Non case	0% Case, 33% Borderline	4% Case 30% Borderline	8% Case 23% Borderline

Note. <sup>1</sup> Emergency accommodation provided by the Local Authority, most likely to have been a Bed and Breakfast.

## Discussion

Homeless young people tended to be more likely to meet threshold for anxiety than housed young people. While there were no sex differences found in the homeless group, housed women were significantly more likely to meet threshold for anxiety compared to their male counterparts. The prevalence of above-threshold scores for anxiety in particular, in both groups, was substantially higher than in 16-24 year olds (the closest comparison age range) of the general population, with rates of 39% in the homeless group and 27% in the housed group compared with 6.3% (3.8% for males, 9% for females; McManus, Bebbington, Jenkins, & Brugha, 2016). Rates of above-threshold scores for depression were also higher than in the general population 16-24 year olds, at 6% (homeless) and 11% (housed) versus 2.3% (McManus et al., 2016). The reasons behind the increased prevalence of above-threshold scores for depression in the housed group, relative to both the homeless group and the general population data, are unclear, and may be related to problems with the consistency of the subscale. Although there seemed to be a sex difference in rates of depression in the 16-24 year old general population (McManus et al., 2016), this was not apparent in either of the groups. These findings also differ from Cauce and colleagues' (2000) findings of higher anxiety and depression in homeless young women compared to men. This may have been due, at least in part, to the discrepancy in consistencies between the anxiety and depression subscales of the HADS in the current study, which will be discussed further later in this section. Alternatively, it may have been a product of the small numbers in this study. Despite overcoming many challenges associated with recruiting a hard-to-reach group, and recruiting a

similar number of participants to other studies in the field, it is possible that there was not enough power to detect an effect of sex. If this is the case, it does not reflect a failure of recruitment, but the reality of working with young people who lead chaotic lives.

In terms of associations with EFs, anxiety did not appear to be related to any EFs in either group, but there was some indication that depression was negatively related to category fluency in the homeless group. Comparison of correlation coefficients relating to the relationship between category fluency and depression revealed no apparent difference in the strength of the association between groups.

No relationship was found between anxiety and depression score and housing outcome in the homeless group. This was not what would have been expected given previous literature in this area suggesting poor mental health compounds other difficulties associated with homelessness (e.g., Hodgson et al., 2013). However, it is possible that using a self-report screening measure rather than standardised diagnostic interviews (as used by Saperstein and colleagues (2014, for example) could have contributed to the derived pattern of results. It is also important to note that the present study measured housing outcome as either maintaining, which could be considered a neutral outcome, and progressing. Perhaps it is the case that high levels of anxiety or depression were more important for discriminating those who have progressed with those who had negative outcomes, which we were unable to test in the current study due to low numbers in the negative outcome group. For the few participants we did have in this group, anxiety did appear to be higher

than in the other groups, which may indicate a potential pattern to be tested with larger numbers of participants. It could also be a positive sign that some of those with higher scores on anxiety and depression were able to move on and the rest maintain their accommodation arrangements in spite of their difficulties.

Consistent with the findings from Chapter 4, which highlighted its importance in discriminating homeless and housed groups, working memory was found to be the only predictor of housing outcome, that is, whether homeless young people maintained the type of accommodation they were already in or whether they progressed onto accommodation with less support. Good working memory may represent a protective factor for those with higher levels of anxiety or depression, as working memory appeared to predict housing outcome regardless of anxiety or depression score. As mentioned earlier, it may be that mental health is more important for comparisons involving those young people with negative outcomes and those with positive outcomes, and there is some indication that anxiety levels were high in the negative outcomes group. When looking at those with above average working memory, these young people were 2.5 times more likely to have progressed rather than maintained compared to those of average or below working memory span.

It is perhaps surprising that working memory emerged as the only predictor of housing outcome, as planning and impulsivity / risky decision making would have been considered more likely candidates. It begs the question of why, then, working memory would impact on housing outcome.

To answer this, a detailed examination of what working memory is proposed to do, and what functions it performs, is required. An important concept to start with is that working memory has a limited capacity for storage, and processing can be affected when this capacity is exceeded (Baddeley & Hitch, 1974; Holmes, Gathercole, & Dunning, 2010). Aside from the more obvious functions that working memory performs, it has also been proposed to manipulate and monitor information, reconstruct / reconfigure / integrate information from different sources, sustain goal-relevant processing, control attention, be involved in construction of mental models, reduce interference, and coordinate resources (Baddeley, 1992; Baddeley & Hitch, 1974; Engle & Kane, 2004; Gathercole et al., 2008; Holmes et al., 2010; Oberauer, 2009; Schmeichel, Volokhov, & Demaree, 2008; St Clair-Thompson, 2011). It is also thought to contribute to the regulation of emotions (Schmeichel et al., 2008). In turn, working memory is considered to impact a myriad of other abilities, including: planning / organising, attention, learning, problem solving, maths, reading / literacy, reasoning, comprehension (e.g., of long complex documents), cognitive load, speed of processing, monitoring, mind wandering, general school achievement, failure to self-correct, and ability to hold down employment (Alloway, Gathercole, Kirkwood, & Elliot, 2009; Baddeley & Hitch, 1974; Evans & Fuller-Rowell, 2013; Gathercole et al., 2008; Holmes et al., 2010; Medalia & Revheim, 2002; Saperstein et al., 2014; Schmeichel et al., 2008; St Clair-Thompson, 2011). As is apparent from this section, working memory holds a plethora of functions and affects a diverse range of abilities that are likely important in many areas of life.

The second thing to consider when exploring why working memory predicted housing outcome, are the factors that affect young people's ability to exit homelessness. Although substantial work has been done examining factors affecting young people's entry into homelessness, rather less research has been conducted on factors affecting exit from homelessness in young people. Factors that have been identified so far include: availability of affordable housing, access to services, relationships with family / family conflict, maternal social support, experience of abuse, school / education, helpful / unhelpful peers, more stability (less moving between services), and legal issues / involvement in criminal activity (Mayock, Corr, & O'Sullivan, 2011; Milburn et al., 2009; Molino, 2007). Expanding to those studies examining factors affecting exit from homelessness more generally, many of the factors listed above apply and additional factors emerge, though it remains to be seen if these are relevant to the youth homeless population. These include: employment / work experience, labour market, cognitive impairment, mental health, social capital, processing speed, previous independent living / homelessness, substance use, and self-efficacy / self-esteem (Backer & Howard, 2007; Burra et al., 2009; Busch-Gertseema et al., 2010; Chamberlain & Johnson, 2013; Cobb-Clark, Héroult, Scutella, & Tseng, 2016; Dworsky & Piliavin, 2000; Fowler, Toro, Tompsett, & Hobden, 2006; Gabrielian et al., 2015; Hegarty, 2014; Johnson, Scutella, Tseng, & Wood, 2015; Medalia & Revheim, 2002; Morrell-Bellai, Goering, & Boydell, 2000; Piliavin, Entner-Wright, Mare, & Westerfelt, 1996; Rosenheck et al., 2001; Shier, Jones, & Graham, 2012; Schutt et al., 2007; Zlotnick, Robertson, & Lahiff, 1999). Considering this section and the previous section together, it is

easy to see areas of overlap where working memory likely contributes to factors affecting exit from homelessness, and thus why working memory emerged as a predictor of housing outcome. Further discussion can be found in Chapter 6.

Those with negative outcomes represented a minority of the homeless sample, but some characteristics included the majority of the subsample being male, care leavers, young offenders, and all reporting regular and often long-term cannabis use. These characteristics are not dissimilar to those of a subgroup of homeless young people identified by Hodgson and colleagues (2015), which suggests homelessness may be one element of a pattern. The subgroup were mostly male, had mostly become homeless before they were 16, had high rates of substance dependence, conduct disorder, and suspension from school, and were less likely to have spent time in their own accommodation between initial interview and follow-up than the other identified subgroups (Hodgson et al., 2015). In the current study, it was difficult to profile those who were falling through the cracks of services, as our sample was ostensibly supported and were arguably less likely to have negative outcomes than homeless young people not in contact with services like Llamau. To be able to assess the similarities and differences between homeless young people across the range of positive, neutral, and negative outcomes, we would have needed to recruit from the street or more transient hostels. However, for young people as a group in the UK, this represents a challenge as many are considered in priority need upon presentation to the Local Authority, meaning, at least in theory, that there are relatively few homeless young people living on the streets for extended periods of time



(Mackie et al., 2012; Quilgars et al., 2008). Future work could consider recruiting those who are 'hidden homeless', for example staying on friends' sofas, to represent a group of homeless young people not picked up by services, though this brings challenges in terms of definition, identification, and recruitment of 'hidden homeless' young people. In the current study, working memory did not seem to differ in the negative outcomes group from those in the wider homeless group, though anxiety scores were higher than in the other outcome groups.

Taken together, the findings suggest that working memory is an important contributing factor to being able to progress into less supported housing and live independently, and that anxiety may be more important in discriminating those with negative outcomes from the other groups, though further investigation is needed. In terms of theoretical perspectives, the results illustrate that even contexts that appear to be similar among young people, such as those related to homelessness, can interact diversely with proximal processes to differentially impact on housing outcome. In addition, working memory was identified as a potential resource for resilience contributing to positive housing outcomes in homeless young people, consistent with the suggestion that certain EFs may represent 'tools' for successful development (e.g., Masten & Coatsworth, 1998). There were also many homeless young people who did *not* report substantial anxiety and/or depression difficulties (i.e., reach 'threshold'), which could indicate resilience processes at work given the likelihood of adverse experiences in this vulnerable group (e.g., Llamau, 2017b).

