



INSTITUTO UNIVERSITÁRIO EGAS MONIZ

MESTRADO EM PSICOLOGIA FORENSE E CRIMINAL

**IS CRIMINAL PROFILING A VALID FORENSIC TECHNIQUE?
APPLICATION IN PORTUGUESE CASES OF RURAL ARSONISTS**

Trabalho submetido por
Rita Alexandra Brilha Ribeiro
para a obtenção do grau de Mestre em Psicologia Forense e Criminal

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Trabalho orientado por
Prof. Doutora Cristina Soeiro

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“No harvest is had without the seed first being sown.”

~King Olaf Trygvísson's Saga, c.8

Abstract

Criminal profiling was developed to predict personality patterns, behaviors and demographic characteristics of criminals with crime scenes as a fundamental basis (e.g. Douglas, Ressler, Burgess, & Hartman, 1986). This allows the profiler to understand who committed the crime, when, where and how it was done and what was the underlying motivation (Kocsis, 2006). However, there is still controversy regarding the validity of this technique, which is the aim to clarify in the first article. The validity in criminal profiling is related to whether this forensic technique can accurately predict an unknown criminal characteristics (Montet, 2007). There are three types of validity: content validity, construct validity and criterion validity (eg. American Psychological Association, 2018). Most studies use profilers' and police officers' beliefs to test criminal profiling validity, others confuse accuracy with validity and some studies test profilers' predictive capabilities instead of the technique itself and therefore so far there is no well structured investigation direction regarding this technique. Regarding arson's criminal profiling, there is also no consensual investigation path concerning arsonists' characteristics and even less studies on rural arsonists. So far exist three different criminal profiles for rural arson from Australia (Willis, 2005), Portugal (Soeiro, Branco, & Carvalho, 2008) and Spain (Sotoca, González, Fernández, Kessel, Montesinos, & Ruíz, 2013) and none is validated. The second article studies 309 rural arsonists' cases and through an exploratory and confirmatory analysis shows the existence of three valid typologies for rural arson criminal profiling: Expressive Motivation – Psychiatric/Alcohol Problems, Expressive Motivation – Socially Maladjusted and Instrumental Motivation – Socially Adjusted. Thus, this dissertation is divided in two articles: the first one covers criminal profiling validity through a systematic review, while the second one studies its validity applied on rural arson, using a new validation methodology based on the previous article conclusions.

Keyword: criminal profiling, validity, rural arson, forensic technique

Resumo

Os perfis criminais foram desenvolvidos para prever padrões de personalidade, comportamentos e características sociodemográficas de agressores, relevando-se também a cena do crime (e.g. Douglas, Ressler, Burgess, & Hartman, 1986). Assim permite-se que os *profilers* descubram quem cometeu o crime, quando, onde e como foi feito e qual a motivação subjacente (Kocsis, 2006). Contudo, ainda existem controvérsias quanto à validade desta técnica. Nos perfis, a validade relaciona-se à precisão da técnica a prever as características de agressores desconhecidos (Montet, 2007). Existem três tipos de validade: validade de conteúdo, validade de construto e validade de critério (e.g. American Psychological Association, 2018). A maioria dos estudos utiliza crenças dos *profilers* e polícias para testar a validade dos perfis, outros confundem exatidão com validade e outros avaliam os *profilers* em vez da técnica. Não existe, portanto, uma linha de investigação bem estruturada sobre a validade da técnica. Quanto aos perfis do crime de fogo posto, não existe uma linha de investigação consensual que defina os comportamentos dos incendiários e existem ainda menos estudos sobre incendiários rurais. Até o momento existem três perfis sobre incendiários rurais da Austrália (Willis, 2005), Portugal (Soeiro, Branco, & Carvalho, 2008) e Espanha (Sotoca, González, Fernández, Kessel, Montesinos, & Ruíz, 2013) e nenhum é validado. O segundo artigo estuda uma amostra de 309 incendiários rurais e através de uma análise exploratória e confirmatória demonstra a existência de três tipologias válidas: Motivação Expressiva – Problemas Psiquiátricos/Álcool, Motivação Expressiva – Socialmente Desajustado e Motivação Instrumental – Socialmente Ajustado. Assim, esta dissertação divide-se em dois artigos: o primeiro abrange a validade dos perfis através de uma revisão sistemática, enquanto o segundo estuda a sua validade aplicada a incêndios rurais, utilizando uma nova metodologia de validação baseada nas conclusões do artigo anterior.

Palavras-chave: perfis criminais, validade, incêndio rural, técnica forense

Introduction

Considering this briefly introduction to the theme, this dissertation aims to validate criminal profiling has forensic technique. This way, it is intended to take a step forward in the construction of valid forensic psychology techniques – in this case, criminal profiling – in order to contribute for the criminal behavior understanding and therefore, to improve the prevention of such crime. For that, the research is organized in two different steps and presented in two different articles. The first article studies criminal profiling validity through a systematic review of the literature, underlying the problems around validity and criminal profiling and giving suggestions for future studies dedicated to this subject. This article is already submitted to Journal of Investigative Psychology and Offender Profiling and is currently under review. The second article is an empirical study that considers the conclusions on the first article and uses a sample of rural arson cases for a new proposed validation methodology on criminal profiling.

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Abbreviation List

CP – Criminal Profiling

RA – Rural Arson

MCA – Multiple Correspondence Analyses

LCA – Latent Class Analysis

1st Article

Analysing Criminal Profiling Validity: Underlying Problems and Future Directions

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Profiling

Abstract

Criminal profiling is a forensic technique which predicts criminal's personality patterns, behaviors and demographic characteristics, allowing the understanding of who committed the crime, when, where, how and what was the underlying motivation. This technique has been rising in criminal investigations even if there is controversy regarding its validity. Therefore, the present article aims to clarify this controversy by analyzing 17 articles about criminal profiling validity which are selected through a systematic review of literature methodology. Findings demonstrate that most studies focus on professionals' beliefs regarding criminal profiling and on profiler's predictive abilities which mean this forensic technique is yet to be validated. Thus, this article also analyses the existing attempted validation methods, pointing out some major problems and contributing with directions for future studies on criminal profiling validity.

Keywords: criminal profiling, validity, systematic review, forensic tool

Resumo

Os perfis criminais são uma técnica forense destinada a prever padrões de personalidade, comportamentos e características sociodemográficas dos agressores, permitindo compreender quem cometeu o crime, quando, onde, como e qual a motivação subjacente. A utilização desta técnica nas investigações criminais tem vindo a aumentar apesar das controvérsias quanto à validade da mesma. Deste modo, o presente artigo tem como objetivo analisar a validade dos perfis criminais com a análise de 17 artigos relacionados com a temática através de uma revisão sistemática da literatura. Os resultados demonstram que a maioria dos estudos foca-se nas crenças dos *profilers* no que toca aos perfis criminais e nas suas capacidades preditivas, o que significa que esta técnica forense necessita de ser validada. Assim, este artigo analisa também os métodos de validação existentes, denotando alguns dos principais problemas e contribuindo com sugestões para estudos futuros sobre a validade dos perfis criminais.

Palavras-chave: perfis criminais, validade, revisão sistemática, técnica forense

Summarizing Criminal Profiling: Definition, Profilers and Approaches

Criminal Profiling (CP) is a form of behavioral analysis technique (Dean & Yule, 2017) that helps criminal investigations in the identification of certain criminal characteristics, such as patterns of behavior and personality, through the analysis of crime scenes (Douglas, Ressler, Burgess, & Hartman, 1986; Canter, 2000; Snook, Cullen, Bennell, Taylor, & Gendreau, 2008; Alison, Goodwill, Almond, van den Heuvel, & Winter, 2010; Canter, 2010; Chifflet, 2015). This forensic technique can be used to study the criminal acts of the most violent crimes (Soeiro, 2009) by enabling the creation of perpetrator's psychological profiles (Muller, 2000). These profiles are based on a crime scene analysis which evaluates details of the crime, the consequently victim of it and other evidence available (Goodwill, Allen, & Kolarevic, 2014). CP evaluates as well any other crimes presumed to be connected to the offender (Dean & Yule, 2017). To narrow down potential suspects (Douglas et al., 1986), it is also necessary to analyse the location of the crime, the type of weapon used (if applicable), victim's characteristics (Muller, 2000) and the motivation that led the individual to commit the crime (Kocsis, 2006; Soeiro, 2009; Chifflet, 2015).

This technique is used for atypical crimes, i.e. in whose perpetrators seem to have "bizarre" motivations usually considered out of the normative criminal standard (Fisher, 1993; Soeiro, 2009). Thus, CP is more likely to be used in sexual and homicide crimes (Copson, 1995; Canter, 2000), and arson (e.g. Kocsis, 2003; Strano, 2004). Still, there is some controversy around whether criminal profiling can be used for robbery crimes or not. Some studies support they can be used for these crimes as well (Kocsis, 2003; Strano, 2004) whereas others defend they have very common or minimal behaviors to be used in CP since it is aimed for crimes where behaviors are easily distinct (Dean & Yule, 2017). Therefore, in order to categorize an unknown perpetrator of a particular crime in a certain profile, it is necessary to make inferences regarding their characteristics (Canter, 2000; Fujita, et al, 2015) when it comes to the different variables mentioned earlier and compare to characteristics of known criminals (Soeiro, 2009). In conclusion, CP allows the user to find out who committed the violent crime, when and where it was committed, how it was done and what was the motivation behind it (Kocsis, 2006).

With criminal profiling basic concepts explained, rises the first question: is using criminal profiling enough for anyone to be considered a profiler? Or does it take more to be considered one?

Kocsis (2004) defines that a profiler is a person who is integrated in a profile construction for a particular investigation and calls him or herself a profiler, disregarding their experience. This definition, however, conflicts with what was defined by Hazelwood, Ressler, Depue, and Douglas (1995) (as cited in Canter, 2004): a profiler is someone who has considerable scientific investigative experience. These different definitions led Snook and colleagues (2007) to conduct a meta-analysis to attempt to clarify which type of profiler would be more appropriate – the self-titled one, defended by Kocsis, or the experienced one, defended by Hazelwood and colleagues. The conclusions from the meta-analysis demonstrated that, in general, self-titled profilers performed better than those who had extensive research experience. However, better performance does not equal to specialist performance, which, in a way, leads to a lack of consensus on the definition of a profiler (Snook, et al, 2007). Thus, a profiler may be a researcher, criminologist, psychologist, psychiatrist, police or other professional linked to the practice of criminal profiles (Montet, 2007).

