Where There's Smoke There's Fire: Firesetting Behaviour in Children and Adolescents

Ian Lambie, Shane McCardle, Ray Coleman
University of Auckland

The issue of juvenile firesetting has recently gained a considerable increase in media attention in New Zealand. A number of adolescents have been charged with arson, and in such cases they have caused great shock and cost to the community. This has led to increasing recognition of the problem and the identification of a need for appropriate intervention. This article provides a brief overview of the literature, includes two case studies to illustrate clinical features of child firesetters, and describes the appropriate clinical assessment and intervention for this group of children.

Prior to the recent spate of fires set by the "Mangere Serial Arsonist" and the fire at Fraser High School in Hamilton, the public had little awareness of the problem of child and adolescent firesetting in New Zealand. The cost from such fires can be measured in terms of emotional and social effects, along with financial consequences. Financially alone, the cost of arson is thought to run into the millions of dollars each year as houses, cars, and school classrooms are set alight. Children are particularly vulnerable because of their more limited ability to understand the consequences of fire and their lack of effective strategies for extinguishing a fire should it get out of control.

Prevalence of Childhood Firesetting

While arson is often thought to be a crime perpetrated by adults, forensic statistics from the United States have painted quite a different picture. According to FBI crime data, between 1986 and 1994, children and adolescents accounted for between 40 and 49% of arrests for arson. This peaked in 1994 at 55%, then declined to 50% by 1988 (Bradish, 1999). These statistics indicate that arson has the highest percentage of child and adolescent involvement of any serious offence (Kolko, 1999).

In Australia, the Melbourne Metropolitan Fire Brigade estimates that 20% of all fires reported to the fire service are lit by children and adolescents (Melbourne Metropolitan Fire Brigade Annual Reports, 1986-1992). Each year in Auckland, the Fire Service deals with up to 220 young people involved in firesetting. This figure has increased by 10% over the last few years (New Zealand Fire Service, 2000).

Community studies suggest that a large number of children have set fires at some time in their life (Grolnick, Cole, Laurenitis, & Schwartzman, 1990; Kafry, 1980). In a community sample of 770 children aged between 6 and 14 years, 38% reported having played with fire. Older children reported the highest percentage of fireplay within the past six months (Grolnick et. al., 1990). The prevalence rate of both firesetting and fireplay has been found to be significantly higher among clinical populations of children compared to community samples (Kolko & Kazdin, 1989). Within clinical populations, research has found significantly more firesetting and fireplay among those in inpatient settings compared to outpatient settings (Kolko & Kazdin, 1988). Kolko and Kazdin (1988) found 19.5% of those in an outpatient setting had engaged in deliberate firesetting causing destruction to property, while 24.4% reported match play with no damage to property. Rates in a comparative inpatient sample were found to be nearly double that of an outpatient sample, 34.6% and 52% respectfully.

From the previous findings it appears that a large number of children engage in fireplay and firesetting, and to a degree this behaviour can therefore be considered "normal". However it appears that significantly more children in clinical populations engage in fireplay and firesetting, suggesting a relationship between clinical problems and firesetting behaviour.

What Is Considered a Normal Child's Involvement With Fire?

It is important that a young person's interest in fire is viewed on a natural continuum of psychosocial development (Gaynor & Hatcher, 1987). Gaynor (1996) argues that there are three main developmental phases related to fire, namely,

fire interest, fireplay and firesetting. Each phase is indicative of an increasing level of risk and indicates an opportunity for the child to learn age-appropriate firesafe behaviours.

Fire interest: Curiosity

Fire interest typically occurs between three and five years of age and is considered a normal path in a child's development. It is evidenced by the child asking age appropriate questions about fire and/or their play may include fire (e.g., model fire engines, dressing up as firemen, "Is this hot?", "What happens if I touch this?"). An interest in fire is a normal part of child curiosity about the world. Kafry (1980) found the majority of a sample of kindergarten and primary school boys display an interest in fire.