## ***Limitations***

There are some limitations to note. First, although removal of a problem item on the HADS depression subscale improved the internal consistency to almost adequate levels, we were not able to remove the item from the threshold variable as it was unclear how much the item contributed to the scores and what would represent appropriate new cut-off points. Despite this, there did not seem to be any discrepancies in overall findings between analyses using the depression score without the item and analyses using depression threshold. The HADS also relies on self-report, so there may have been underreporting of difficulties not considered socially acceptable, as participants were given the option to have questions read to them and respond verbally to mitigate any effects of reading difficulties. Indeed, prevalence according to threshold (not including borderline), was substantially lower than those found in a previous study with homeless young people using the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998; Hodgson et al., 2014), though this study also required verbal responses to questions about symptoms. Anxiety and depression are often comorbid, and the subscales did correlate moderately with each other across groups ( $r = .324, p < .001$ ). The subscales were considered separately here as, although there was a moderate correlation between them and there is often comorbidity between anxiety and depression, they were not highly correlated and do not always occur together, with some evidence for differential cognitive difficulties (e.g., American Psychiatric Association, 2013; Castaneda et al., 2008).

Turning to the housing outcomes, the quality of data from DEMon, the monitoring and evaluation database, relied on the level of accurate and consistent recording of information by support staff and on accurate input of data by monitoring and evaluation staff. As some of this data is reported back to funders, it may be that variables like housing outcome were presented in a positive light. However, as a more objective variable, this bias would be arguably less likely than for support-staff-reported variables, such as 'engagement with support' and 'achievement of support plan goals'. These potential outcome variables were not included in the analyses because of the likely bias in the reporting of outcomes, which did limit the range of outcomes we could examine, however, housing outcome was chosen as it was the least likely to have been affected. The volume and detail of information we were able to obtain from DEMon, though, was considered to outweigh the potential disadvantages to its use, and being able to access such a valuable resource was crucial to fulfil the research aims.

## **Conclusion**

The aims of this chapter were to examine relationships between EFs, anxiety, and depression, and to investigate which factors predicted short-term outcomes in the homeless group. Rates of anxiety were higher in the homeless group than the housed group, though the same was not true for depression. In contrast, anxiety was not associated with EFs in either group, but depression was negatively associated with category fluency in the homeless group. Somewhat surprisingly, neither anxiety nor depression predicted housing outcome in the homeless group. However, working memory was identified as an important predictor of progressing to less supported

accommodation in the homeless group, with those with higher than average working memory spans being 2.5 times more likely to have progressed than maintained in their housing arrangements. Those with negative outcomes were a small group, showing average working memory and higher anxiety than those in other outcome groups. This group was also characterised as male, care leavers, young offenders, and regular long-term cannabis users. More data is needed to properly test these observations. The current chapter adds to previous empirical chapters contained in this thesis by providing insight into how EF difficulties, specifically working memory, may affect not only the everyday lives of homeless young people, but also their short-term housing outcomes. A full discussion of the evidence presented in the three empirical chapters of this thesis and potential implications follows in the next chapter.

## **CHAPTER 6: GENERAL DISCUSSION**

This is the final chapter of the thesis, which draws together findings from the previous chapters, extracts key messages, and places these into the context of the existing literature and the overarching theoretical perspectives that guided the work. Implications of the findings for practice and policy will also be explored along with suggestions for future directions and a discussion of general limitations of the thesis. The aims of the thesis were to:

1. Systematically synthesise the limited evidence base of cognitive functioning in homeless young people, compared to housed young people and two groups at risk for homelessness (care leavers and those in poverty), to inform the main study (Chapter 2).
2. Establish a profile of executive functioning in homeless young people, identifying areas of strength and need (Chapter 3).
3. Examine how this EF profile (including creative thinking) compared to that of housed peers (Chapter 4).
4. Explore how EFs and mental health might be associated in homeless and housed young people (Chapter 5).
5. Explore whether executive function performance would predict short-term housing outcomes in the homeless group, and the impact, if any, of anxiety and/or depression (Chapter 5).

These aims have been broadly fulfilled, by examining a range of computer-based EF tasks, including one tapping 'hot' EFs, examining creative potential using a divergent thinking task (the AUT), and through the use of an index of anxiety and depression symptoms (assessed by the HADS). Short-term housing

outcomes were discovered by accessing homeless young people's records held by Llamau (with participants' permission), at least six months following testing. Efforts were made to make comparison groups as similar as possible on key characteristics, by matching the age range of participants (16-19 years), and recruiting from a high school sixth form and college that were also accessed by young people at Llamau. Key findings from each chapter relating to each aim are discussed below.

### **Key Findings by Chapter**

Chapter 2 presented a systematic review undertaken of the homelessness, foster care, and poverty literatures with regard to cognitive functioning in young people. The key findings included that working memory difficulties were apparent in both homeless young people and the groups at risk for homelessness, that is, care leavers and young people in poverty. There also seemed to be EF deficits in homeless and poverty groups, although evidence was mixed. When compared to other groups, homeless young people performed worse than age-matched peers on auditory selective attention (Borges-Murphy et al., 2012). However, compared to housed young people with low socioeconomic status, homeless young people did not appear to differ on EF and seemed to perform better than their housed peers on a creativity task (Dahlman et al., 2013). Homeless young people also demonstrated worse EF performance compared to norms (Saperstein et al., 2014). Overall, there was some indication that EFs may be problematic in homeless young people, particularly working memory, and there was a possibility that homeless young people are better at creative thinking. This formed the basis of predictions for Chapter 3.

Chapter 3 aimed to construct a profile of EF in homeless young people, using published normative data as a comparison. Adequate normative data was not available for most tasks, and as a result the comparative data was less than ideal. No appropriate comparative data could be sourced for the creativity task. With that in mind, the main findings were that homeless young people tended to perform worse on EF tasks than comparative data, though they appeared to perform better on selective attention / inhibition, with no apparent differences in working memory. Finding better performance on planning was likely due to differences in the variables being compared. These findings are somewhat counterintuitive; although the general pattern of EF difficulties is consistent, the more specific findings conflict with what would have been predicted from the findings of the systematic review. Collectively, the disparity in results could be a reflection of the questionable quality of comparative data or a meaningful discrepancy with previous findings. Chapter 4 presented empirical work that sought to overcome some of the limitations of Chapter 3 by comparing homeless young people to a comparison group of age-matched housed young people on EF performance.

Moving on to Chapter 4, nested within the comparison of EF performance in homeless and housed groups, the hypothesis of stronger creativity in homeless young people was also examined. Key findings were that the homeless group demonstrated poorer performance across several EF tasks than the housed group, and that EF performance was able to discriminate between the two groups, with working memory and impulsivity / risky decision making being particularly important domains. Although there was some effect of IQ when added to the analysis, SES and highest level of

education had minimal impact. In terms of the creativity hypothesis, although the homeless group had greater variability in scores, there were no differences found between groups in terms of originality, fluency, or flexibility. These findings differ somewhat from those of Chapter 3; the procedure and tasks were identical in both groups, suggesting that perhaps the discrepancy in results in the context of other literature was due to the inadequacy of the comparative data and/or lack of normative data available. The relationships between EFs and short-term housing outcomes and relationships with mental health difficulties were explored in Chapter 5.

Chapter 5 explored how EFs relate to anxiety and/or depression and whether EF performance was predictive of short-term housing outcomes in homeless young people. The main findings were that homeless young people tended to meet threshold for anxiety more often than housed young people, but neither anxiety nor depression was related to housing outcome for the homeless group. In terms of outcomes, working memory significantly predicted whether a homeless young person progressed onto accommodation with less support / more independence or maintained the level of supported accommodation they were in, over and above anxiety or depression. Those with longer working memory spans were twice as likely to have progressed as maintained, and those with working memory spans of six or above were 2.5 times more likely to have progressed. Contrary to expectations, creativity was not related to housing outcome. It was somewhat surprising that working memory predicted short-term housing, rather than EFs that could be considered more closely related to housing outcome, such as planning and



impulsivity / risky decision making, and this is discussed further in the following sections.

Six homeless young people had negative outcomes and were profiled in more detail using available information. These young people seemed to share characteristics such as being involved with the Criminal Justice System, regularly using substances over a substantial amount of time, and being care leavers. These characteristics are not dissimilar to a cluster of homeless young people identified in a recent study as having prolonged substance use, involvement with crime, high rates of suspension and expulsion from school, and more likely to be male (Hodgson et al., 2015). Interestingly, the group in the current study seemed to have around average working memory, but higher anxiety scores and greater impulsivity than those who had progressed or maintained. While high rates of anxiety and impulsivity are also present both in young people at risk of offending and in the wider youth offending population (e.g., Bergeron & Valliant, 2001; Cauffman, Steinberg & Piquero, 2005; Cusi, Hernández-Martínez, Canals, & Vigil-Colet, 2011; Lader et al., 2000; Pharo et al., 2011; Teplin, Abram, McClelland, Dulcan, & Mericle, 2002), working memory, and executive functioning more generally, tends to be problematic for these groups (e.g., Bergeron & Valliant, 2001; Cauffman et al., 2005; Ogilvie, Stewart, Chan, & Shum, 2011; Pharo et al., 2011; Syngelaki, Moore, Savage, Fairchild, & van Goozen, 2009). It could be that poor mental health is more important as a predictor for negative housing outcomes, and that working memory is relatively less important for this group. However, this would need to be explored further, due to the size of the group with negative outcomes in the current sample.