Therefore, when elaborating criminal profiles, the profiler will have to take into consideration that there are two approaches that can be used and that can coexist in the same work: clinical orientation – based on the experience, knowledge, intuition and/or training to predict offender characteristics – and statistical orientation – based on the analysis of offenders with similar crimes as those who are being investigated, in order to predict future behaviors (see Snook, et al., 2007, Snook, et al., 2008). According to Soeiro (2009), there are four approaches to analyse criminal behavior: Evaluation and Diagnosis – clinical approach based on experience, training and intuition to predict offender characteristics (Holmes & Holmes, 1996; Turvey, 1999, as cited in Soeiro, 2009); Investigative Psychology – founded by David Canter (1995, 2004), it defends that through criminal actions of a large number of violent criminals, it is possible to propose theories and hypothesis that will allow the establishment of connections between criminals' actions and their characteristics; Crime Action Profiling – based on a multidimensional scaling model and on the disciplinary knowledge of forensic psychology (Kocsis, 2006); Crime Scene Analysis – grounded on the most relevant information for the operational needs of the criminal investigation police that has six

stages: Profiling Input, Decision Process Model, Crime Assessment, Criminal Profile, Investigation and Apprehension (see Douglas, et al, 1986).

When it comes to the profiles information analysis, there are two methods that can be used: inductive or deductive method (Garrido, 2007, as cited in Soeiro, 2009). These methods resulted from the work developed by the FIB which promoted a deductive methodology in the elaboration of CP. The inductive method, defended by Canter's Investigative Psychology (1995), besides being quicker than the deductive, explains that if certain crimes are similar but carried out by different perpetrators, then perpetrators might share common personality traits (Soeiro, 2009). However, this method is limited by considering a set of assumptions inherent to psychology and not considering the integration of knowledge from the various scientific areas that might contribute to the study. In the deductive method, on the other hand, is based on inferring conclusions from case data (Rice & Turnbull, 2015), where there is an exhaustive study of the crime scene and of the physical and psychological evidences, giving importance to victimology: the more the victim is known, the more reliable will be the knowledge about the crime (Holmes & Holmes, 1996).

Considering the limitations on scientific researches regarding this area and the increasing interest on criminal profiling, a question is drawn when considering the different issues and controversy: is criminal profiling a valid technique?

Issues Related with Validity on Criminal Profiling

Regarding criminal profiling applied to the police work, not many articles focus on CP's validity which allows understanding the impact of this technique in the process of criminal investigation on violent crimes. It is considered to be a flawed and reductive technique (Wilson, Lincoln and Kocsis, 1997) which does not contemplate empirical evidence neither on how it really works nor on its validity (Snook, et al, 2008; Chifflet, 2015). It is reinforced that CP should not be used until further experimentation and scientific support is proven (Snook, et al, 2008; Kocsis, 2013). Despite this, some studies mention that this forensic tool is slowly developing empirical evidence on its validity (Kocsis, 2013; Kocsis & Palermo, 2016), especially geographic profiling (Woodworth & Porter. 2001), and that overall police officers show satisfaction with CP (Kocsis, 2003).

Taking in consideration the validity concepts, most criminal profiling studies focus on its face validity. Face validity is defined as an assessment of experts' opinions, beliefs and thoughts on the apparent soundness of an instrument (Heale & Twycross, 2015; APA, 2018) which is not considered a form of validity by many validity theorists (APA, American Educational Research Association, & National Council on Measurement in Education, 1999). Thus, in an attempt to prove the validity of CP, some studies concerns depend on this belief (e.g. Kocsis & Hayes, 2004; Kocsis & Heller, 2004) and for instance many criminal profiling studies trust on whether profilers think if CP is a reliable, useful and valid tool that actually “works” (Eastwood, et al., 2006). However, some of the problems regarding this validity rely on profilers being reluctant to let their abilities be tested to experimental scrutiny (Kocsis, Irwin, Hayes, & Nunn, 2000) which leads to the majority of studies' sample be police officers (e.g. Snook, Haines, Taylor, & Bennell, 2007), college students (e.g. Kocsis & Heller, 2004) or other professionals (e.g. Torres, Boccaccini, & Miller, 2006). This will lead to a lack of empirical validity (APA, 2018), considering how the results obtained by questionnaires will depend on the type of questions formulated and the evaluation process (Eastwood, et al, 2006).

The validity in criminal profiling is related to whether it accurately can predict the characteristics of an unknown criminal (Montet, 2007). According to the American Psychological Association, validity depends on the “degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of conclusions drawn from some form of assessment.” (APA, 2018, Validity, ¶2) while other definitions describe validity related to how a study is accurately measured (Heale, & Twycross, 2015). Validity can also be explained as “the extent to which any measuring instrument measures what it is intended to measure” (Carmines & Zeller, 1979, p.17).

There are three main types to be considered in this article: content validity, construct validity and criterion validity. Content validity measures if the test really evaluates the variables they propose to assess (Garson, 2013; Heale & Twycross, 2015). If a tool has empirical and theoretical support (measuring what the theory say it does), it is said that it has construct validity (Jansson & Nordgaard, 2016). Construct validity is divided in two subtypes: convergent validity (also known as congruent validity) is

associated to the relationship between instruments that measure similar variables or concepts (Jansson & Nordgaard, 2016; APA, 2018) and discriminant validity (or divergent validity) which evaluates the relationship between instruments who measure different concepts or variables. Criterion validity assesses if a test or item is well correlated with an established standard of comparison (Garson, 2013; Jansson & Nordgaard, 2016; APA, 2018), being branched in predictive validity – verified when the criterion studied can only be assessed in the future, after the instrument was administered (Cronbach & Meehl, 1955; Garson, 2013; APA, 2018) – and concurrent validity – evaluated through the correlation between a tool and a criterion in the same period of time (Carmines, & Zeller, 1979; APA, 2018).

So far, few studies have been made in order to evaluate these validity types when considering criminal profiling. However, some of them have considered CP's predictive validity, even if most of them focus primarily on profilers' predictive ability (Eastwood, et al, 2006; Kocsis, 2013; Chifflet, 2015).

Another issue associated with the concept of validity is the often confusion with concept of accuracy. Accuracy is the exactness of an instrument, which means the lack of bias in a measure, usually associated with the proportion of correct responses. The more accurate an instrument is, the closer it is to the true scores (APA, 2018). Accuracy is sometimes used as a synonym for validity in criminal profiling (e.g. Kocsis, 2003), which is why it is important to underline the difference between these concepts, even if they can be related.

Method

Criteria for inclusion

For this systematic review was considered articles that focused on the validity of criminal profiles according to the following inclusion criteria: Articles whose publication was between 1995 and 2018, in order to allow a more recent study on the validity of this technique; literature reviews and empirical studies with qualitative or quantitative methods; and full text articles peer-reviewed published in English. Articles without these criteria and articles that didn't focus directly on CP's validity were excluded.

The articles were found by the following research equation: *Criminal Profiling AND Validity*. The reason for this research to consider just one equation is to narrow the investigation to articles that focus primary on CP's validity. The research was conducted during November of 2018 and articles were selected by reading the title and the respective abstract and/or introduction.

After applying the above mentioned criteria, a total of 72 articles were gathered (33 from SAGE, 18 from EBSCO, 1 from Scielo and 20 from ScienceDirect). Subsequently, the inclusion criteria mentioned above was applied and 42 articles were excluded due to several issues: they did not cover the theme (N = 31); repeated articles (N = 9); they were not empirical or literature reviews (N = 2). Thus, 30 articles were obtained. Of these 30 articles, after reading each one of them, 20 were excluded because they did not address validity in criminal profiles as one of the main focuses. Therefore, for this review, 17 articles are included: nine empirical studies and eight literature reviews (Appendix A). The results of the underlying research will be presented next.

Articles quality assessment

To evaluate if the 17 articles were adequate for this systematic review, a quality assessment was done. For this, two tables were created, one for the empirical studies (Table 1) and another for the literature review articles (Table 2). These articles were discussed between the two authors independently in order to evaluate their quality in the best and most objective way possible. For the empirical studies, the scores varied like this: 0 – Not reported; 1 – Reported, but not clear; 2 – Reported properly/Reported without instruments' psychometric characteristics; 3 – Reported with instruments' psychometric characteristics (only present in the Instrument variable). As for the literature review articles, the scores were: 0 – Not described; 1 – Described, but incomplete; 2 – Described properly. The articles' quality assessment was adapted from Higgins and Green (2011) which a high score means the article has good scientific quality, while a lower score presents distrust on the veracity of the article.

Table 1

Articles' Quality Assessment (Empirical Studies)

Authors (Year)	Data collection	Aim	Abstract	Inclusion/Exclusion Criteria	Sample	Instruments	Discussion/Conclusion	Limitations/Suggestions	Total (Articles quality)
Kocsis & Hayes (2004)	2	2	1	1	2	2	2	2	14 (Good)
Kocsis & Heller (2004)	2	2	1	1	2	2	2	2	14 (Good)
Kocsis & Middledorp (2004)	2	2	1	1	2	2	2	2	14 (Good)
Torres, Boccaccini, & Miller (2006)	2	1	2	1	1	3	2	2	15 (Very Good)
Snook, Eastwood, et al (2007)	2	2	2	2	2	3	2	2/1*	16/15* (Very Good)
Snook, Haines, et al (2007)	2	2	1	1	2	2	2	2	14 (Good)
Bennell,et al. (2013)	2	2	2	2	1	2	2	1	14 (Good)
Fujita, et al (2013)	2	2	2	2	1	2	2	2	15 (Very Good)
Fujita, et al (2015)	2	2	2	2	2	2	2	2	15 (Very Good)

Note. 0 – Not reported; 1 – Reported, but not clear; 2 – Reported properly/Reported without instruments' psychometric characteristics; 3 – Reported with instruments' psychometric characteristics

* Items scores differed between investigators.