Fireplay: experimentation

As the child gets older, experimentation normally takes place between the ages of five to nine years and by the age of ten the majority of children have learnt fire safety rules and are able to handle fire appropriately under the supervision of an adult. Firesafe behaviour is considered a normal part of a child's developmental education and involves experimenting with matches in a safe way. Behaviours considered "firesafe" take place within a context of the parent supervising the child regarding firesafe behaviour (e.g., cooking marshmallows over an open fire, or lighting candles). In this age group, fireplay that is unsupervised is usually an isolated event, and typically is motivated by curiosity (Gaynor, 2000). Despite the motive, the consequences may be disastrous and can result in significant property damage and, possibly, personal injury. Gaynor and Hatcher (1987) believe that children who engage in fireplay are likely to attempt to extinguish the fire should it get out of control.

Firesetting – fires set with a deliberate intent

Firesetting refers to a group of children who have a deliberate intent when lighting fires. Though there is little empirical evidence, such children are thought to be at increased risk of repeating such behaviours. The terms firesetting and arson are often confused, however arson is the legal terminology used to describe intentional and willful firesetting with an awareness of the potential consequences of the behaviour.

Gaynor (1996) has classified fireplay and firesetting using the distinctions listed in Table 1.

Table 1. Distinguishing Fireplay and Pathological Firesetting

Factor	Fireplay	Firesetting
History	Single episode	Recurrent
Method	Unplanned	Planned
Motive	Accidental	Intentional
Ignition	Available	Acquired
Target	Non-specific	Specific
Behaviour	Extinguish fire	Run away

NB: This is a proposed model and has not been tested in research

Classifying Firesetters

In an attempt to understand both the causal and maintaining factors involved in firesetting, personality typologies have been used, but no specific profile exists of a child or adolescent firesetter. Typologies, while serving as a useful guide, clearly lack the necessary empirical validation and are obviously limited in that, like many conduct disorders, there are multiple motives to their firesetting (Fineman, 1980; 1995). Kolko (1999) summarised the following four classifications as the most commonly used:

1. **Curiosity firesetters** – typically light a single fire that is commonly accidental. The motive is curiosity/experimental. This is more likely to occur in younger children.

2. **Pathological firesetters** – children who light fires that are frequent, destructive, concealed, and are planned. This is more common in middle and adolescent aged children. According to Gaynor and Hatcher (1987), pathological firesetters have deliberately set fires for a period of at least six months. Such individuals typically use ignition materials (e.g., lighters, petrol), and the fire behaviour generally occurs close or near to the home in an isolated place to avoid detection. Once the fire is going, an attempt may be made to gather other flammable materials to assist in the fire spreading. These children may typically set the fires for reasons such as revenge and anger, seeking attention, boredom, and fascination with fire. Should the fire get out of control the young person is unlikely to get help to put it out but may run away and/or sometimes stay close by to watch the arrival of fire engines.

3. **Cry for help firesetters** – sets fires with the intention of getting attention. Typically this occurs around stressful life events.

4. **Delinquent firesetters** – firesetting is a part of generalised antisocial and delinquent behaviour and may occur in the company of peers. These behaviours are more common in adolescent males.

Case examples

The following two case examples are included for the purpose of illustrating some clinical features of children who deliberately set fires and in particular the different motivating factors.

Case illustration one:

Harry was initially referred to our treatment programme at the age of 14 after he had sexually assaulted a four-year-old girl at a shopping mall. At the time of the offence he was living with his mother and two younger female siblings. His father had left the family when Harry was five years old and there were indications that Harry had been sexually abused by him. Harry's relationship with his mother was classified as ambivalently attached. She was considered a dominant, controlling, and at times unpredictable woman, she was also prone to violent outbursts. Furthermore, she was a heavy consumer of alcohol, and had blurred sexual boundaries around her children. Despite Harry having an IQ in the borderline range, he displayed a good range of

social skills.

Harry reported being fascinated by fire, and fire-related toys, at a young age. He remembers playing with toy fire engines and police cars, and feeling excited when he "heard and saw the real thing". His history of firesetting began when he set fire to papers in a rubbish bin in a department store and then pressed the fire alarm; he was 12 years old. He reported being excited by the fire alarm and the arrival of the fire engine. Six months later he set fire to a caravan by piling rubbish underneath. He again recalls watching the caravan burn and feeling excited when the gas bottle exploded and fire engines arrived. Harry's fourth reported fire occurred following an argument with his mother during which she struck him. Using petrol, he set a fire to a house by pouring it over rubbish and paint cans. He was again excited by the arrival of the fire engines. His fourth reported fire-related behaviour occurred following an argument with his mother when he was 16 years old. On this occasion he ran away to a shopping mall, pressed the fire alarm and watched the fire engines come. He again reported a sense of pleasure from watching them arrive. He did not report feeling any sexual arousal during or following any of the firesetting. The final incident occurred when he set fire to another house and a church after feeling angry at being told what do to by his caregivers.