## Findings in the Context of Previous Literature

Homeless young people seemed to have EF difficulties in a range of areas, particularly working memory and impulsivity / risky decision making, compared to housed young people. This is broadly consistent with other studies examining EF among homeless young people (Borges-Murphy et al., 2012; Pluck et al., 2017; Saperstein et al., 2014), and working memory was identified as a difficulty across all disadvantaged groups in the review, that is, for care leavers and young people in poverty as well as homeless young people (Fry et al., 2017). This suggests that there may be factors common to young people who have experienced adversity, lack resources and experience residential instability that impact on working memory development. However, working memory was also a key predictor, in terms of EF, of positive short-term housing outcomes in the homeless group. Longer than average working memory span may therefore represent a protective factor in relation to housing, enabling young people to move on, despite barriers such as anxiety and depression. As we were only able to compare those who maintained (arguably a 'neutral outcome') and those who progressed, due to the small number of young people with negative outcomes, it is unclear whether working memory would also be an important factor for this group. I predict that working memory may be less important in distinguishing homeless young people with negative housing outcomes from homeless young people with more positive outcomes, and that anxiety, in particular, may be more important.

Factors that have been found to affect young people's ability to exit homelessness include: availability of affordable housing, access to services,

relationships with family / family conflict, maternal social support, experience of abuse, school / education, helpful / unhelpful peers, less mobility between services, and legal issues / involvement in criminal activity (Mayock et al., 2011; Milburn et al., 2009; Molino, 2007). Consideration of the functions that working memory has been proposed to perform (see theoretical section for further discussion), coupled with its impact on other abilities, reveals some clear links with the factors affecting exit from homelessness in young people. For example, working memory is vital for maths, reading, and general school achievement, and doing well at school is associated with young people's exit from homelessness (Baddeley & Hitch, 1974; Evans & Fuller-Rowell, 2013; Gathercole et al., 2008; Holmes et al., 2010; St Clair-Thompson, 2011). In addition, emotion regulation is likely to be involved in family relationships and/or conflict, an important component of which is working memory (e.g., Schmeichel et al., 2008). Such a seemingly straightforward task as understanding long, complex documents, for example tenancy agreements, could be hampered by difficulties with working memory, and result in an inability to secure or maintain independent accommodation. Similarly, struggling with calculations and budgeting due to underlying working memory issues may lead to not saving enough for a rental deposit and/or falling into rent arrears and losing independent accommodation. Conversely, as seems to be indicated here, those with good working memory capacity for storage and processing are able to, among other things, navigate long documents, budget effectively, and, in regard to associations with emotion regulation, able to hide how angry or frustrated they may be feeling, avoiding conflict with landlords, family, and education providers / employers.

These are just a small selection of the abilities facilitated by good working memory that likely contribute to effective independent living in homeless young people.

In the current study, a difference between groups on creative thinking was not found. This is in contrast to Dahlman and colleagues' (2013) findings and may reflect differences in comparison group (housed vs. low SES), or may reflect the fact that street youth in South America demonstrate more creativity compared to their peers, for example, due to opportunities for street enterprise, than homeless young people living in supported accommodation in Wales where such opportunities are less common. These alternatives should be explored in future work, for example comparing the creativity of more precariously housed youth (including those on the street) to the creativity of those living in supported accommodation and, if possible, also to a housed comparison group.

Finally, anxiety rates were higher in the homeless group, but there seemed to be no apparent difference in depression rates. While high rates of anxiety are consistent with previous work in the area, higher prevalence of depression was expected (e.g., Cauce et al., 2000; Edidin et al., 2011; Hodgson et al., 2013). The reason for this discrepancy in findings is not clear: due to the self-report nature of the measure, it may be that young people were more reluctant to endorse the depression items as they felt it was more socially acceptable to endorse items relating to anxiety. It is also plausible that the lower internal consistency of the depression sub-scale contributed to

the failure to reject the null hypothesis, or that the symptoms were less recognisable in the self than anxiety symptoms.

It is clear from the discrepancy in findings between Chapters 3 and 4 that characteristics and choice of comparison group can have a real impact on whether EF differences are found between homeless and housed young people in EF performance and in which areas. My comparison group was chosen to be of a similar age and recruited from educational institutions that were also accessed by homeless young people currently in education, in an attempt to reduce differences in socioeconomic status. Most comparative papers, on the other hand, due to the age-group concerned, tended to use university undergraduate students, who were likely to have been from more affluent families and practised in computer tasks of a similar nature. Looking back to the studies included in the systematic review with homeless young people, half did not have any kind of comparison group, Dahlman et al. (2013) and Rafferty et al. (2004) recruited young people from low socioeconomic status backgrounds (one from the same school and one that spent some time in the street environment but were considered to be supervised), and Borges-Murphy et al. (2012) recruited age-matched young people from the same school with no mention of their socioeconomic status. This could account for at least some of their disparate findings, for example, no differences between groups on EF tasks in Dahlman's study contrasted with selective attention difficulties found in Borges-Murphy's homeless group (Borges-Murphy et al., 2012; Dahlman et al., 2013). Thus, careful consideration of comparison group characteristics and type should feature in future research in this area.

## Findings in the Context of Theoretical Perspectives

The results are consistent with many of the theoretical perspectives presented in Chapter 1. The overall poorer EF performance in the homeless group compared to the housed group was predicted by theories of risk, as the homeless group was likely to have multiple risk factors that had accumulated and placed them towards the higher end of the continuum of risk (Buckner, 2008; Masten et al., 1993; Sameroff et al., 1993; Whitbeck et al., 1999). Although we were unable to explore this in the current study, due to insufficient numbers in the comparison group for analysis by socioeconomic status, it would be interesting to test if the continuum of risk applies to executive function. That is, whether those who fell at the greatest risk end of the continuum also demonstrated the poorest performance on executive function tasks, and whether there was a graded pattern of performance depending on position on the continuum. The results are also consistent with theories relating to stress and specifically early life stress, as homeless young people are more likely to experience chronic stress and have experienced adverse childhood experiences (Bellis et al., 2015; Evans & Schamberg, 2009; Felitti et al., 1998; Llamau, 2017b; McEwen, 2000; Smith et al., 2015). Homeless young people are also more likely to have reduced cognitive capacity due to experience of scarcity (Mani et al., 2013; Mullainathan & Shafir, 2013).

Stress, adversity, and lack of economic resources have all been found to impact on the development of both executive functions and the brain (DePrince et al., 2009; Evans & Fuller-Rowell, 2013; Farah et al., 2006; Hackman & Farah, 2009; Masson et al., 2015; McEwen, 2000; Nikulina &

Widom, 2013; Noble et al., 2007; Pechtel & Pizzagalli, 2011; Wenzel & Gunnar, 2013). In this thesis, EF performance as a whole represented a discriminating factor of the groups and this, coupled with the findings of differential performance across EF domains, lends some support to the idea of EFs as connected yet separable (Gilbert & Burgess, 2008; Miyake et al., 2000, Miyake & Friedman, 2012; Teuber, 1972). There was also some support for the distinction between ‘hot’ and ‘cool’ EFs (Happaney et al., 2004; Zelazo & Carson, 2012) as, although both working memory (‘cool’) and impulsivity / risky decision making (‘hot’) difficulties were apparent in the homeless group and these difficulties made the greatest contribution to the discrimination of the groups, working memory alone predicted short-term housing outcome. However, this appeared to be the only contrast of this nature; for the most part, impulsivity / risky decision making performance seemed to fit in with its ‘cooler’ counterparts. Perhaps EF difficulties in homeless young people cut across ‘hot’ and ‘cool’ distinctions and show specificity in other ways. Alternatively, there could be multiple areas of non-optimal development across both the dorsolateral PFC (associated with ‘cool’ EFs) and orbitofrontal cortex (associated with ‘hot’ EFs; Happaney et al., 2004), impacted by factors such as maltreatment (e.g., DePrince et al., 2009).

One finding that did not marry with tentative predictions was finding no difference between the groups on creativity, nor any associations between creativity and short-term housing outcome. Work investigating creativity in people with ‘diversifying experiences’, that is, experiences that are unusual and out-of-the-ordinary, had considered that those with such experiences tended to be more creative (Cohen, 2012; Damian & Simonton, 2015; Ritter et

al., 2012; Runco, 2007; Simonton, 2000). Experiences that have been investigated in previous work include: psychopathology, particularly depression, suicidality, and alcohol and substance misuse (e.g., Damian & Simonton, 2015; Nettle, 2006; Post, 1994); unconventional backgrounds, including belonging to an ethnic or cultural minority group and poverty (e.g., Damian & Simonton, 2015; Simonton, 2000); unusual education / training experiences, such as studying abroad and having diverse hobbies (e.g., Damian & Simonton, 2015; Maddux, Adam, & Galinsky, 2010). Homelessness is arguably a 'diversifying experience' which, in addition to unconventional childhood experiences, is likely to enable young people to be flexible in their thinking and break boundaries (Damian & Simonton, 2015), but perhaps the heterogeneity of the experiences within the group obscured effects. Alternatively, as discussed previously, it may be that a single divergent thinking task is not sufficient to truly assess creativity as a potential strength.