Table 2

Articles' Quality Assessment (Literature Review Studies)

Authors (Year)	Data collection	Aim	Abstract	Inclusion/exclusion criteria	Discussion/Conclusion	Limitations/Suggestions	Total (Articles Quality)
Wilson, Lincoln, Kocsis (1997)	2/1*	2	1	1	1	0	7/6* (Sufficient)
Woodworth & Porter (2001)	2	1	2	2	0	2	10 (Good)
Kocsis (2003)	2	2	2	1/2*	2	2	11/10* (Very Good)
Eastwood, et al (2006)	2	2	2	2	1	0	9 (Good)
Snook, et al (2008)	2	2	2	2	2/1*	0	10/9* (Good)
Kocsis (2013)	2	1	1	1	2	0	7 (Sufficient)
Chifflet (2015)	2	2	2	1	1	1	8 (Sufficient)
Kocsis & Palermo (2016)	2	2	2	2	2	1	11 (Very Good)

Note. 0 – Not described; 1 – Described, but incomplete; 2 – Described properly

* Items scores differed between investigators.

For the Data Collection dimension, the suitability (acceptable methods used for sample collection) and the procedures used (e.g. participants recruitment; articles chosen) were analyzed. In all articles, data collection is found to be precise and suffice for each study, enabling to understand what the authors explored and how.

The Aim dimension is related to the study aim and hypothesis (if present) are evaluated in order to understand if they rely on previous studies. All empirical studies report clearly and correctly their aim, as well as most literature studies except for Woodworth and Porter (2001), Torres, Boccaccini and Miller (2006) and Kocsis (2013), whose articles' aim is briefly resumed comparing to all matters explored in the articles.

The Abstract contemplate if essential information (aim, methodology, results, conclusion and keywords) is correctly presented in the abstract. Considering first the empirical studies, Kocsis and Snook's studies (Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004; Snook, Haines, et al, 2007) show more incomplete abstract information comparing to the remaining studies when it comes to literature introduction (absent in Snook and colleagues study and poorly described in the remaining mentioned studies) and sample collection (Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004). As for the literature review studies, most studies describe the abstract clearly except for Wilson, Lincoln, Kocsis (1997) and Kocsis (2013), which lacks general conclusion.

For the Inclusion/Exclusion Criteria, it is assessed if inclusion and/or excluded criteria is defined regarding for example studies, aim, language, methodology, participants, variables, etc. Overall studies report inclusion and/or exclusion criteria, being more detailed in the studies from Woodworth and Porter (2001), Eastwood and colleagues (2006), Snook, Eastwood and authors (2007), Snook and remaining authors (2008), Bennell and collaborators (2013), Fujita and colleagues (2013, 2015) and Kocsis and Palermo (2016).

As for the Sample, only presented in the first table, it is analyzed if a complete description of the participants' socio-demographic characteristics exists. In general, a relevant description of the sample is fulfill, being less characterized in Torres, Boccaccini and Miller (2006), Bennell and collaborators (2013) and Fujita and colleagues (2013) studies.

In the Instruments dimension, also only considered for empirical studies, the scale was specially adapted to three points as mentioned earlier. Only one study has reported properly the instruments with psychometric characteristics (Snook, Eastwood,

et al, 2007). The remaining articles have a structured and clear description of the instruments/materials, but do not have their psychometric characteristics.

For the Discussion/Conclusion, it is assessed if there is an association between the results and the aim/hypothesis regarding the literature presented. On all empirical studies, this variable is clearly reported. When it comes to literature review articles, half studies have their discussion/conclusion properly described (Kocsis, 2003; Snook, et al, 2008; Kocsis, 2013; Kocsis & Palermo, 2016), whether the other half have incomplete information (Wilson, Lincoln, Kocsis, 1997; Eastwood, et al, 2006; Chifflet, 2015) or no discussion/conclusion at all (Woodworth & Porter, 2001).

Finally, Limitations/Suggestions evaluate the articles' limitations and their recommendations for future studies. For the empirical studies, except for Bennell and colleagues (2013) which do not present limitations for their study and suggested few recommendations, all of them properly report their articles limitations and suggestions. As for the literature review articles, only two of them (Woodworth & Porter, 2001; Kocsis, 2003) clearly describe their studies limitations/suggestions, two Chifflet (2015) and Kocsis and Palermo (2016) have only the suggestions or limitations respectively explored and the remaining studies do not mention any limitations or future suggestions (Wilson, Lincoln, Kocsis, 1997; Eastwood, et al, 2006; Snook, et al, 2008; Kocsis, 2013).

The total scoring for the empirical studies is 17 – considering that in the Instruments dimension the scores could go from 0 to 3 – while the literature review articles have a total of 12 points. Regarding this fact, for the empirical studies, the articles' quality was divided as the following way: Insufficient: <9 points; Sufficient: 9-11; Good: 12-14; Very Good: 15-17; for the literature review studies, scores were divided similarly: Insufficient: <6 points; Sufficient: 6-8; Good: 9-10; Very Good: 11-12.

To evaluate the agreement rate between authors, Cohen's Kappa was done. The concordance scale adapted from Landis and Koch (1977) is scored in six ways: ≤ 0 (no agreement); .01 – .20 (low to no agreement); .21 – .40 (low agreement); .41 – .60 (moderate agreement); .61 – .80 (moderate to high agreement); .81 – 1.00 (high agreement). In this study, Cohen's Kappa obtained was .92, which means there is a high agreement between the authors and so the articles evaluation can be performed.

The results of the underlying research will be presented next.

Results

The 17 articles considered for this systematic review were analysed and divided in two tables – one for empirical studies and another to literature reviews – to better explore the different contents on each (Table 1 and 2).

Study characteristics

Overall, the studies are distributed in Australia ($n=8$), America ($n=7$) and Asia ($n=2$). Regarding the nine empirical studies (see Table 1), five of them use quantitative and qualitative methods (e.g. questionnaires, surveys, interviews) while four use retrospective and statistical methods, being one of them a meta-analysis (Snook, Eastwood, Gendreau, Goggin, & Cullen, 2007). In the five quantitative and qualitative articles, two gather a police officer sample, another two college students and Torres, Boccaccini, & Miller's (2006) study works with forensic mental health professionals. In the other four studies – with retrospective and statistical methods –, three use homicide cases and one (Snook, et al, 2007) uses criminal profiling studies. The overall sample of the nine articles are 2408 participants with the biggest sample of 839 homicide cases (Fujita, et al, 2013) and the smallest with 51 police officers (Snook, et al, 2007).

Accuracy versus validity

Many articles compared validity to accuracy as a synonym. Overall Kocsis and collaborators articles (Kocsis, 2003; Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004; Kocsis, 2013; Kocsis & Palermo, 2016) refer to validity as being accuracy, which also happens in Woodworth and Porter (2001) and in Snook, Eastwood and authors (2007) studies, which use accuracy as another terminology to validity.

Criminal profiling types and models' validity

Regarding the CP existing models, Bennell and collaborators (2013) attempted to validate Keppel and Walter's Model (1999) for sexual murder/murderers, although they concluded it was not possible to validate. They also underlined that Holmes and Holmes (2002) motivation-based typology also lacks empirical support. On the other hand, Woodworth and Porter (2001) concluded that geographic profiling has validity evidence. Finally, considering two CP approaches, Wilson, Lincoln & Kocsis (1997) concluded that the Diagnostic Evaluations and the Crime Scene Analysis lack validity.

Tabel 3

Summary of the Empirical Articles

Year	Authors	Aim	Sample	Materials	Validity Type	Results/Conclusion	Future Studies/Limitations
2004	Kocsis & Hayes	Study if a bias related to the evaluation of CP by the police exists and if the perceived author identity influences it.	59 police officers with a mean age of 34.24 years (92% with experience in homicide or violent crime investigations)	A short homicide case and a short questionnaire with a seven point Likert scale.	Face Validity.	The validity of criminal profiling cannot be justified by police officers' assessments because they are unlikely to be a reliable measure of its accuracy. The biases related to the identity of a CP author are related to the belief on the validity of this tool.	In this article, validity is portrayed as a synonym of accuracy. It is suggested that future research focus on measuring the belief in CP.
2004	Kocsis & Heller	Examine if the bias on police officers' perception would replicate in a non-police sample and investigate the relationship between the degree of belief and perceptions on CP.	353 freshman college students (64% male; 36% female) with a mean age of 19.6 years.	Believe in Profiling Scale (five-item scale to measure the beliefs on CP).	Face Validity.	The use of profiles by police officers does not necessarily measure the validity of profiling. It is important to understand if the practice and validity of CP are based on objective scientific facts, regardless of the positive beliefs and perceptions of this technique.	Validity is depicted as a synonym of accuracy. Future studies suggested replicating the study with a police sample.
2004	Kocsis & Middeldorp	Replicate Kocsis and Heller's (2004) study to test the consistency of their findings, i.e., study the relationship between one's belief and CP's perceived accuracy, considering the types of information.	353 freshman college students (52% male; 48% female) with the mean age of 19.7 years old.	Believe in Profiling Scale.	Face Validity.	Evidence shortcoming is found when it is tried to justify the validity of CP through operational utilitarianism arguments of profilers' practices.	Accuracy and validity are synonyms in this article. For future studies, the replication the study with a police sample is suggested.
2006	Torres, Boccaccini, & Miller	Explore the perceptions of the CP's validity and utility among forensic psychologists and psychiatrists.	161 forensic mental health professionals.	15 online survey questions.	Face Validity.	Of 10% of the sample that had experience as profilers, less than 25% believe that the profiles are scientifically reliable or valid. Even though	The findings are insufficient to prove that CP evidence should be admitted to court; For future studies, the study recommends to examine different CP