Case illustration two:

The following example is a transcript from a young person describing a series of fires he lit over the course of one day:

Yesterday morning I got Michael's Game Boy out of its box and I saw his lighter hidden in there and I grabbed it and put it in my pocket; about half an hour later, out of curiosity, I lit my bedroom curtain just to see how it would burn. The part I burnt melted and eventually caught fire. I quickly put it out and put the lighter back in my pocket and then I started playing on the Game Boy. After some time we went up to the church and I went into the toilet and saw the paper. I got the lighter out and lit it. There were three rolls in the toilet paper holder and I lit one and left the other one burning. I put the lighter back in my pocket and went outside. There was a rubbish fire outside and I biffed the lighter into the fire and after a minute or less it exploded. I thought this was really neat and what a buzz. I then went upstairs and there were heaps of people standing round the toilet block and they showed me what had happened. It was real cool. There was ash and the plastic on one side of the toilet paper holder was all melted. They asked me if I did it and I denied and denied and denied it but eventually I came out with the truth.

Recidivism

Recidivism rates in children who set fires vary considerably. Relatively few studies have been conducted on recidivism rates following specialised intervention programmes. There have only been a small number of published studies and these studies have varied greatly in methodology and have reported disparate results, hence it is very difficult to draw any meaningful comparison. There is some evidence that firesetting is a behaviour that children will engage in repetitively. Kolko and Kazdin (1988) found between 52% and 72% of the firesetters from mental health services, reported histories of setting two or more fires. Recidivism studies of fire specific intervention programmes are relatively rare in the literature. In a prospective study, Kolko and Kazdin (1992) found that 21 out of 60 firesetters (35%) had set multiple fires at one-year follow-up. Many of the earlier studies undertaken of firesetters in mental health programmes find lower rates of recidivism (e.g., 9%, Strachan, 1981), while more recent studies (e.g., 59%, Kolko, 2001) are much higher. In the United States, Specialist Fire Service Intervention programmes have reported much lower recidivism rates (e.g., 1.4%, 6.3%, Kolko, 1988; 3%, Kolko, 2001). However, in these surveys the method that individual programmes used to assess recidivism in unclear, therefore we must treat these figures with some caution.

Research has reported a range of different factors to be associated with recidivism. Kolko and Kazdin (1992) found recidivism associated with parental reports of greater hostility and carelessness, lax discipline, family conflict, exposure to stressful events, and knowledge of combustibles and engagement in fire-related activities. The families of recidivists have been characterised by greater conflict and less organisation. The recidivist firesetters have been characterised with higher levels of arguing and fighting and more covert behaviours. Similar predictive factors have been reported in a group of adult arsonists (Rice & Harris, 1991). However, some of these identified factors have been challenged by a recent study. Kolko (2001) conducted a two year follow-up study and found parental or family factors were not predicative of recidivism. Rather, recidivism was associated with a history of match play, involvement in fire-related acts, and a high level of covert antisocial behaviour. Not surprisingly prior firesetting and match play has been consistently found across most studies as one of the key predictors in recidivist firesetting (Kolko & Kazdin, 1994).

A Model of Firesetting

A range of theories have been proposed to account for firesetting behaviour. This has included psychosexual development, proposed by the psychoanalytic theorists (Freud, 1932), through to the influences of modelling, reinforcement and expression of anger, proposed by the social learning theorists (Gaynor & Hatcher, 1987). In recent times models that account for a range of influential variables have been proposed. The most important of these has been Fineman's (1995) "Dynamic-behavioural formulation". This model proposed that firesetting behaviour might be understood by a dynamic relationship between the following three main factors:

1. Historical factors - These factors are historical events that predispose a firesetter to antisocial and maladaptive behaviours. This would include a problematic family background, poor supervision, lack of fire safety education, poor peer relationships and learning disabilities.

2. Historical contingencies related to fire - These factors include being taught that firesetting is an acceptable behaviour, and having firesetting behaviour reinforced. This can occur through modeling of firesetting behaviour and encouragement from peers.