Finding greater anxiety in the homeless compared to the housed group was consistent with predictions and related to theories of risk, stress, and adversity, as exposure to multiple risk factors, chronic stress, and adverse experiences have all been found to predict poor mental health (Beesdo et al., 2009; Björkenstam et al., 2017; Chapman et al., 2004; Dahl et al., 2017; Green et al., 2010; Hammen, 2005; Kessler et al., 2003; Lorant et al., 2003; McEwen, 2003; Moffitt et al., 2007; Najman et al., 2010; Patel & Kleinman, 2003; Ruscio et al., 2017). Finally, indication that good working memory was related to moving on towards independence complements resilience approaches (Cicchetti, 2010; Fergus & Zimmerman, 2005; Luthar et al., 2000; Masten, 2014; Rutter, 1985; Zolkoski & Bullock, 2012), in that, on the one



hand homeless young people are at risk of developing poorer working memory, yet those with better-developed working memory had better short-term housing outcomes.

Finding working memory as a predictor of short-term housing outcomes, rather than arguably, at least on the face of it, more closely related EFs such as planning or impulsivity / risky decision making, was somewhat unexpected. However, a more fine-grained examination of the functions that working memory is considered to contribute to and/or perform helps to make sense of this finding. Firstly, considering Baddeley & Hitch's (1974) model of working memory and later expansions (e.g., Baddeley, 2000), working memory is conceived as a limited capacity, multi-modal system that simultaneously stores and processes information (temporarily), which recodes / reconstructs / interprets information, transfers information to long-term memory (LTM), controls attention, binds/integrates information, and coordinates resources (Baddeley, 1992, 2000; Baddeley & Hitch, 1974). It has also been suggested to reduce vulnerability to interference, control LTM retrieval, monitor and revise information, sustain task goals / keep on-task, and be involved in constructing mental models and regulating emotions (Engle & Kane, 2004; Gathercole et al., 2008; Holmes et al., 2010; Oberauer, 2009; Schmeichel et al., 2008; St Clair-Thompson, 2011). Other abilities affected by working memory include: planning / organising, attention, learning, maths, reading, comprehension, problem solving, reasoning, cognitive capacity, processing speed, ability to complete complex / multi-step tasks, mind wandering, school achievement, ability to self-correct, and ability to hold down employment (Alloway et al., 2009; Baddeley & Hitch, 1974; Evans & Fuller-

Rowell, 2013; Gathercole et al., 2008; Holmes et al., 2010; Medalia & Revheim, 2002; Saperstein et al., 2014; Schmeichel et al., 2008; St Clair-Thompson, 2011). All of these abilities are likely to be required to obtain and maintain suitable accommodation, for effective engagement in education / training / employment, as well as in everyday life.

Linking back to factors affecting moving on from homelessness in young people, several potential pathways emerge. There are factors that affect working memory and/or its development that also often feature in homeless young people as a group, such as: ACEs, stress, poverty, scarcity, anxiety, and substance use (Broyd et al., 2016; Crean et al., 2011; DePrince et al., 2009; Evans & Fuller-Rowell, 2013; Evans & Schamberg, 2009; Masson et al., 2015; Medalia & Revheim, 2002; Mullainathan & Shafir, 2013; Shackman et al., 2006; Solowij & Battisti, 2008). It is possible, then, that these factors could impact on working memory and its plethora of functions in homeless young people, which in turn could influence their ability to obtain and maintain independent accommodation. This is illustrated in Figure 15. More complex relationships may also exist, for example, experience of abuse is both a factor affecting working memory development and a factor influencing young people's ability to exit homelessness, which could indicate that working memory plays a mediating or moderating role in this pathway. There is much work needed to substantiate this proposal, however it serves as a useful starting point to considering underlying mechanisms of the effect of working memory on housing outcome in homeless young people.

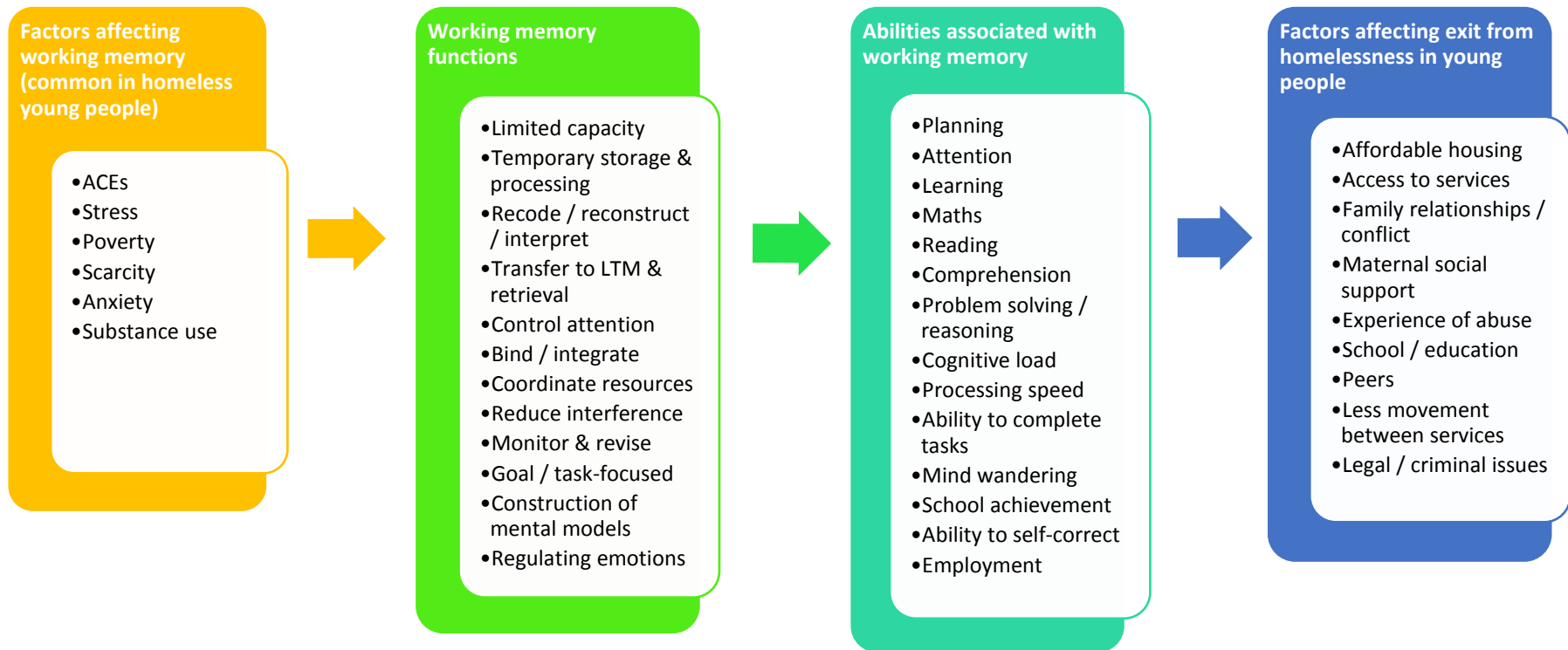


Figure 15. Pathways linking working memory and housing outcome.

(N.B. See text for references)

Another unexpected finding was no discernible differences in depression between the homeless and housed groups. This is contrary to what would have been predicted by the risk models and theories of stress and early adversity, as accumulation of risk, stress, and experience of adversity as a child have all been identified as predictors of mental ill-health, and emerging adulthood represents a sensitive period of vulnerability (American Psychiatric Association, 2013; Beesdo et al., 2009; Björkenstam et al., 2017; Chapman et al., 2004; Dahl et al., 2017; Green et al., 2010; Hammen, 2005; Kessler et al., 2007; McEwen, 2003; Moffitt et al., 2007; Patel et al., 2007; Paus et al., 2008). Possible reasons for this were discussed in the previous section and include the self-report nature and the less than ideal internal consistency of the depression scale.

Although this thesis has focused mainly on individual factors, it is likely that many interacting influences and systems, both proximal and distal, contribute to the development of EF, creativity, and mental ill health in homeless young people (e.g., Bronfenbrenner, 1977, 1994; Haber & Toro, 2004; Tudge et al., 1997). Incoming macrosystem changes in the form of a new welfare system (Universal Credit) and, looking further into the future, probable economic downturn and uncertainty related to the UK leaving the European Union will potentially compound existing macrosystem factors, such as the availability of affordable housing (e.g., Mackie, 2016), and interact with more proximal systems, contributing to increased instability in the chronosystem at a time of developmental and educational/occupational transition for homeless young people (e.g., Arnett, 2000). This is likely to result in homeless young people being even more vulnerable and at risk for

negative outcomes than they are presently. Therefore, if it is the case that working memory can contribute to resilience and consequently positive outcomes, as suggested by the results of this thesis, now would be an opportune time for services to intervene and encourage positive development of working memory, in particular, in homeless young people (e.g., Luthar et al., 2000; Masten, 2014; Masten & Cicchetti, 2010). The feasibility of training working memory in this vulnerable group and promise in terms of the transfer of training to other areas of functioning have been established (Holmes & Gathercole, 2014; Medalia et al., 2017), and through developmental cascades there is scope for such intervention to impact on multiple areas of adaptation (e.g., Masten & Cicchetti, 2010; Sapienza & Masten, 2011), with the hope of weathering the challenges ahead and improving the likelihood of positive housing outcomes.