2007	Snook, Eastwood, Gendreau, Goggin, & Cullen	With a narrative-review and a meta-analysis, this article aims to determine the scientific credibility of CP.	First study: 130 criminal profiling articles; Second study: four studies.	PsycINFO and Criminal Justice Abstracts; Statistical Approach.	Predictive Validity.	criminal profiling lack support, respondents consider them useful for law enforcement. The literature around criminal profiling is largely based on common sense justifications, which makes it difficult to substantiate validity. CP is likely to be hazardous with no sound evidence from profiler's predictive validity.	approaches. In this article, validity is portrayed as a synonym of accuracy; Confidence Intervals limited the conclusions; there is not an exhaustive literature research; the study mentions the importance to replicate the study; There are three limitations on this study: sample size; sample cannot be generalized to the Canadian context or to other countries; and the opinions from the participants may be different from those who did not participate. Future research should examine if possible explanations contribute to CP illusions and a replication of the study should be done.
2007	Snook, Haines, Taylor, & Bennell	Overview on CP, review of previous consumer satisfaction studies and study experience and perceptions of CP's utility and validity of Canadian police officers'.	51 police officers: 46 men and 5 women from Atlantic Canada ($M = 44.1$ years).	Structured interview with three sections: demographic data, belief-related statements and personal experience of CP questions.	Face validity.	Most police officers report a belief that profilers and CP are valuable to criminal investigations, although they admit CP might misdirect an investigation and should not be applied to all crimes nor used as evidence in the court.	For future studies it is suggested to examine other classification systems to determine if they could provide empirically approaches for serial sexual murderers profiling.
2013	Bennell, Bloomfield, Emeno, & Musolino	Attempt to validate Keppel and Walter's (1999) classification system for serial sexual murder/murderers.	53 male serial murders.	Proximity Scaling (PROXSCAL).	Predictive validity and face validity.	Keppel and Walter's Model isn't validated. Holmes and motivation-based typology also lacks empirical support.	It is suggested to apply the multivariate models to other crimes (e.g. arson), explore CP statistical models considering predictive and content validity and explore models for
2013	Fujita, Watanabe, Yokota, Kuraishi, Suzuki, Wachi, &	Examine the predictive validity of homicides' CP using a scientific statistical approach.	839 homicide cases from 2004 to 2009 (591 committed by a single offender and 248 by	Murder Analysis Database (MAD); Receiver Operating	Predictive validity.	Multivariate logistic regression models have moderate and sufficient accuracy, as well as predictive validity, although the validity of the models could be improved if the moderators of	

	Otsuka		multiple).		Characteristics Analysis.		situational factors or interaction variables were included.	deducing a broader range of offenders' characteristics that could be important during police interviews.
2015	Fujita, Watanabe, Yokota, Suzuki, Wachi, Otsuka, Kuraishi	Study the validity of a multivariate prediction model that deduces homicide classifications by three dichotomous variables.	539	single	Murder Analysis Database (MAD).	Predictive Validity.	The approach is found to have medium accuracy and the homology hypothesis are supported; The multivariate approach using crime scene information is more valid than only predictions on the existence of robbery in the crime scene.	It is needed research to examine the validity of models that predict different offender classifications (e.g. related to criminal record); it is suggested that the multivariate approach usefulness should be tested in police investigations and that the multivariate prediction models should be applied to homicides in other countries.

Tabel 4

Summary of the Literature Review Articles

Year	Authors	Aim	Validity Type	Results/Conclusion	Future Studies/Limitations
1997	Wilson, Lincoln, Kocsis	Review CP development aspects and what conclusions can be drawn regarding validity, utility and ethics on criminal profiling.	Face Validity.	Diagnostic Evaluations and Crime Scene Analysis lack validity. Many critiques are also made regarding the validity and utility of CP, since it is considered limited, reductive and somehow incorrect, leading to some stereotypes and wrongful arrests. It is likewise considered a flawed tool since it relies on convicted offenders rather than those never caught. Nonetheless, it is considered a promising investigative technique.	Not mentioned.
2001	Woodworth & Porter	Review on the crime scene profiling and offender profiling and description of the development of CP approaches in the Canadian context.	Construct and face validity.	There is no systematic evidence to validate the classifications proposed in CP, like for the FBI's organized-disorganized dichotomy. However, geographic profiling underlying criminal geographic targeting (CGT) has validity evidence. On the other hand, the Violent Crime Linkage Analysis System (ViCLAS) program should have examined its efficacy.	Validity is represented as a synonym of accuracy. It is suggested to focus on areas that might not have been considered as important for criminal investigations and to consider the information of surviving victims of violence in order to allow the validation of CP classifications. It is also referred that experts' personal opinion should have empirical basis. To increase CP's reliability and validity, a combination of the FBI's profiling method and the investigative psychologists' empirical and inductive method could suffice (ex. geographic profiling).
2003	Kocsis	Review the empirically conclusions of accuracy studies and the skill of various groups regarding CP.	Face validity	Many studies show police officer's satisfaction with CP on investigations. Support is found about profilers producing a more accurate prediction of an unknown offender compared to other groups. Therefore, CP is slowly developing empirical evidence to support its validity.	Validity is represented as a synonym of accuracy. The findings on this article are only important to the accuracy, not utility. It is recommended to use different approaches to study CP in order to evade methodological limitations (to go beyond multiple-choice questionnaires).
2006	Eastwood, Cullen,	Critique review on CP's validity through the "user satisfaction"	Profiler's Predictive	Although police officers think CP is a useful investigative tool, there is no empirical evidence to	Not mentioned.

	Kavanagh, Snook	and the predictive validity of profiler's predictions.	Validity and Face validity.	support the validity of profilers' predictive abilities because studies on predictive validity regarding this matter have many methodological concerns. Face validity relies on how questions are made and what are the available options.	
2008	Snook, Cullen, Bennell, Taylor, & Gendreau	Review CP techniques, the frequency with which it is used and to what extent police officers and mental health professionals perceive CP as a valuable tool.	Face Validity.	Positive beliefs about the validity and reliability of CP are not supported by empirical evidence. Thus, studies rely on beliefs as a validation technique. Therefore, CP should not be used as an investigative tool until scientific support is proven.	Not mentioned.
2013	Kocsis	Examine empirical experiments and analyses aimed at assessing CP's accuracy.	Profilers' Predictive "accuracy"	Although some evidence demonstrates accuracy in criminal profiling, this is still a technique that looks for further development and experimentation.	In this article, accuracy and validity are depicted as a synonym.
2015	Chifflet	Examine the evidence of criminal profiling validity.	"Predictive accuracy" and face validity.	There is not enough empirical evidence to confirm that CP really works. The lack of validation is due, in part, to difficulties associated with the design of appropriate test models, as well as the reluctance of profilers to get involved in the processes.	It underlined the importance for an objective validation of CP in its different forms.
2016	Kocsis & Palermo	Analyze the research which tests CP's validity and the existing legal principles that considers its admissibility.	Face validity.	Although exists scientifically grounded research to support the validity of criminal profiling, many studies have occurred at a tardy rate, making it necessary to develop more studies around this matter, while caution should be taken when using CP.	Validity is depicted as a synonym of accuracy. One of the validities limitations gathers around the inability of CP to provide some indication of the likely error rates inherent to the analysis.

Types of validity

Regarding the validity types explored in these articles, 15 articles focus on face validity (Wilson, Lincoln, Kocsis, 1997; Woodworth & Porter, 2001; Kocsis, 2003; Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004; Eastwood, Cullen, Kavanagh, & Snook, 2006; Torres, Boccaccini, & Miller, 2006; Snook, Haines, Taylor, & Bennell, 2007; Snook, et al, 2006; Bennell, Bloomfield, Emeno, & Musolino, 2013; Chifflet, 2015; Fujita, et al, 2013; Fujita, et al, 2015; Kocsis & Palermo), five demonstrate predictive validity (Eastwood, Cullen, Kavanagh, & Snook, 2006; Snook, Eastwood, et al, 2007; Bennell, Bloomfield, Emeno, & Musolino, 2013; Kocsis, 2013; Chifflet, 2015) and only one describes construct validity (Woodworth & Porter, 2001). It is important to denote that some articles refer to more than one type of validity (Woodworth & Porter, 2001; Eastwood, Cullen, Kavanagh, Snook, 2006; Bennell, Bloomfield, Emeno, & Musolino, 2013; Chifflet, 2015).

Professional perceptions and beliefs (face validity)

Kocsis and colleagues studies (Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004) reveal that relying on the beliefs and perceptions of police officers on CP might create biases and cause a lack of validity of this technique, particularly if people already have a formed opinion about criminal profiling, based on experience or in positive/negative influences. Consequently, these studies show that an individual's beliefs on CP will influence their perceptions on its validity and therefore, the validity of criminal profiling (or lack of it) can be justified by this belief-perception relationship of an individual. Also with a sample of police officers, Snook, Haines, Taylor, and Bennell (2007) results show that most of them believed CP is a valid investigative tool, even if it has limitations. Torres and colleagues (2006) conclude that forensic mental health professionals didn't have much experience with criminal profiling and less than a quarter of these didn't believe it is a valid tool.

Predictive validity

Profiler's predictive ability

Some investigations focused on the profiler's predictive ability to study CP's validity. Snook, Eastwood and collaborators (2007) conclude that there is no sound evidence from profiler's predictive validity and therefore using CP could be hazardous.

With the same conclusion, Eastwood and authors (2006) also underline the lack of empirical evidence and methodological concerns regarding profiler's predictive ability. On contrary, Kocsis (2003) defends that support is found when it comes to profilers accurately predict unknown offenders better than other groups.

Criminal profiling for homicide offenders' predictive validity

The two articles from Fujita and authors permitted to evaluate the CP for homicide offenders when it comes to its predictive validity using multivariate regression models. The first study concludes that CP has moderate accuracy as well as predictive validity, although the validity could be improved (Fujita, et al, 2012), whereas the second investigation's results shows that crime scene information allows the multivariate approach to become more valid (Fujita, et al, 2015).

Overall considerations

Considering overall results, many critiques are made regarding the validity of CP. Wilson, Lincoln and Kocsis (1997) consider it to be limited, reductive and somehow incorrect, being a flawed tool since it relies on convicted offenders rather than those never caught. Snook and colleagues (2008) and Chifflet (2015) also corroborate by defending that there is still lack of empirical evidence on how CP works and its validity. Considering the lack of validation for this tool, Chifflet (2015) explains by underlying the difficulties associated with the design of appropriate test models and profilers' hesitancy to get involved in the processes. On the other hand, overall Kocsis studies conclude that CP is slowly developing empirical evidence supporting its validity (Kocsis, 2003; Kocsis, 2013; Kocsis & Palermo, 2016).