3. Immediate environmental factors - These factors include immediate events that trigger or cue firesetting behaviour. This might include trauma and/or life crises; thinking errors (cognitive distortions before, during and after the fire); feelings before, during and after the fire; and internal and external reinforcement for the firesetting.

Clinical Presentation

The importance of identifying individual and family factors is seen as crucial to providing an intervention that meets the needs of both the individual and their family. Currently what does the typical presentation of child firesetters look like?

Individual Factors

Firesetting has been found to be far more common among males. This has been the case in clinical samples (Jacobson, 1985), forensic samples (Kolko, 1985), and referrals to Fire Service treatment programmes (Kolko, 1988). The ratio of males to females is thought to be nine to one. The New Zealand Fire Service report males accounted for 89% of those seen by the juvenile intervention programme across New Zealand in 1999 (NZFS, 2000). There has been some indication in literature that female firesetting may be on the increase (Fineman, 1980), and that firesetting may be more common among adolescent females compared to younger females (Jacobson, 1985; Porth, 1997).

Firesetting has been reported in children as young as two and three (Nurcombe, 1964). There is some evidence that firesetting behaviour peaks between the age of eight and thirteen (Jacobson, 1985). Adolescents are believed to set more fires than children (Kolko, 2002), set fires away from home (Jacobson, 1985), fire-set more often in groups (Gaynor, 1996) and are more likely to continue to set fires following intervention (Stewart & Culver, 1982). Many firesetters have poor academic achievements, which is more related to a generalised set of behaviour problems. This includes more suspensions, expulsions, and being kept back from progressing onto the next class (Kolko, 1985). Studies of child and adolescent firesetting have more frequently been focused on conduct disorder, attention deficit disorder and adjustment disorder. Studies that have compared firesetters and conduct disordered control groups have found firesetters are comparable to an extremely antisocial end of the conduct disorder spectrum (Forehand et al., 1991).

Family

Kolko and colleagues (1986, 1990) compared the family factors of children with firesetting behaviour and those without. They found significantly more marital dysfunction and less martial satisfaction, less cohesion, and less affectionate expression in those families with child firesetters. Parents of firesetters acknowledged greater personal and marital distress, parenting difficulties and family dysfunction. These parents reported less monitoring and discipline of their children and lower family affiliation. This led Kolko and Kazdin (1990) to conclude that parents of firesetters had restricted involvement and management of their children, similar to results found for other anti-social, aggressive, and conduct disordered children. In a more comprehensive follow-up study, Kolko and Kazdin (1990) found parents of firesetters reported overall greater levels of personal and marital distress, with overall higher levels of pathology when compared to parents of non-firesetters.

From our clinical experience with adolescent firesetters, for those children who light multiple fires, firesetting is but one part of a more comprehensive set of behaviour problems, the motives of which occur for a variety of reasons and typically include emotional impulse control problems such as misdirected anger and boredom, and experimentation. It is these issues, along with other antecedent and systemic factors that need to be addressed in intervention programmes.

Psychological Intervention and Treatment

Given that interest in lighting fires is a normal part of a child's development and that only a small number of children are likely to become repetitive firesetters, it is imperative that any intervention be targeted to suit the particular needs of the child and family. In this section, a brief overview is given regarding the current available options for children who set fires in New Zealand.

In North America, two main treatment approaches have been used (DeSalvatore, 2002). Firstly community approaches which are linked to fire departments or youth courts, and secondly is the use of residential treatment that include hospital and child welfare facilities. In New Zealand, most treatment for children and adolescents who set fires is carried out by the New Zealand Fire Service. They operate a youth intervention programme for children and adolescents who engage in both deliberate and curiosity firesetting. All regional centres in New Zealand operate a youth intervention programme, the aim of which is to increase the child's understanding of the elements of fire, develop fire safety awareness, and develop safe and appropriate firesetting behaviour. It is targeted at children and families that have fire-related behaviour problems. It covers the following issues. (1) *Fire Awareness Work Books*: Three different types of books are used, suitable for five to nine year olds, ten to twelve years olds, and twelve to sixteen year olds. They are designed to give the client a better understanding of safe fire practices. (2) *Fire Escape Plan*: Here both the family and child design a fire escape plan for the family home and are encouraged to practice this. (3) *Junior Fire Safety Officer*: This intervention is suited to children under the age of ten. It involves them taking on the role of Junior Fire Safety Officer and can include such activities as the maintenance of smoke alarms, organising practice of fire escape plans, and other areas of general fire safety around the home. For younger children, star charts are used to reinforce positive behaviours such as not playing with matches or fire, successfully carrying out his/her duties as a Junior Fire Safety Officer, and successfully completing homework tasks.