### **Strengths and General Limitations**

This study was able to access a relatively large number of homeless young people, across a range of areas in the South East Wales vicinity because of the support of staff and service users at Llamau. Though this was a cross-sectional design, we were also able to access data held by Llamau for monitoring and evaluation purposes (with participants' consent), and this meant we could trace participants' housing outcomes for at least six months after testing. This highlights the value of collaboration with organisations working with vulnerable young people who are traditionally difficult to follow-up, gives the outcomes component of the study a quasi-longitudinal angle, and may represent a useful way to attempt follow-up with homeless young people in the future. Another strength of the work reported in this thesis was

the recruitment of an age-matched comparison group. As seen in Chapter 2, studies with homeless young people are often without comparison groups, making it difficult to draw conclusions about performance relative to other young people of a similar age. This is particularly important for EFs as it is likely they are still developing. I tried as far as possible to recruit the comparison group from educational institutions that homeless young people also accessed, to avoid a large difference in socioeconomic status, and the resulting difference in scores on the Family Affluence Scale was minimal between the groups (see Chapter 4). What differentiates this study from the scant previous studies investigating executive functions in homeless youth was the use of a broad range of tasks tapping a diverse range of EF domains, including 'hot' EF with the gambling task, and the investigation of relationships between EF domains and short-term housing outcomes.

Although specific limitations have been highlighted in individual chapters, there are some overarching limitations of the research that need to be noted. The sample size was not as large as had been hoped, due to difficulties with recruitment of the comparison group. As I was recruiting from educational institutions, testing was restricted by term dates and exam times, and a delay with ethics further reduced the time available. Despite my best efforts, attendance rates for the participants recruited from the college were around 50%, even after text reminders, resulting in a lot of wasted sessions. This prompted the decision to expand to the sixth form high school, but only a dozen pupils wanted to take part (promotion relied on tutors telling their students about the study and encouraging them to participate). The pupils taking part tended to be those that had English as a second language

and this may have impacted the findings somewhat, though there were a similar number of young people whose first language was not English in the homeless group, so this should have largely balanced out when looking at group differences. In an ideal world, I would have been able to randomly sample from students / pupils in the respective institutions, but this just was not feasible as it would likely have entailed a lot of work for staff at both institutions who were extremely busy; they went out of their way to accommodate and support us as it was. It would not have been feasible to employ this method at Llamau either, as many young people move between projects. Part of the reason recruitment was so successful was that I was able to recruit on an *ad-hoc* basis, for example, young people would see others in the project taking part and not want to be left out, and being able to follow-up quickly when staff had identified a willing young person was key.

Another limitation relates to the classification of housing outcomes. It was difficult in some cases to determine whether a reported housing outcome was positive, neutral, or negative. For example, while custody was an unambiguous negative outcome, moving in with friends and moving out of area were ambiguous. Although one could argue that spending time in a young offenders' institution (YOI) could provide opportunities to suspend criminal activity and access interventions, it appears to have an overall negative effect for most young people, as conditions in custody have drastically declined and reoffending rates continue to be as high as 70-80% (Bateman, 2017). To try and get a more accurate picture, I looked at housing outcome and accommodation at end variables together, and consulted with Llamau to discuss how they would view any ambiguous outcomes. This again

highlighted one of the advantages of having a close relationship with Llamau staff and their investment in the research. Any move on to less supported accommodation or moving back with family / in with friends was considered positive for the purposes of the analysis, whereas any move to accommodation with similar levels of support or staying put was considered maintained. It is likely there was only a very small number in the negative outcomes group because our sample were being supported by the charity. Although there were some common characteristics, the EF profiles of these participants were diverse, potentially indicating that they are a heterogeneous group. To get a better idea of how EFs and mental health relate to negative housing outcomes we would have needed to recruit from more transient hostels or from the street, which was not possible in the current study.

The homeless group, particularly, often reported regular substance use in the form of cannabis. It could have been the case that the difference between groups was not as stark as it seemed, as the homeless group felt able to be more honest than the housed group, who were tested in an educational setting and may have been fearful of teachers / tutors finding out. As mentioned in earlier chapters, originally all who had reported taking substances in the 24 hours preceding testing were going to be excluded, however, this was not feasible and adjusted to those who had reported using more than usual or polysubstance use. This means that there were a substantial number of participants in the homeless group who had reported using cannabis in the 24 hour period before testing in keeping with their usual use, which had potential implications for EF performance. Cannabis has been



found to have differential acute, short, and long-term effects on some areas of EF (Broyd et al., 2016; Crean et al., 2011; Fernández-Serrano, Pérez-García, & Verdejo-García, 2011). Within 48 hours, it has been found to impact on impulsivity, inhibition, and working memory (Broyd et al., 2016; Crean et al., 2011; Solowij & Battisti, 2008). In the short-term (up to a month), risky decision making and verbal fluency seem to be negatively affected, but the effects on working memory are no longer present (Crean et al., 2011; Fernández-Serrano et al., 2011). Looking longer term (longer than a month), risky decision making and planning deficits are present, while evidence is mixed for other EF effects, with working memory showing no long-term disadvantage (Broyd et al., 2016; Crean et al., 2011; Fernández-Serrano et al., 2011). In hindsight, the use of a simple Yes/No screening question was not sufficient to determine the amount, frequency, and type / strength of cannabis used, all of which can influence the effect cannabis has on cognitive functioning (e.g., Broyd et al., 2016; Castellanos-Ryan et al., 2017; Herzig, Nutt, & Mohr, 2014). Relying on participants' own reports of how much they had taken was also problematic, as people tend to vastly underestimate the amount of substances consumed (e.g., van der Pol et al., 2013). Continuous measures such as the DUDIT (Berman et al., 2005; Hildebrand, 2015) and AUDIT (Babor et al., 2001) could have given greater insight into how much of an effect cannabis use had on the results, and should be used in future work in this area.

Generalisation of the findings to the wider homeless youth population could be problematic, as the homeless young people described here originate from one homelessness charity, having sought advice/assistance with their

housing situation, and subsequently received a fairly comprehensive package of support (as described in Chapters 1 and 3). Although it is likely that the findings apply to homeless young people living in supported accommodation provided by similar organisations (common in the UK), it remains to be seen how well the results would generalise to both ‘hidden’ homeless or precariously housed young people and street youth, that is, homeless youth groups that are less well supported. Further work is needed to establish the applicability of the current findings to the wider population of homeless young people.

Following on from the previous point, there was considerable heterogeneity within our single sample of homeless young people, in terms of backgrounds and experiences that may account for the variability in EF performance within the group. In other words, it may be that instead of a single group of ‘homeless young people’, there were smaller subgroups with factors in common that demonstrated similar EF performance to each other yet were distinct from other subgroups. For example, it is likely that those who were care leavers differed from those who were kicked out of home on factors associated with EF development, such as attachment patterns based on early relationship experiences and their ability to regulate their emotions, as well as engagement in criminal activity and problematic substance use (discussed above). Indeed, experience of trauma, adult support, and substance use have been found to be key distinguishing factors among subgroups of homeless young people (Narendorf et al., 2018). Taking this into consideration, it may have been informative to perform a cluster analysis to identify potential subgroups and their characteristics based on EF

performance, determining what characterises those with few or no EF problems, those with some EF problems, and those with severe EF problems. This may be a useful suggestion for future work with homeless young people and EF.

Finally, it must be noted that owing to the gaps in knowledge in this area, most of the work in this thesis was exploratory in nature. As a consequence, corrections for multiple testing were not always applied, and this should be considered when interpreting the results. In Chapter 4, results were presented with and without Bonferroni correction to aid the reader's interpretation, and notes were made throughout the chapters where findings would not have survived Bonferroni correction. Bonferroni can often be overly conservative and correct excessively, so it is likely the true result lies somewhere in between the two (e.g., Field, 2009). The results from this thesis are intended to form building blocks for future work.

### **Feasibility Notes**

In many ways, this thesis could be considered a feasibility study, aiming to inform future research with homeless young people by highlighting areas that worked well, areas that did not work so well, and any modifications made. For instance, originally all participants who answered 'Yes' to the dichotomous question 'Have you taken drugs (including legal highs) in the last 24 hours?' were to be excluded, however, it rapidly became apparent that drug use was common in the homeless group (cannabis particularly), and enforcing this criteria would have resulted in having very few participants who were eligible to participate. Instead, I decided to exclude those who

reported having taken more than they usually did or who had used multiple substances in the 24 hours prior to testing, leaving those who would be performing at the level that was 'normal' for them. As a result, I was able to recruit a fairly large sample of homeless young people, but cannabis use may have had an impact on the findings. This is discussed further in the limitations section.

In terms of the practicalities of testing, having the tasks on the laptop added to the appeal of taking part as they seemed more like games to the young people, and interacting with a laptop or computer is perhaps something the homeless group did not often get a chance to do, making it quite exciting. A possible downside to this would be that the housed group may have had more practice and experience using laptops, though unlikely to have come across the tasks before.

Having high street vouchers as incentives worked well, particularly for the homeless group, as they could either get useful things such as food or have a rare opportunity to treat themselves to something nice, and £15 was both proportional to the time involved and perceived as a substantial amount. For the housed group, the vouchers seemed to be much less of an incentive. This did not seem to be due to the value being perceived as too small (£10, as the majority of housed participants' sessions were shorter), but more to do with vouchers not being seen as exciting or special, presumably as families often provided for housed participants and they were used to more frequent and/or more expensive gifts.