Overview on research development

Some articles proposed suggestions for future studies regarding the validity on criminal profiling. Woodworth and Porter (2001) suggest focusing on areas that might not have been considered important for criminal investigations, as well as information from surviving victims of violence. To increase CP's reliability and validity, the authors suggest a combination of the FBI's profiling method and the investigative psychologists' empirical and inductive method like geographic profiling. Kocsis (2003) and Torres, Boccaccini and Miller (2006) underline the importance of using different approaches to study CP in order to evade methodological limitations, while Bennell and

colleagues (2013) recommend to examine other classification systems on serial sexual murderers profiling to determine if they could provide empirically approaches. Fujita and authors studies (2013, 2015) proposed some recommendations: apply the multivariate models to other crimes; test predictive and content validity on the criminal profiling statistical models; explore models for deducing a broader range of offenders' characteristics; examine the validity of models that predict different offender classifications; test the multivariate approach in police investigations and be applied on homicides from other countries. At last, Chifflet (2015) emphasize the importance of an objective validation of criminal profiling in its different forms.

Discussion

Overall, the present article findings do not diverge from the majority studies' conclusions: criminal profiling is still not a valid forensic tool (Wilson, Lincoln & Kocsis, 1997; Eastwood, et al, 2006; Snook, et al, 2007; Snook, et al, 2008; Bennell, et al, 2013; Chifflet, 2015). Nonetheless, this study demonstrates why this happens. Before going into a further explanation, it should be mentioned that unfortunately most articles focused on validity as an overall concept without specifying the type of validity they were studying nor defining it. Thus, an already upfront limitation on this systematic review is the fact that some articles' validity type focus are mentioned in their article, whereas others were inferred by reading the full article, which can cause disparity in the general results. Nonetheless, for those which validity type are found indirectly expressed, it was used the definitions given before, increasing the accuracy of the selection. Underlying this fact, the remaining conclusions will be presented next.

An interesting finding in this systematic review relies on the confusion between accuracy and validity, leading some authors to associate these two different concepts as identical (Woodworth, Porter, 2001; Kocsis, 2003; Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middeldorp, 2004; Eastwood, et al, 2006; Snook, Eastwood, et al, 2007; Kocsis & Palermo, 2016)). Indeed, they have similar definitions which can lead to misunderstanding. However, while accuracy measures the exactness of an instrument (lack of errors), validity evaluates the underlying aim for what the instrument was created for, measuring if it does assesses what it is proposed to. Nonetheless, it should be mentioned that both are important for criminal profiling to grow as a scientific investigative tool, despite this article focusing solely on its validity.

It is important for future studies on criminal profiling psychometrics to clarify what are they assessing (e.g. validity), resorting to existing consensual and empirical definitions.

Even though these articles focus on criminal profiling validity, most of them neglect the most important part: validation methods. Face validity is the prominent consideration on most articles (Wilson, Lincoln, & Kocsis, 1997; Kocsis, 2003; Kocsis & Hayes, 2004; Kocsis & Heller, 2004; Kocsis & Middledorp, 2004; Eastwood, et al, 2006; Torres, et al, 2006; Snook, Haines, Taylor, & Bennell, 2007; Snook, et al, 2008; Kocsis & Palermo, 2016), even though it is not considered a scientific form of validity like mentioned before (see APA, American Educational Research Association, & National Council on Measurement in Education, 1999). Studies might be relying on face validity because they are not aware it is not a form of validity or, lacking other known validation methods, they attempt to prove its validity by the major opinions and perspectives of overall individuals. Predictive validity is the second type of validity most found expressed on CP studies. However, with the exception of Fujita and collaborators' studies, most articles focus on profiler's predictive accuracy more than criminal profiling predictive validity, which becomes impracticable considering the confusion on who can be a profiler, as discussed beforehand (e.g. Kocsis, 2004). It is suggested to analyse if criminal profiling as a forensic technique can, indeed, predict criminal's characteristics correctly and not if the person who is using it can.

The closer criminal profiling gets to statistical validation, rather than just face validity, the better for it to rise as an empirical tool that actually helps criminal investigations. Even though it might not be possible to test all validity types on CP, some suggestions will be presented: Content validity, might be evaluated through self and hetero evaluation (Soeiro, 2005), exploratory factor analysis and other multivariate statistical procedures (APA, 2018). To the criminal profiling context, gathering items that evaluate all characteristics related to the variables connected to this technique might be possible to test by using one of the statistical procedures mentioned; Convergent validity can be evaluated through Cronbach's alpha or through a simple factor structure (Garson, 2013) between CP and another psychological tool that measures similar concepts; Discriminant validity, on the other hand, can be assessed through correlational methods, simple factor structure and average variance extracted (AVE) method (Garson, 2013), using criminal profiling and another instrument that evaluate different concepts; CP's predictive validity might be evaluated through a ROC analysis (see Fujita, et al,

2013); Concurrent validity could be evaluated by comparing criminal records with other assessments (e.g. questionnaires or interviews) (Jolliffe, et al, 2003) or, in this case, with criminal profiles.

Although a validation method still needs to arise in order to validate CP, one should not forget that a small yet strong contribute on this technique's predictive validity has been rising with Fujita and authors studies for murder profiling (2013, 2015). For overall criminal profiling to be validated though, it is recommended the creation of a checklist with items portraying the different dimensions it, adapted to the different crimes (e.g. homicide, sexual crimes and arson) and relying on theories and concepts that support CP. This way, it should be easier to assess the different types of validity and contribute to a more rigorous methodology of criminal profiling.

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2nd Article

New Approach on Criminal Profiling: Testing a Valid Methodology with a Sample of
Rural Arsonists

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Abstract

Arson is one of the crimes that have more diversified impacts due to its damages on mostly community and environment, leading recurrently to destruction or even death (Stanley, 2013), especially when it is rural arson. Even so, it is often found to be disregarded as a crime (DeLisi, 2001), mostly when it comes to prevention and intervention. Although there are already many studies that focus on arson and arsonists' motivations and characteristics, it is clear that the conclusions will largely differ depending on each study, which does not help to follow a consensual study line to create a solid typology that characterizes this type of crime. Thus, the lack of studies and typologies on rural arson and the complexity of the crime itself will present a starting point to this study. Subsequently, to contribute for the study of criminal profiling as a valid technique, bearing in mind the results of the systematic review, it is proposed a new methodology for criminal profiling technique considering 309 rural arsonists and using two different statistical approaches: Multiple Correspondence Analysis and Latent Class Analysis. Results showed the existence of three rural arson typologies: Expressive Motivation – Psychiatric/Alcohol Problem, Expressive Motivation – Socially Inept and Instrumental Motivation – Socially Integrated. The creation of this criminal profiling not only allowed the better understanding of the rural arson phenomenon, but also allows future studies getting closer to statistical validity with this new criminal profiling methodology.

Keywords: arson, rural arson, criminal profiling, validity

Resumo

O crime de fogo posto é um dos crimes com mais impactos ao nível de danos na comunidade e no ambiente, que levam frequentemente à destruição ou em alguns casos até à morte (Stanley, 2013), especialmente quando se trata de um incêndio rural. Contudo, é muitas vezes negligenciado enquanto crime (DeLisi, 2001), principalmente no que toca à prevenção e intervenção. Embora já existam muitos estudos focados nas motivações e características do incêndio e dos incendiários, as conclusões retiradas variam bastante consoante o estudo, o que não facilita o seguimento de uma linha orientadora consensual que permita a criação de tipologias consistentes que caracterizem este tipo de crime. Assim, a falta de estudos e tipologias sobre os incêndios rurais, juntamente com a complexidade do próprio crime, serão um ponto de partida para este estudo. Posteriormente, de modo a contribuir para os estudos dos perfis, considerando os resultados da revisão sistemática, propõe-se uma nova metodologia dos perfis criminais neste crime através da análise de 309 incendiários rurais. Os resultados demonstraram a existência de três tipologias de incêndio rural: Motivação Expressiva – Problemas Psiquiátricos/Consumo de Álcool, Motivação Expressiva – Socialmente Não Integrados e Motivação Instrumental – Socialmente Integrados. A criação destes perfis criminais não só permite uma melhor compreensão do fenómeno incêndiarismo rural em Portugal, mas permite também que estudos futuros se aproximem da validade estatística com a nova metodologia de perfis.

Palavras-chave: incêndio, incêndio rural, perfis criminais, validade

Arson: Definitions and Terminologies

Although being a legal term – which leads to the fact there might be different jurisdiction definitions (Gannon & Pina, 2010) –, the Department of Justice (1980) began to describe arson as “the willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property or another, etc.” (Department of Justice, 1980, as cited in Davis & Lauber, 1999). Thus, this is a crime that can be responsible for deaths and injuries and financial damage to property owners and governments [2]. (Mojtahedi, Prince, & Ryan, 2017). Summarizing, arson is a crime that was set intentionally, for an unlawful purpose that resulted in the damage of property or personal belongings (Fritzson, 2015). Douglas and colleagues defined an arsonist as being a person arrested, accused or convicted for firesetting (Douglas, Burgess, Burgess, & Ressler, 1992) A similar term to arson that can also be found is deliberate firesetting, which definition doesn’t differ significantly from arson’s (Davis & Lauber, 1999; Fritzson, 2015).

Some confusion between the concept of arson and firesetting rises up, which makes it relevant to distinguish these two terminologies. Firesetting, unlike arson, is a broader and more general term, not requiring the intent of setting the fire, which means it also includes firesetting by accident/negligence (Davis & Lauber, 1999) or which didn’t result in a criminal conviction (Fritzson, 2015). Firesetting, comparing to other areas of forensic psychology, still hasn’t received much attention (Gannon & Pina, 2010).

As a crime, many studies have shown that arson is a crime with great prevalence and prejudices, being often disregarded (DeLisi, 2001). In England and Wales it is estimated an increase of 4.5% arson offences in half a century, with the highest prevalence between 1980 and 1981 ($n=5,584$) (Soothill, Ackerley, & Francis, 2004). In 2013, only 12% of the 19.306 arson offenses resulted in police detention (Smith et al., 2013, as cited in Barrowcliffe & Gannon, 2015) and almost 8% ($n=1,503$) proceeded against in court, being mostly male offenders ($n=1,187$) (Justice Statistics Analytical Services, 2015, as cited in Barrowcliffe & Gannon, 2015). Netherlands reported that from 19,700 fires in 2012, 67.4% was due to arson (CBS Statistics Netherlands, 2013, as cited in Wilpert, van Horn, & Eisenberg, 2017). In United States, around 282,600 deliberate fires were reported between 2007 and 2011 (Campbell, 2014). In France, the number of arsons duplicated between 1975 and 1985, while during the last 20 years, the

numbers of arson in Germany have quadrupled. In Switzerland varies around 1,265 cases every year (Lamon & Haas, 2003). Lastly, Portugal registered a decrease of 44% fires set and also a decrease of 68% of burned area in the last decade. It was also registered that 2018 has a decrease of 36.8% comparing to 2017, even if there is a total number of 12,208 fire occurrences and around 41,309 hectares area burned (Sistema de Segurança Interna, 2018). These fires have many different negative impacts to the community, such as financial loss, damage to roads and other infrastructures, injuries and deaths and environmental destruction (Stanley, 2013).