Those children who have set multiple and/or serious fires, who have complex needs across a range of psychological and educational areas, and who are assessed as high risk, require a thorough psychological and if appropriate, psychiatric assessment. Assessments include fire specific assessment and cover similar questions to those of the Children's Firesetting Inventory (Kolko & Kazdin, 1989; Wilcox & Kolko, 2002). Assessment areas include, but are not limited to, motivational factors about the fire, consequences of the firesetting, antecedent events, factors that increase and decrease the likelihood of the behaviour, historical firesetting, involvement in fire-related activities, preparation of their firesetting, behaviour following their firesetting, knowledge about how things burn, fire competence, exposure to fire materials and modeling from others regarding fire, and the level of supervision from caregivers. Interventions should be tailored to meet the developmental needs of the child and also the family. They might include behavioural monitoring and contingencies, cognitive-behavioural interventions, family therapy, and interventions that cover a broad systemic level. Interventions that are multi-disciplinary and collaborative across many community agencies are likely to have the greatest impact for those children and families with the highest needs. Such models have been successfully employed in the Massachusetts Coalition for Juvenile Firesetting and State-wide programmes in Oregon that are coordinated by the Office of the State Fire Marshall.

The Clinical Psychology Programme at the University of Auckland is currently developing a comprehensive treatment programme for firesetters. This treatment programme will cater for children who are assessed as moderate to high risk and who may be unresponsive to education programme and will be the first such programme to operate in New Zealand. In the United States such programmes typically cater for between 10-20% of all firesetters (Elliott, 2002). There is also a need in New Zealand for child welfare and mental health services to be better informed of the needs of children who set fires and what appropriate treatment and risk management strategies are required. To address this issue, the New Zealand Fire Service Commission plans to develop a national coalition to raise awareness and improve co-ordination of services, particularly for high-risk youth.

Conclusion

Currently in New Zealand, children with serious firesetting problems pose a challenge for mental health professionals in being able to provide age appropriate, specialist intervention to address their firesetting behaviour. There is evidence in New Zealand that many professionals are unaware of children who set fires and fail to recognise its seriousness. Sound empirical research is particularly lacking on risk estimation and typologies of children who set fires. The available research suggests that for chronic and severe firesetters, their firesetting behaviour forms part of a more complex set of behaviour problems. It is such children who require a multi-agency approach that includes the fire service, mental health agencies, and the Department of Child, Youth and Family.

Until recently psychology has had little formal involvement in the field of child and adolescent firesetting in New Zealand. In collaboration with the New Zealand Fire Service, psychologists can play an important role by providing specialist assessments and intervention for medium to high risk firesetters in the community. Comprehensive multi-agency treatment approaches for serious firesetters, when combined with ongoing research will lead to better informed clinical practice and a reduction in firesetting recidivism.

References

Bradish, J. K. (1999). Arson in America: 1999 national update. *Firehouse, September,* 40-41.

Elliott, E. (2002). Juvenile justice diversion and intervention. In D.J. Kolko (Ed.), *Handbook on firesetting in children and youth* (pp. 383-394). San Diego, CA: Academic Press.

Fineman, K. R. (1980). Firesetting in childhood and adolescence. *Psychiatric Clinics of North America, 3,* 483-499.

Fineman, K. R. (1995). A model for the qualitative analysis of child and adult fire deviant behavior. *American Journal of Forensic Psychology, 13,* 31-60.

Forehand, R., Wierson, M., Frame, C. L., Kemptom, T., et al. (1991). Juvenile firesetting: A unique syndrome or an advanced level of antisocial behavior? *Behaviour Research & Therapy, 29,* 125-128.

Freud, S. (1932). The acquisition of power over fire. *International Journal of Psycho-Analysis, 13,* 405-410.