Something that was important for the homeless group especially, was being flexible whilst keeping as closely as possible to the protocol. A break was scheduled into the sessions after the WASI (approximately halfway, depending on the order), as this was thought likely to be a particularly challenging and potentially the least enjoyable set of tasks. Participants who smoked tended to need more breaks than this, and breaks were also used to aid participants' wellbeing after getting frustrated or disheartened with a particular task. Overall, I think this really helped to minimise the number of homeless young people refusing to continue (only one did), as they often felt much happier to carry on after breaks and it helped to demonstrate that the session was not an exam, reducing potential perceived pressure and anxiety. This strategy was also used in the housed group; although there was less variation as participants had often come between lessons or out of lessons so were less likely to take multiple breaks, they were still offered after tasks that seemed to have been particularly challenging and/or frustrating. There were variations between participants as to the number of breaks taken (maximum three including the scheduled break, none during a task), and this may have affected performance on tasks prior to and after breaks, however, there were seven different orders of tasks which makes it unlikely such effects would be apparent at a group level. On a small number of occasions it was necessary to complete half of the session at another time, usually due to participants underestimating how long it would take and having other immovable commitments, for example an appointment they could not miss. It was important participants were able to fulfil these commitments, as it was positive they had remembered and were going to go, but it was also important

to give them the opportunity to complete the session as they had shown willingness to participate.

### **Implications for Practice**

Currently, there is a focus in the literature on difficulties with mental health, substance use, physical health, and risky sexual behaviour in homeless youth, which are important and the focus of intervention (along with immediate needs for shelter and safety; e.g., Fry et al., 2017; Solliday-McRoy, Campbell, Melchert, Young, & Cisler, 2004). However, this thesis has demonstrated that both researchers and services should also give consideration to cognitive functioning, and working memory in particular, as it can impact on housing outcome. It is likely that housing outcome is just one area that is influenced by working memory, and future work could explore its broader impact, not only in homeless young people, but also in young people from other adverse backgrounds to assess if the effect of working memory is related to adversity more generally.

As alluded to above, services tend to prioritise immediate needs and problems that are considered risky or health-related, resulting in cognitive function being overlooked (e.g., Solliday-McRoy et al., 2004). To begin dissemination of the results to service providers, I presented some of the findings from this thesis to Llamau staff at one of their Full Team Meetings (21/09/17), which as many staff as possible attend. The aim of the presentation was to communicate the research findings in an accessible way and discuss application of the findings which were relevant and useful. Feedback highlighted that a particularly valuable slide for staff was the one

included below, which included suggestions for things to bear in mind when working with homeless young people who may struggle with EF. As the key findings centred on working memory, the most important recommendation could be considered to be presenting information in small, manageable chunks. Following my presentation, Llamau have expressed interest in applying the findings of this study to the development of thinking skills workshops, to try and maximise young people’s potential and their likelihood of moving on.

**WHAT IT MEANS**

- Things to keep in mind:

Thought bubbles:

- Not too much info at once – small chunks
- Try to minimise distractions (if possible!)
- Could try and get young people to think about costs and benefits or help to reflect
- How are you presenting information?
- Try to encourage slowing down to give themselves time to think before reacting
- Maybe preoccupied
- One thing at a time
- Support making simple manageable plans may help

- Many of these are likely things you do already – just to highlight that they’re important

Figure 16. Slide from presentation given to Llamau staff at Full Team Meeting 21/09/2017.

Focusing specifically on working memory, there are three main approaches that can be taken to either improve or reduce difficulties with working memory: reducing working memory load by changing or adapting surroundings, the use of strategies (and training to use them), and direct training and/or intervention to improve working memory (Backer & Howard, 2007; Holmes et al., 2010; Medalia & Revheim, 2002). Suggestions from these approaches can be found in Figure 17. It is important to bear in mind when expecting engagement in training or intervention sessions / programmes from people with working memory difficulties whether they are actually able to engage and fulfil the requirements of the session / programme, or whether adjustments and/or appropriate support systems need to be put in place to achieve this (Backer & Howard, 2007; Burra et al., 2009). Working in a strengths-based way can also be beneficial (Medalia & Revheim, 2002).

The final implications considered here are those relating to policy. Housing First approaches (Atherton & McNaughton Nicholls, 2008; Busch-Gertseema et al., 2010; Tsemberis, Gulcur, & Nakae, 2004) are becoming increasingly popular as an approach to reducing homelessness. The idea behind the original Housing First model (Tsemberis et al., 2004) was that homeless people would be offered their own housing, no matter their needs, and tailored intensive support would be put in place to increase the likelihood of them maintaining their own accommodation. However, models based on the original have not always included the support side of the model (see e.g., Busch-Gertseema et al., 2010). In terms of the link between working memory and short-term housing outcome, it is clear that a Housing First approach would only be successful for homeless young people if tailored wraparound



support was available to assist with often complex needs, as well as specific training and/or intervention around working memory. To maximise the likelihood of success, working memory intervention should take all three approaches discussed above, that is, adapt the surroundings (e.g., using memory aids around the house), encouraging use of strategies (e.g., using flow charts / diagrams or imagery), and direct working memory training, for example, that used as part of wider programmes with homeless people (e.g., BrainWise; Welsh, Gorman Barry, Jacobs, & Beddes, 2018), or as part of cognitive remediation (e.g., Medalia et al., 2017).



**Figure 17. Practical suggestions to improve and/or reduce difficulties with working memory.**

*Suggestions collated from Backer & Howard (2007), Burra et al. (2009), Holmes et al. (2010), Medalia & Revheim (2002), and Solliday-McRoy et al. (2004).*

## Future Directions

The investigation of cognitive functioning more broadly is still in its infancy in vulnerable groups such as homeless young people (Fry et al., 2017). To my knowledge, this is the first study in the UK to examine executive functioning in homeless young people, and the first in the world to explore potential relationships between executive functioning and short-term housing outcomes. The focus on executive functioning means that there is more work to be done to fully investigate the profile of cognitive functioning (e.g., attention, learning, memory) in this group of vulnerable young people. Although the sample size was moderate for the comparisons, it is possible that the logistic regression analysis with housing outcome in the homeless group was underpowered due to the exclusion of the insufficient number with negative outcomes. The period of time that had elapsed between testing and follow-up data extraction also varied for each young person, with a minimum of six months. This means that some young people had more opportunity to have moved on than others, though this is likely to also have differed by area, as there is a lot more availability of housing in Cardiff than the South Wales valleys, for example. To strengthen the conclusions of this thesis, future research could focus on the link between EFs and housing outcome in homeless young people, designing a study that assessed EF while in hostel or supported accommodation and follow-up after a set period of time, ideally a year or more. This would be challenging to accomplish, relying on accurate and rigorous record-keeping and keeping in contact with young people, but follow-up has been successful in the past with this group (Hodgson et al., 2014, 2015). Ideally, if follow-up was viable in person, a second EF assessment

could be completed to compare to baseline, though there would have to be careful selection of tests and alternate forms of certain tests would need to be used to avoid practice effects. This would give some insight as to whether EFs also improve with more independent living, which would presumably offer more opportunities to practise using EF skills. Ultimately, if the results were replicated, given more promising findings recently in training working memory (Holmes & Gathercole, 2014) and feasibility of cognitive skills training in homeless young people (Medalia et al., 2017), the next step would be to design an intervention study, ideally a randomised control trial. This would investigate a) whether working memory could be improved via intervention in homeless young people and b) if so, whether improved working memory led to better housing outcomes, either in stability (i.e., private rented) or in speed of moving on.

I would also want to further explore whether there are any interactions between EFs and mental health. In particular, with reference to the current research activity surrounding Adverse Childhood Experiences (ACEs; e.g., Bellis et al., 2015) and the increased likelihood of several ACEs in homeless young people, I think it would be important to explore the impact of trauma on housing outcomes, as well as on the relationship between working memory and housing outcome. Trauma can be difficult to define, so it may be beneficial to include a combination of measures to validate the findings. One example of a relatively short measure that provides indication of PTSD symptoms is the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1997), which has been used successfully with homeless young people in previous research (Hodgson et al., 2014, 2015). This could be combined with

the gold standard in PTSD assessment, which is considered to be the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995), a structured clinical interview that aligns with diagnostic criteria. In addition, although the current study did not find any differences between the groups in creativity, I would want to investigate this further using a combination of more comprehensive measures, such as the Torrance Tests of Creativity (e.g., Torrance, 1965; Runco, Millar, Acar, & Cramond, 2010), and less structured tasks. It could be that it was not creativity *per se* that explained the differences found in Dahlman and colleagues' (2013) study, but cognitive flexibility and fluency more generally, and using measures that rely less on divergent thinking and tap a range of facets of creativity would shed some light on this. Another possibility is that creativity may aid those at risk of homelessness to avoid presenting to their Local Authority and be considered 'officially' homeless, via identification of alternative temporary housing solutions. As such, perhaps higher levels of creativity would be found in young people who are precariously housed or 'sofa surfing', that is, the 'hidden' homeless. This possibility is worthy of further exploration.

## **Conclusions**

This thesis aimed to profile EFs in homeless young people, compare EF performance and creativity between homeless and housed young people, investigate potential relationships with anxiety and depression, and explore whether EFs predict short-term housing outcomes in the homeless group. It is the first study in the UK to examine cognitive functioning in homeless young people, and one of the first in the world in homeless young people to explore the impact of EFs on housing-related outcomes. Although questions on

demographic characteristics and background, computer-based EF tasks, and questionnaires assessing indicators of anxiety, depression, and resource-based socioeconomic status were administered at a single time-point, access to homeless young people's records enabled identification of housing outcome at least six months after testing. Findings were largely consistent with the small selection of previous literature and theoretical perspectives informing the current work. EFs, working memory specifically and cognitive functioning more broadly, are understudied in homeless young people, yet have significance for pertinent outcomes relating to accommodation, education / training, and employment; more work is urgently needed in this area to inform approaches to practice.