Arsonists' Characteristics

Offenders who commit arson are found to have heterogeneous characteristics between themselves. These characteristics will most likely vary depending on each typology they belong to and on the study they are from. The reason this happens is explained by most studies supporting different methodological and conceptual characteristics related to the type of investigation developed, which will lead to different arsonist characteristics.

Lamon and Haas (2003) point out that around 10% of the arsonists are women, while Bourget and Bradford (1989) defend that women are between 10 to 18% of the overall firesetters sample, which show that the firesetting behavior is more preponderant in male offenders. Inciardi revealed that most firesetters were single men with a mean age of 27 years-old, Caucasian, with a normal IQ, who usually had alcohol problems and did not have specialized jobs (Inciardi, 1970). However, Vaughn and authors (2010) explain that most arsonists are men under 65 years-old, might have an alcohol or drugs abuse and are also found to most likely have an antisocial or obsessive-compulsive disorder (Vaughn, et al, 2010). Anwar, Långström, Grann, and Fazel (2009), on the other hand, refer that most arsonist are young unmarried males that are poorly educated and have history of psychiatric hospitalization (Anwar, Långström, Grann, & Fazel, 2009). Another study also supported that arsonists have high probability to have a history of psychiatric treatment and alcohol abuse (Labree, Nijman, vanMarle, & Rassin, 2010). For the Portuguese context, Soeiro, Branco and Carvalho (2008) reveal that most arsonists are unmarried men with poor education and unspecialized jobs, who have high probability of alcohol consume when committing the crimes. Most of these arsonists are found to have history of mental problems and not have criminal history until the first firesetting (Soeiro, Branco, & Carvalho, 2008). As for women firesetters,

some studies found that most of them are single or in an abusive relationship, unemployed (Stewart, 1993), with low education (Harmon, Rosner & Wiederlight, 1985; Wachi, et al, 2007) and socially and affectively outcasts (Bourget & Bradford, 1989). They most likely have mental disorders (e.g. depression) or substance abuse problems and mostly set fire as a result of revenge or attention seeking (Bourge & Bradford, 1989). Nevertheless, women arsonists' recidivism is found to be low (Stewart, 1993).

Even if there are general characteristics of arsonists, there is still no developed system that will adequately represent the scope and depth of their characteristics and behaviour (Doley, 2003).

Arsonists' Typologies

When it comes to the criminal profiling of arson, no consensus or clarity in the definitions of the different arsonists seem to be found (Doley, 2003). Some studies are based on the FBI organized/disorganized typology (e.g. Kocsis, Irwin, & Hayes, 1998), while most are based on arsonists' motivation and characteristics (eg. Canter & Fritzon, 1998; Walsh & Lambie, 2013). The following paragraphs will focus on the different arsonists types found in several studies and after it will be presented a table summarizing some studies' typologies. But before covering the motivation arson typologies, it is found to be imperative to enlighten what it is motivation.

Motivation is a complex construct studied for over a century and consequently has multiple definitions (see Kleinginna & Kleinginna, 1981). It can be intrinsic or extrinsic. When someone has the motivation to do something for their own sake and resolve that will most likely end up in pleasure, it is referred as intrinsic motivation. On the other hand, if there is an imposed constraint (usually social-environmental factors) that leads the person to have to perform something in order to achieve an external goal, the motivation is called extrinsic (Hennessey, Moran, Altringer, & Amabile, 2015). When it comes to arsonists, if the fire is set by an arsonist with an intrinsic motivation, setting the fire is usually the main goal and no other. It is usually linked to people with severe pathologies. Otherwise, the arson that works as a way to achieve another goal is resulted from an extrinsic motivation. Other goals that might be associated are frequently crime concealment or profit (material gain) (Rider, 1984, as cited in Lamon & Haas, 2003).

Considering the arsonists motivation typologies, these are found to be highly confusing since seemingly each author classifies arsonists according to their study. For example, Lewis and Yarnell (1951), as cited in Kelm (2016), began to define four main motives: pyromania (fireman-buff, hero-self, vagrant, and other – wanted to see a fire, mentally retarded, group, wanted to see fire engines, sexual satisfaction, and irresistible impulse), psychotic, revenge/jealousy, and burglary. Other authors began to increase the motives associated with arson, like for example Inciardi (1970) with six motives – revenge, excitement, institutionalized, “insurance claim”, vandalism and to cover up another crime – or MacDonald (1977) with nine motives (revenge/jealousy, financial gain, intimidation/extortion, social protest, attention seeking, crime concealment, vandalism or accidental, arson to facilitate other crimes and suicide by fire). Lamon and Haas (2003) defined only two categories that justify why someone might set fires: acts of reason (mostly motivated by vengeance, attention seeking and crime concealment) and acts of madness (due to personality disorders, overall mental problems or alcoholism). Regarding instrumental and expressive motivation, Canter and Fritzon (1998) defined four categories: instrumental person, instrumental object, expressive person and expressive object. More recently, Douglas and authors (2013) suggested six motivations – vandalism, excitement, revenge, crime concealment, profit and extremism.

Regarding juvenile arsonists, Walsh and Lambie (2011) defined four motives: anger, experimentation, peer pressure, and boredom, while Del Bove and Mackay (2011) came up with three risk categories: conventional limited (juvenile arsonists which had lowest risk factors and least severe firesetting episodes), home-instability-moderate (youngest arsonists with fire interest and with at least a story of three firesetting behaviors, with a problematic family environment) and multi-risk-persistent (with a high interest on fire, this type has an extensive history of firesetting, with lack of remorse in most cases, motivated by mostly antisocial reasons, having significant clinical difficulties with attention, externalizing behaviors and social skills).

On another typology line, Harris and Rice (1996) proposed four categories for psychiatric male arsonist: psychotics, unassertive, multi-firesetters and criminals. Kocsis, Irwin and Hayes (1998), along with Douglas and collaborators (2013) followed the organized/disorganized typology and suggested two typologies for arsonists: organized arsonist and disorganized arsonist. Additionally, Douglas and colleagues also

defined serial arsonists, spree arsonist and mass arsonists. It is important to underline that these were some of the studies regarding arson motivation typologies and, therefore, not all studies are represented here. The next table will enlighten the studies that explained arsonists' classification and consequent limitations (Table 5).

After a brief explanation of arson's definitions and criminal profiling typologies, the next section will be focused solely on rural arson, its definitions and characteristics and the typologies associated.

Rural Arson: Definitions, Framework and Criminal Profiling

One of the arson branches, deliberate bushfires or rural arsons are another understudied crime that is a current preoccupation with little consideration (Doley, Dickens, & Gannon, 2015). Rural arson – terminology used for this study – happens when the fire set extends over rural field, affecting vegetation that was not meant to be burned (Vélez, 2003). In the Portuguese jurisdiction, a rural arsonist is “anyone who causes a fire on an area occupied by forests, including woods or pasture, bushes and/or spontaneous plant formations or on agricultural lands, whether their own or others” (“Código Penal”, 2017).

According to Doley, Dickens, and Gannon (2015), 50% of the fires set in forests/rural areas are deliberate. On another hand, Willis (2005) states that deliberate bushfires are difficult to determine but might range from 20 to 90%, being 25 to 50% most likely to be right. In Australia, over 60.000 bushfires are registered every year, with almost half being deliberately lit (Stanley, 2013). It is not always possible to determine the right cause of rural fires – it can be a natural cause, an accident or deliberate firesetting. However, considering the percentage of deliberate forest fires mentioned by Willis (2005) and Doley and collaborators (2015), the number of arrested arsonist is still low. From 11,928 forest fires in Spain in 2015, only 429 authors could be identified (González, Muñoz, Cacerrada, & Sotoca, 2017). Considering the 1,296 cases of rural fires occurrences in Portugal in 2018, only 44 offenders were arrested (*GPAA-PJ*, 2018).

When it comes to RA criminal profiling, establishing a criminal profiling is not an easy task. According to Gomes, rural arsonists have very similar characteristics to the population they are inserted – especially when it is rural population – which makes

it difficult to establish a profiling (Gomes, 2012). Nonetheless, three studies – from Australia, Spain and Portugal – have attempted to come up with a rural arson profiling.

Australian Typology

The Australian profiling has five typologies related to motivation: excitement, attention seeking, gain, no apparent motivation and mixed motives. Excitement is the motivation for those offenders that set fires to create excitement or relief boredom and can be usually associated with vandalism, stimulation and/or activity (e.g. firefighters). Fires lit for Attention Seeking strive for recognition and attention. They are usually connected with the need of pleading and heroism. Gain is typically a motivation for arsonists to set fire for a specific purpose that might involve pragmatism or material gain (like land clearing) and altruism (when the fire is lit because the arsonist believes it will benefit others). The apparent lack of motivation is found when there the arsonist has psychiatric disorders or is a child. Mixed motives, on the other hand, implicates at least two of the motives from before. This also might count incidental firesetting (e.g. setting fire to a farm and spreading accidentally to the bushes) (Willis, 2005)

Portuguese Typology

On the other hand, the Portuguese CP follows Canter's and Fritzon's motivational typology, considering three main typologies: instrumental/retaliation, instrumental/profit and expressive/clinical history.

The Instrumental/Retaliation ("A" Profiling) involve arsonists older than 46 years-old who usually report hostility against the owner, anger and/or revenge, which means that this offender has a close relationship with the victim. They are usually married and have completed the elemental school. These arsonists can report a diagnostic of epilepsy and alcoholism and a criminal history of aggression problems and disciplinary processes. They set fire to forests or uncultivated grounds using matches, lighters or candles and the crime is done usually near their neighborhood, between 12 and 4pm, leaving the place after setting up the arson (Soeiro, Branco, & Carvalho, 2008).