Gaynor, J. (1996). Firesetting. In M. Lewis (Ed.). *Child and adolescent psychiatry: A comprehensive textbook* (pp. 601-611). Baltimore, MD: Williams & Wilkins.

Gaynor, J., & Hatcher, C. (1987). *The psychology of child firesetting: Detection and intervention.* Philadelphia, PA: Brunner/Mazel.

Grolnick, W.S., Cole, R.E., Laurenitis, L., & Schwartzman, P.I. (1990). Playing with fire: A developmental assessment of children's fire understanding and experience. *Journal of Clinical Child Psychology, 19,* 128-135.

Jacobson, R. R. (1985). Child firesetters: A clinical investigation. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 26,* 759-768.

Kafry, D. (1980). Playing with matches: Children and fire. In D. Canter (Ed.), *Fires and human behaviour* (pp. 47-60). Chichester, UK: Wiley.

Kolko, D. J. (1985). Juvenile firesetting: A review and methodological critique. *Clinical Psychology Review, 5,* 345-376.

Kolko, D. J. (1988). Community interventions for juvenile firesetters: A survey of two national programs. *Hospital & Community Psychiatry, 39,* 973-979.

Kolko, D. J. (1999). Firesetting in children and youth. In V. Van Hasselt & M. Hersen (Eds.), *Handbook of psychological approaches with violent offenders-: Contemporary strategies and issues* (pp. 95-115). New York: Plenum Press

Kolko, D. J. (2001). Efficacy of cognitive-behavioral treatment and fire safety education for children who set fires: Initial and follow-up outcomes. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 42,* 359-369.

Kolko, D.J. (2002). Research studies on the problem. In D.J. Kolko (Ed.), *Handbook on firesetting in children and youth* (pp. 33-56). San Diego: Academic Press.

Kolko, D. J., & Kazdin, A. E. (1986). A conceptualization of firesetting in children and adolescents. *Journal of Abnormal Child Psychology, 14,* 49-62.

Kolko, D. J., & Kazdin, A. E. (1988). Parent-child correspondence in identification of firesetting among child psychiatric patients. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 29,* 175-184.

Kolko, D. J., & Kazdin, A. E. (1989). The children's firesetting interview with psychiatrically referred and nonreferred children. *Journal of Abnormal Child Psychology, 17,* 609-624.

Kolko, D. J., & Kazdin, A. E. (1990). Matchplay and firesetting in children: Relationship to parent, marital, and family dysfunction. *Journal of Clinical Child Psychology, 19,* 229-238.

Kolko, D. J., & Kazdin, A. E. (1992). The emergence and recurrence of child firesetting: A one-year prospective study. *Journal of Abnormal Child Psychology, 20,* 17-37.

Lewis, N. D. C., & Yarnell, H. (1951). *Pathological firesetting (pyromania).* New York: Nervous and Mental Disease Monographs.

Melbourne Metropolitan Fire Brigade (1986-1992). *Annual reports.* Melbourne, Australia: Author.

New Zealand Fire Service (1997). *Annual reports.* New Zealand Fire Service Commission, Wellington, NZ.

New Zealand Fire Service (2000). *Annual reports.* New Zealand Fire Service Commission, Wellington, NZ.

Nurcombe, B. (1964). Children who set fires. *Medical Journal of Australia, 16,* 579-583.

Porth, D. (1997). *Juvenile firesetting: A four year perspective.* Portland, OR: SOS Fire Youth Intervention Program.

Rice, M.E., & Harris, G.T. (1991). Firesetters admitted to a maximum security psychiatric institution: Offenders and offenses. *Journal of Interpersonal Violence, 6,* 461-475.

Stewart, M. A., & Culver, K. W. (1982). Children who start fires: The clinical picture and a follow-up. *British Journal of Psychiatry, 140,* 357-363.

Strachan, J. G. (1981). Conspicuous firesetting in children. *British Journal of Psychiatry, 138,* 26-29.

Wilcox, D., & Kolko, D. (2002). Assessing recent firesetting behavior and taking a firesetting history. In D.J. Kolko (Ed.), *Handbook on firesetting in children and youth* (pp. 161-175). San Diego, CA: Academic Press.

Address for correspondence:
Ian Lambie, PhD
Psychology Department
University of Auckland
Private Bag 92019
Auckland
Email: i.lambie@auckland.ac.nz