The key findings of this thesis were that homeless young people demonstrated worse EF performance than housed young people across a range of EF domains, with working memory and impulsivity / risky decision making representing areas of particular difficulty. However, good working memory predicted progression into more independent accommodation, such that those with longer working memory spans were twice as likely to have progressed rather than maintained. This suggests that working memory can be both an area of vulnerability and an asset in homeless young people. Recent evidence suggests that training skills like working memory is feasible in homeless young people and there is some indication that training working memory can result in improvements in other areas of functioning. As adolescence and emerging adulthood have been identified as sensitive periods in EF development, this represents an ideal opportunity for services to consider supporting homeless young people with EF skills, and especially efforts to improve working

memory. This, in turn, could positively impact on homeless young people's ability to increase their independence and ultimately move into their own accommodation.





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## Appendix 1. Adapted NOS from Systematic Review Chapter 2

### NEWCASTLE - OTTAWA QUALITY ASSESSMENT SCALE CASE CONTROL STUDIES

Note: A study can be awarded a maximum of one star for each numbered item within the Selection and Exposure categories. A maximum of two stars can be given for Comparability.

#### **Selection**

- 1) Is case definition adequate? (poverty / homelessness / foster care)
  - a) Well defined with a reasonable duration of exposure. \*
  - b) Well defined but short exposure or overlap with the other risk factors.
  - c) No description
- 2) Representativeness of the cases
  - a) Representative series of cases \*
  - b) Potential for selection biases or not stated
- 3) Selection of Controls
  - a) Well-matched controls (irrespective of disadvantaged status) \*
  - b) Not well-matched or matched on very few factors
  - c) No description
- 4) Definition of Controls
  - a) Clear distinction from cases \*
  - b) No description of source or overlap with cases.

#### **Comparability**

- 1) Comparability of cases and controls on the basis of the design or analysis
  - a) Study controls for \_\_\_\_\_ Education \_\_\_\_\_ \*
  - b) Study controls for any additional factor \*

#### **Outcome**

- 1) Ascertainment of exposure (cognitive ability)
  - a) Validated objective test \*
  - b) Non-validated measurement tool but tool is available or described
  - e) No description
- 2) Same method of ascertainment for cases and controls
  - a) yes \*
  - b) no
- 3) Non-respondents:
  - a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. \*
  - b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory.
  - c) No description of the response rate or the characteristics of the responders and the non-responders.

## NEWCASTLE - OTTAWA QUALITY ASSESSMENT SCALE COHORT STUDIES

Note: A study can be awarded a maximum of one star for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability

### Selection

- 1) Ascertainment of exposure (poverty / homelessness / foster care)
  - a) National registers \*
  - b) Well defined with a reasonable duration of exposure. \*
  - c) Well defined but short exposure or overlap with the other risk factors.
  - d) No description
- 2) Representativeness of the exposed cohort
  - a) Truly representative of the average young person with experience of homelessness / foster care / poverty in the community \*
  - b) Somewhat representative of the average young person with experience of homelessness / foster care / poverty in the community \*
  - c) Selected group
  - d) No description of the derivation of the cohort
- 3) Selection of the non exposed cohort
  - a) Drawn from the same community as the exposed cohort \*
  - b) Drawn from a different source
  - c) No description of the derivation of the non exposed cohort

### Comparability

- 1) Comparability of cohorts on the basis of the design or analysis
  - a) Study controls for \_\_\_\_\_ Education \_\_\_\_\_ \*
  - b) Study controls for any additional factor \*

### Outcome

- 1) Assessment of outcome (cognitive ability)
  - a) Validated objective cognitive test \*
  - b) Non-validated measurement tool but tool is available or described
  - c) No description
- 2) Adequacy of follow up of cohorts
  - a) Complete follow up - all subjects accounted for \*
  - b) Subjects lost to follow up unlikely to introduce bias \*
  - c) Subjects lost to follow up likely to introduce bias
  - d) No statement

## NEWCASTLE - OTTAWA QUALITY ASSESSMENT SCALE (adapted for studies that are not cohort or case/control)

Note: A study can be awarded a maximum of one star for each numbered item within the Selection and Outcome categories. A maximum of two stars can be given for Comparability

### Selection

#### 1) Definition of poverty / homelessness / foster care (ascertainment of exposure to risk factor):

- a) Well defined with a reasonable duration of exposure. \*
- b) Well defined but short exposure or overlap with the other risk factors.
- c) No clear definition.

#### 2) Representativeness of the sample:

- a) Truly representative of the average in the target population. \* (all subjects or random sampling)
- b) Somewhat representative of the average in the target population. \* (non-random sampling)
- c) Selected group of users.
- d) No description of the sampling strategy.

### Comparability

#### 1) The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.

- a) The study controls for the most important factor (Education). \*
- b) The study control for any additional factor. \*

### Outcome

#### 1) Assessment of cognitive ability (outcome of interest):

- a) Validated objective test. \*
- b) Non-validated measurement tool, but the tool is available or described.
- c) No description.

#### 2) Non-respondents:

- a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. \*
- b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory.
- c) No description of the response rate or the characteristics of the responders and the non-responders.

These scales have been adapted from the Newcastle-Ottawa Scales (Wells et al., 2000) which are widely used quality assessment tools for case-control and cohort studies, recommended for use in systematic reviews by Deeks et al. (2003). We have created a new scale for studies that are not case-control or cohort design by adapting items from other scales and that of Patra et al. (2015), as well as adapting these scales to be as comparable across designs as

possible, for the purpose of assessing the quality of the studies included in the systematic review: 'A Systematic Review of Cognitive Ability in Young People With Experience of Homelessness, Foster Care, or Poverty: Similarities, Differences, and Comparisons to Youth Without Such Experiences'.

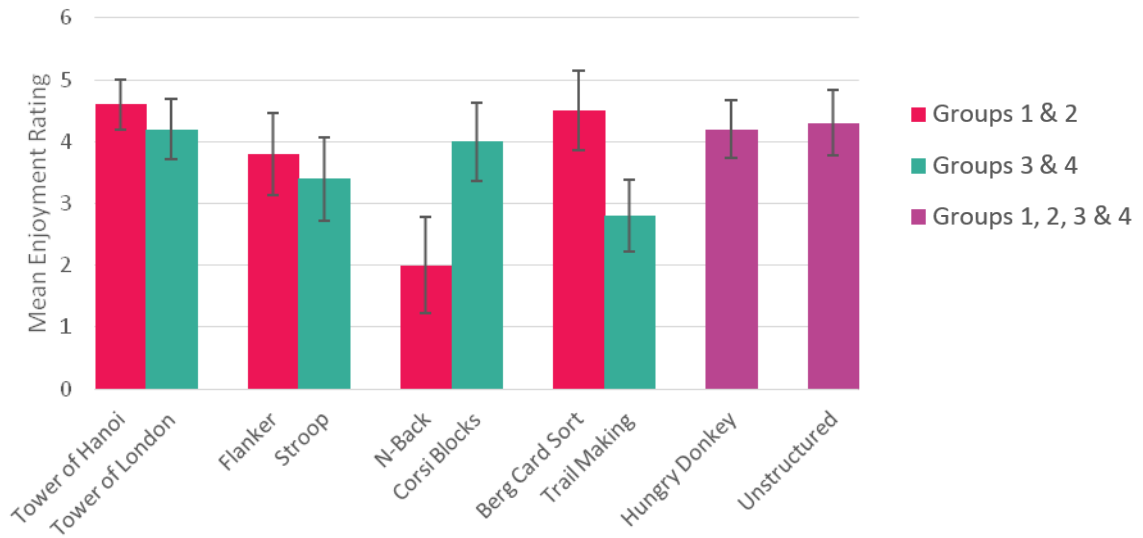
Wells, G. A., Shea, B., O'Connell, D., Peterson, J. E. A., Welch, V., Losos, M., & Tugwell, P. (2000). The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Retrieved from: [http://www.ohri.ca/programs/clinical\\_epidemiology/nosgen.pdf](http://www.ohri.ca/programs/clinical_epidemiology/nosgen.pdf)

Deeks, J. J., Dinnes, J., D'Amico, R., Sowden, A. J., Sakarovich, C., Song, F., ... & Altman, D. J. (2003). Evaluating non-randomised intervention studies. *Health Technology Assessment*, 7(27), 1-179.

Patra, J., Bhatia, M., Suraweera, W., Morris, S. K., Patra, C., Gupta, P. C., & Jha, P. (2015). Exposure to Second-Hand Smoke and the Risk of Tuberculosis in Children and Adults: A Systematic Review and Meta-Analysis of 18 Observational Studies. *PLoS Med*, 12(6), e1001835. doi:10.1371/journal.pmed.1001835.