Table 5
Arson Typologies, Limitations and Futures Studies

Author(s) (Year)	Typology	Classification	Limitations / Future Studies
Inciardi (1970)	Revenge	Portraying 58% of the sample, arsonists with a revenge motivation are people who want to avenge the victim by burning the victims' properties.	It is not a recent article and the sample is constituted only by men. It is suggested to study the relationships with victims of revenge-motivated fire crimes to better understand the arsonists, as well as give relevance to alcoholism when it comes to intervention.
	Excitement	The second most frequent motivation, it is defined as the one that sets fire by the feeling of excitation from the outcome (whether the action of putting fire, seeing it, watching the fire-fighters extinguish the fire away or even helping in that operation).	
	Institutionalized	Arsonists with some type of mental disorder.	
	"Insurance claim"	Those who set fire to their property for monetary reasons.	
	Vandalism	Firesetters who intentionally burn property for fun. There is usually at least one accomplice.	
	To cover up another crime	Arsonists who set fire to the place where they committed another crime to hide the evidence, being the most frequent crime robbery.	
	Psychotics	Usually schizophrenic or have alcohol abuse, these arsonists have a low history of aggressive or criminal behaviour and set arson due to delusions.	
Harris & Rice (1996)	Unassertive	The motive for the arson is usually revenge or anger. The unassertive arsonists have low recidivism and history of aggressive and criminal behaviour.	The sample has only men from a high-security psychiatric institution. The attempt of developing a arson typology did not work (there was a large cluster of small fires and small cluster of severe fires), reason why the characteristics of the arsonists were not present.
	Multi-Firesetters	These arsonists have history of child abuse, high levels of aggression and low levels of intelligence, setting fires due to anger, revenge, excitement or attention seeking.	
	Criminals	Like its name, criminal arsonists have criminal history, history of child abuse (with abusive parents) and aggressive behaviour. There is high likelihood of personality disorder and recidivism. The victim is usually unknown.	
Kocsis , Irwin, & Hayes (1998)	Organized	Organized arsonists are found to use accelerators, to bring the materials to the crime scene, to use	The sample of this study has 53 cases of organized and 18 disorganized, which not only

Canter & Fritzon (1998)	Disorganized	<p>sophisticated methods to perpetrate the crime, have an easy entry into the local and leave no evidence left, or leave it on purpose (signature). On the other hand, disorganized arsonists do not use accelerator, they use materials that are found in the crime scene, they force the entry into the local and leave evidence.</p>	<p>is not a large sample, but it is also heterogeneous, although providing support to the organized / disorganized dichotomy.</p>
	Instrumental Person	<p>The fire is set motivated by revenge. There should be a pattern of threats and quarrels between the offender and victim, as well as premeditation of the crime and specific targets associated.</p>	
	Instrumental Object	<p>There is no apparent motivation behind the crime. It is usually perpetrated by juvenile offenders and it is frequently associated with theft of property.</p>	
	Expressive Person	<p>The arsonist in this category sets fire to seek attention. The presence of suicide letters and the self-perception of being the victims are common with this arsonist.</p>	
	Expressive Object	<p>The motivation underneath the fire in this category is associated with emotional relief. These arsonists may have multiple offenses perpetrated in hospitals, enterprises or public buildings. They usually remain at the crime scene.</p>	
Lamon & Haas (2003)	Acts of Reason	<p>The arson has a pseudo-rational logic of soothing an emotion or a malicious forecast. It is typically linked to vengeance (against a acquaintance, worker or family member of the arsonist) (Lewis & Yarnell, 1951, as cited in Lamon & Haas, 2003), attention seeking (mostly among teenagers) (Laxenaire, 1995, as cited in Lamon & Haas, 2003), crime concealment (Geller, 1992) or vandalism.</p>	<p>This typology is based mostly on studies that are over two decades, which might bias the conclusions considering nowadays context.</p>
	Acts of Madness	<p>Arsonists in this category have a psychiatric pathology that are correlated to personality disorders (Laxenaire, 1995, as cited in Lamon & Haas, 2003), psychotic disorders (e.g. schizophrenia) (Lewis & Yarnell, 1951, as cited in Lamon & Haas, 2003), alcoholism (Kammerer, Singer, & Michel, 1967, as cited in Lamon & Haas,</p>	

			2003), epilepsy, dementia and other mental disorders.	
Douglas, Burgess, and Ressler (2013)	Burgess	Organized arsonist	Complex incendiary devices, methodical approach to setting fires and little physical evidence). Usually associated with a profit motivation.	
		Disorganized arsonist	Use of materials found at the scene of crime, simple ignition devices (e.g. matches) and high evidence is found. Usually arsonists with a vandalism motivation are found to be disorganized.	Not suitable for some countries which percentage of arsonists who set more than one fire is low (e.g. Portugal).
		Serial arsonist	Someone who has set three or more fires in different places, with an emotional cooling period between them.	
		Spree arsonist	Similar to the serial arsonist, but without the period of emotional cooling.	
		Mass arsonist	Similar to the serial arsonist, but all fires are set in the same area	
Vandalism	Associated with people who set fire usually by misconduct or peer/group. They are frequently young arsonists who perpetrate unsophisticated crimes.			
Douglas, Burgess, and Ressler (2013)	Burgess	Excitement	Arsonists who search for excitement, attention or recognition and who might have a sexual perversion. They usually remain at the crime scene and ignite low-risk targets (e.g. vegetation).	Some features are not congruent with the organized-disorganized model since serial crimes are considered organized, but serial arsonists show some disorganized features. Studying the psychological factors that trigger the offenses are suggested.
		Revenge	Retaliation in a personal, societal, institutional or group way or even motivated by intimidation. There is a relationship between the victim and the offender and the crime is typically premeditated and planned, with use of accelerators.	
		Crime Concealment	The arsonists with this motivation use fire to cover another crime (e.g. murder).	
		Profit	Achieving material gain usually by fraud, employment or by using competition.	
		Extremist	This motivation has a social, political or religion root.	

The Instrumental/Benefits (“B” Profiling) gather male arsonists between 20 and 35 years-old who did not finish elemental school and are usually merchants, specialized works or students. They have no known criminal or psychiatric history and the motivation mentioned is tangible benefits. The arson is set between 12am and 12pm in forests, uncultivated grounds, or agricultural, resorting to a fire engine. It is usually in the same location where the arsonist lives, although there is a poor relationship between the owner and the offender. This is found to be the typology with lower incidence in the Portuguese context (Soeiro, Branco, & Carvalho, 2008).

The Expressive/Criminal History (“C” Profiling) type, besides being the most frequent, is subdivided in two: C1 and C2 Profiling.

The C1 type covers a heterogeneous sample of male and female single, divorced and widowers’ arsonists, who haven’t completed primary school or are analphabets and are unemployed, reformed or work as housewives. These arsonists denial the act although investigation shows the possible motivation behind the crime is fire fascination. They have psychiatric history and criminal records for other offenses. The fire is set in the same location they leave or in a far neighborhood, resorting to matches, candles or lighters, between 12pm and 12am. The relationship with the owner depends on the pathology context and life history (so it can be a close relationship or an unknown one). These arsonists usually stay in the crime scene and help in the fire extinction (Soeiro, Branco, & Carvalho, 2008).

C2 embraces single male arsonists younger than 20 or between 36 and 45 years-old, who haven’t completed primary school or are analphabets and are firefighters, shepherds, timber-merchants or not qualified workers. Pleasure for destruction is the motivation reported by the offenders, although the investigation also mentions lack of control (impulsivity), negligence and alcohol consume. These arsonists do not report psychiatric history but they have criminal reports by the same or similar crimes. The fire is set closer to their work and is set with lighters, matches or candles between 8pm and 12am, abandoning the crime scene only to return with firefighter’s arrival (Soeiro, Branco, & Carvalho, 2008).

Spanish Typology

At last, the Spanish profiling focus on different arson characteristics and motivations while taking in consideration the type of rural area burnt, creating, this way, five types: agricultural, rancher, forest, road forest and agricultural hunting.

The Agricultural one covers older offenders with no childhood problems who could be the owner of the place they set fire in or familiar with the owner. These types of arsonists do not usually accept responsibility for the arson and stay in the place they set fire in when the firefighters arrive. The arsonists are typically retired or engaged in agriculture and are married. Most of them never received psychological treatment neither have criminal history (González, Muñoz, Cacerrada, & Sotoca, 2017).

The Rancher, younger than 34 years old, is usually an arsonist related to the industry sector. The motivation behind is usually revenge or punishment. The arsonist may have criminal record and usually does not know the victim (González, Muñoz, Cacerrada, & Sotoca, 2017).

The Forest is a category that involves young arsonists who still live with their parents and work sporadically, with low education level. There may be some hostility against the owned and the arsonist may have family problems. The fire is set by a lighter most of the times and the offender is under the effect of substances, mainly alcohol, taking responsibility for the crime in most cases (González, Muñoz, Cacerrada, & Sotoca, 2017).

Road Forest, on the other hand, includes usually unemployed and unmarried, with a traumatic childhood arsonists, who are solitary individuals and have records of substance abuse – especially alcohol. These offenders have between 46 and 60 years old, low educating level and might be serial arsonists. The motivation behind the arson is usually revenge (González, Muñoz, Cacerrada, & Sotoca, 2017).

Finally, Agricultural Hunting embraces arsonists that are frequently between 34 and 46 years old and work in a forest sector or are unemployed. These offenders usually do not know the owners and the motivation behind it is profit. They do not remain in the crime scene and do not take responsibility for the crime. Substance abuse may be present as well as may have arson history (González, Muñoz, Cacerrada, & Sotoca, 2017).

It is important to underline that these three criminal profiling have yet to be validated and no study so far attempted to. Thus, for this study, we will recreate a new criminal profiling methodology based on statistically methods to allow an advance towards criminal profiling validity.

Method

Sample Characterization

The sample used to test the new methodology consists in 309 cases of arrested rural arsonists. The next sections will characterize offenders by demographic information and integration on the community, criminal and psychiatric history, criminal behavior and crime scene information.

Sociodemographic Information

Most offenders are male (90%) and half are 41 to 64 years old ($M = 44.5$ years). Rural arsonists report frequently low qualifications, with more than half have completed solely primary school or have no qualifications at all (52.2%). When it comes to marital status, most arsonists are single or have lost their partner (56.3%). Considering their occupation, about 42% are unemployed or retired, 18.7% have a job related to farming, 12.7% are related to the construction industry and few are firefighters (3%) and students (3%). In general, this sample lives with their family (41%) and has difficulties in being integrated in the community (i.e. it is present a disruptive or dysfunctional household, mental disorders or consumption problems or criminal history).