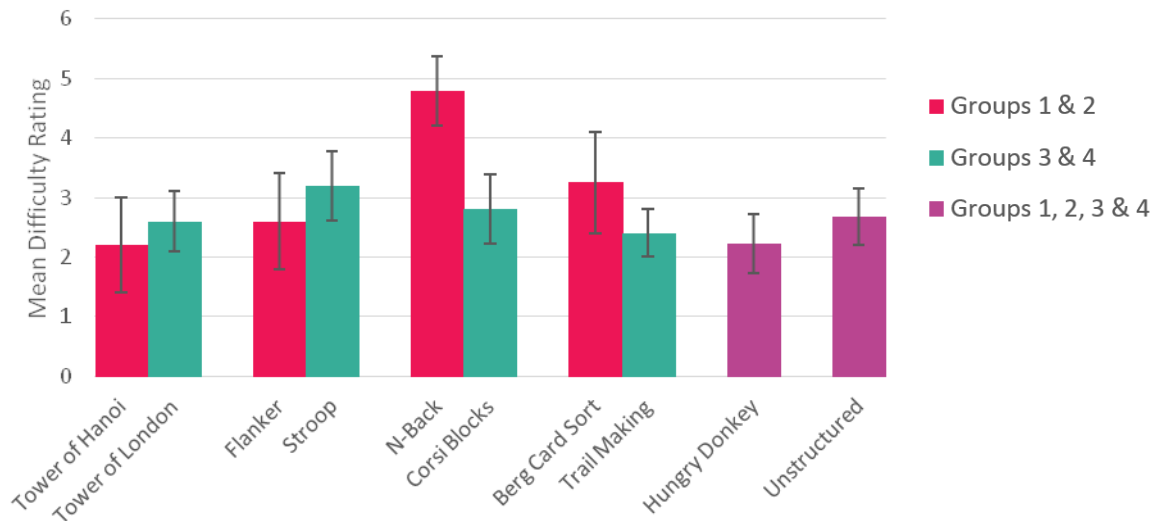


**Appendix 2. Pilot study ratings and results from Chapter 3.**



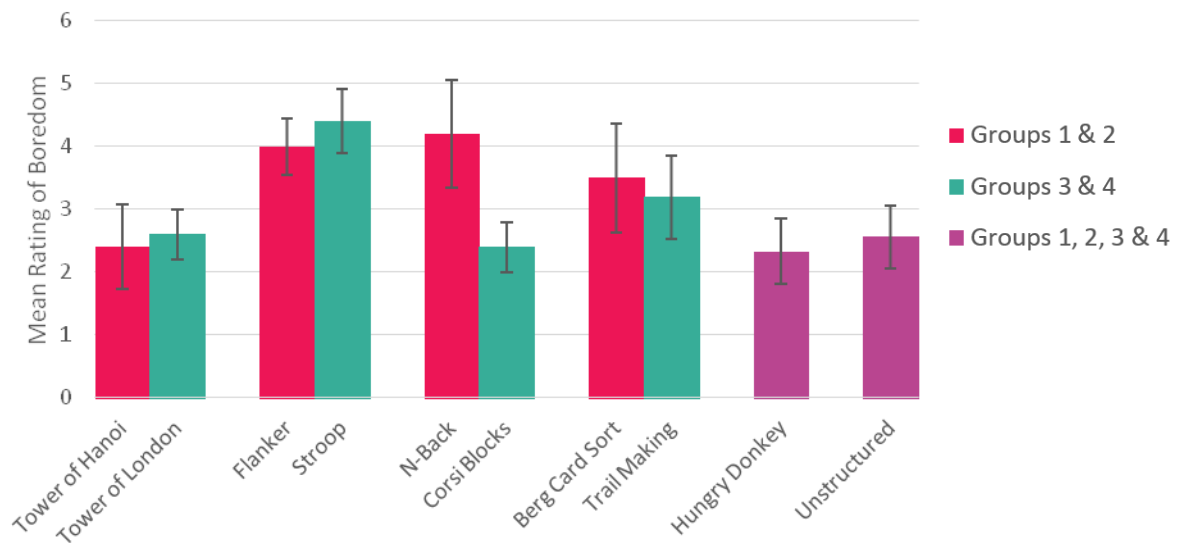
*Figure 18. Mean ratings of enjoyment for pilot EF tasks given by participants for the cognitive tests.*

Ratings: 6 = really enjoyable, 1 = not enjoyable at all. Error bars are  $\pm 1$  standard error of the mean.



*Figure 19. Mean difficulty ratings for pilot EF tasks.*

Ratings: 6 = really difficult, 1 = not difficult at all. Significant differences are indicated by an asterisk (\*). Error bars are  $\pm$  the standard error of the mean.



**Figure 20. Mean ratings of boredom for pilot EF tasks.**

Ratings: 6 = really boring, 1 = not boring at all). Error bars are  $\pm 1$  the standard error of the mean.

## Pilot study questions

Pre-task questions

Participant number \_\_\_\_\_

1. How old are you? \_\_\_\_\_ years
2. Gender     Male/Female/prefer not to say
3. Do you consider yourself to be homeless?     Yes/No
4. Have you ever lived in foster care or a residential care home?     Yes/No
5. Have you consumed any alcohol in the past 24 hours?     Yes/No  
*If yes, make a note of estimated quantity consumed*

6. Have you taken any drugs in the past 24 hours?     Yes/No  
*If yes, make a note of what drugs and estimated quantity consumed*

7. Are you colour-blind?     Yes/No

Post-task questions

Participant number \_\_\_\_\_

Task number \_\_\_\_\_ Name of task \_\_\_\_\_

1. How enjoyable did you find the task on a scale of 1-6?

Not  
enjoyable  
at all

Really  
enjoyable

1	2	3	4	5	6
---	---	---	---	---	---

2. How difficult did you find the task on a scale of 1-6?

Not  
difficult at  
all

Really  
difficult

1	2	3	4	5	6
---	---	---	---	---	---

3. How boring did you find the task on a scale of 1-6?

Not boring  
at all

Really  
boring

1	2	3	4	5	6
---	---	---	---	---	---

4. Were the instructions given to you before the task easy to understand?  
Yes/No

a. If no, what was difficult to understand or confusing?

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5. Which of the options below best describes how long the task took?

- a) Just right
- b) A bit too long
- c) Way too long
- d) Other, please specify \_\_\_\_\_

6. Is there anything else you noticed about the task or want to mention?

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Questions after session complete

Participant number \_\_\_\_\_

1. How did you find the session?

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2. Did you have any problems with the tasks being on the computer?

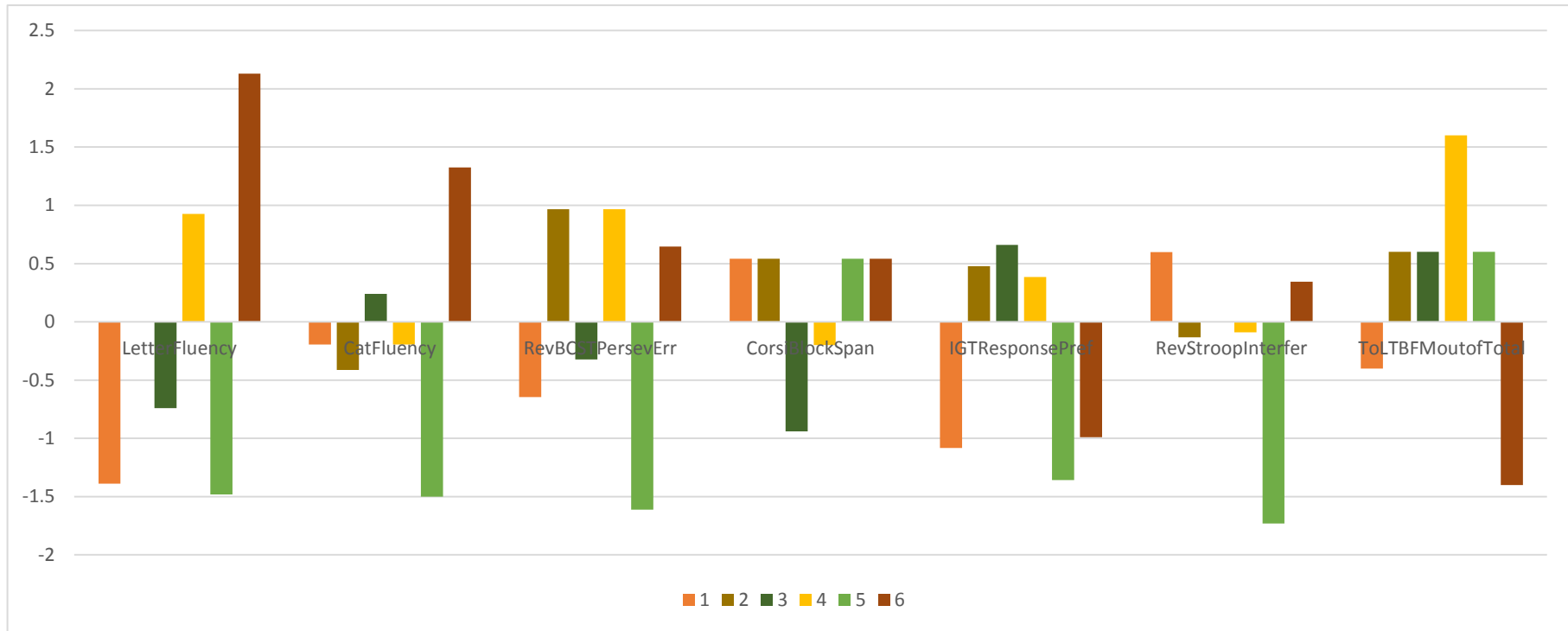
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**Appendix 3. Negative Outcomes Group EF Performance from Chapter 5**



*Figure 21. Profile of EF in homeless young people with negative outcomes (n=6), compared to the average performance of the homeless group as a whole (represented by zero). Stroop Interference and BCSTPersevErr have been reversed, so that for all EF variables higher z scores correspond to better performance on the task.*