Criminal and Psychiatric History

Rural arsonists on this sample do not have any criminal history on general (64.7%) and the ones that have are more related to previous arson convictions (17.2%) than to other crimes (7.4%). Considering psychiatric history, most offenders (63.8%) report having mental diseases (29.6%) and consumption problems (43.3%).

Criminal Behavior

Overall, rural offenders set only one fire (85.7%), so there are few mass arsonists reported in this sample (14.4%). An expressive motivation (i.e. intrinsic motivation) to commit the crime is mostly found (80.4%) such as boredom (22%), attention seeking (20.9%), rage (16.6%), revenge (10.1%) and pleasure (10.1%), while

the remaining (19.6%) set the rural fire with an instrumental motivation (i.e. extrinsic motivation). Considering now the relationship with the victim/property, 55.4% of the offenders do not know who the property owner is. Most arsonists set the fire without any coauthor (90.3%) and set the fire near their house or work place (87.6%), leaving the crime scene after setting the fire (71%). Great part of the sample reported having consumed alcohol at the moment of the crime (47.9%) and another great part did not reveal any kind of consumptions (46.9%). In general, these offenders confess having committed the crime (77.4%).

Crime Scene Information

Most rural arsons happened in working days (71.5%) between 1 p.m. and 7 p.m. (44.4%) and between 7 p.m. and 6 a.m. (41.7%). 94% of the fires were set with a simple ignition (i.e. lighters, candles, matches, etc.) and the burned dimension was mostly diverse such as forest (70%), bushes (69.6%), farming fields (21.1%) and pasture (11.9%).

Data Treatment

The data collection was done in the Escola da Polícia Judiciária database which was created by the summary records analysis of rural arson' recidivism risk factors. This summary sheet was also created originally by the Portuguese rural arson CP (i.e. Soeiro, Branco, & Carvalho, 2008), based on several characteristics found on the RA literature that were mentioned before on the sample characterization. The data collection included cases since 2015 until 2018, with most cases from 2017 ($n = 110$) and 2016 ($n = 90$) and the least from 2018 ($n = 57$) and 2015 ($n = 52$). The reason why the collection started from 2015 is due to 2015 being a turning point in Portugal for a more reliable data collection when it comes to rural arsonists. The collection of older cases would not benefit data treatment since it would be missing information that would not contribute equally to the study like the recent years. The description of the database variables can be seen in Appendix B. Furthermore, it is important to underline that the data collection and treatment was used merely to scientific and statistic reasons, assuring that all cases privacy and confidentially was respected according to General Data Protection Regulation (Regulation, 2016).

Statistical Approach

For this study, two statistical programs were used: IBM SPSS and Latent Gold®. The first one was essentially used for obtaining sample statistics and prevalence and to implement Multiple Correspondence Analysis (MCA), while the second was indispensable to perform Latent Class Analysis (LCA). MCA is essential for nominal data, allowing the creation of a solution in which same category objects are schemed together and different categories objects are plotted further away, distributing the objects into homogeneous subclasses (Meulman & Heiser, 2005). LCA allows the identification of the probabilities of class membership among statistical components, being a person-centered analysis rather than a variable-centered analysis (i.e. there is a focus on heterogeneous groups of people rather than the relationships among variables) (Bauer & Curran, 2004; Porcu & Giambona, 2017). Both statistics are important to see the importance of each variable on the model and to understand what better typologies (and how many) could explain rural arson as a crime itself. This statistical approach was chosen considering the suggestions and limitations presented in the criminal profiling validity systematic review (1st Article).

Results

With the purpose of creating a rural arson CP methodology, the previous statistics procedures – MCA and LCA – were calculated. MCA is going to be used as an exploratory analysis and LCA will work as a confirmatory analysis which will be important to comprehend the how both statistical approaches will have concise results with each other or not. The closer the agreement will be between the two, the better understanding of rural arson phenomenon and arsonists' typologies.

Results with MCA

First, it is important to understand how many dimensions will be used in this statistical approach on the 309 convicted rural arsonists. This will help to understand the variables that explain more the phenomenon, i.e. the ones that have more impact and that will be able to represent more accurately the typology of rural arsonists. For that, it is considered the total number of variable categories minus one (see Meulman & Heiser, 2005). Doing this will allow the representation of the inertia values (Figure 1).

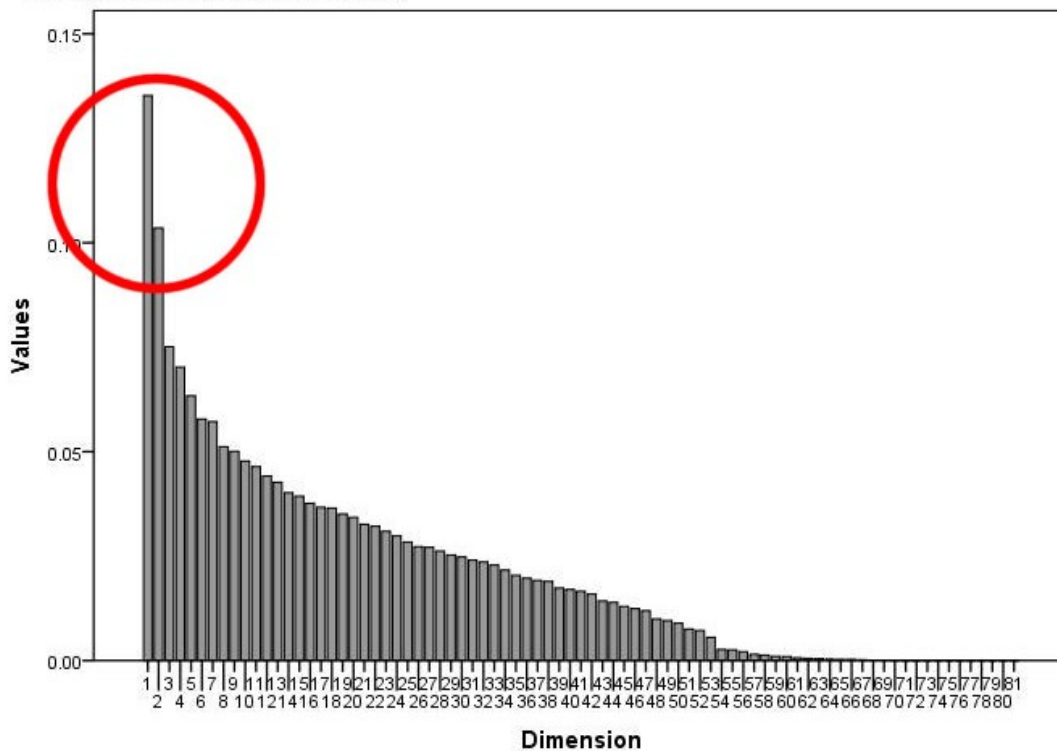


Figure 1. Variance Accounted for Inertia.

According to the inertia values, two dimensions suffice for the analysis of the sample, since it explains more than 20% of the total inertia. A one dimension model will not be chosen since it would represent less than 15% of the total inertia and would not favor profiling analysis correctly. A third dimension could be considered to account more inertia variance, although it would probably bias the outcome since the gap between the two and the three dimensions is significant. Considering this, a two dimension model will be used.

Next step was to analyze the discrimination measures of the 33 variables in this two dimension model in order to identify the variables that really explain rural arsonists' characteristics and behaviors (Table 6).

Table 6.
Variables' Discrimination Measure Considering Two Dimensions.

Variable Name	Dimension		Mean
	1	2	
Age	.146	.481	.313
Behavior After Crime	.013	.002	.008
Bush	.014	.000	.007
Coauthors	.058	.029	.044
Community Integration	.499	.039	.269
Consumption	.413	.283	.348
Consumption Problems	.434	.209	.322
Crime Confession	.026	.024	.025
Crime Hours	.046	.008	.027

Criminal History	.080	.038	.059
Day of the Week	.005	.003	.004
Expressive Motivation	.495	.108	.301
Expressive Motivation: Attention Seeking	.036	.099	.068
Expressive Motivation: Boredom	.042	.106	.074
Expressive Motivation: Pleasure	.009	.081	.045
Expressive Motivation: Rage	.042	.001	.021
Expressive Motivation: Revenge	.033	.000	.016
Farming Field	.014	.009	.011
Forest	.026	.012	.019
Ignition	.010	.046	.028
Instrumental Motivation	.495	.108	.301
Lives with...	.115	.385	.250
Marital Status	.161	.138	.149
Mental Diseases Indicators	.086	.058	.072
Number of Fires Set	.012	.055	.034
Occupation	.072	.327	.199
Pasture	.041	.014	.028
Psychiatric History	.601	.058	.330
Qualifications	.053	.306	.180
Sex	.012	.002	.007
Victim Relationship	.240	.225	.232
Where the Fire was Set	.001	.060	.031
Active Total	4.328	3.313	3.820

From this analysis, nine variables demonstrate having a mean value better than .200. For conceptual reasons associated with the explanation of offenders' behavior characteristics (Almeida, I., 2012) studied in other researches mentioned earlier and considering the variables that have mean values over .100, it was decided to include "Marital Status", "Occupation" and "Qualifications" in the analysis. To identify the impact that these variables have in the model, it was analyzed their contributions values (Table 7).

Differently from the remaining variables analyzed, "Qualifications" is a variable that has a mass of 64%, i.e. its representativeness is less than 70% of the total sample. This will affect the data largely due to the missing values being 27.2% of the total sample. Considering this, the offenders' qualifications will be not used in the forward tests in order to provide a more explicative, reliable and precise information. It is suggested, however, lowering the missing values in future arsonists' studies, since this is shown to be a promising variable that might contribute for a better understanding of rural arsonists typologies.

Table 7.
Marital Status, Occupation and Qualifications' Contributions.

Variable	Category	Frequency	Mass	Inertia
Marital Status	Single/Widowed	171	.052	.042
	Married	89	.027	.068
	Divorced	44	.013	.080
	Missing	5		
	Active Total		.092	.189
Occupation	Unemployed/Retired	126	.038	.056
	Student	10	.003	.088
	Farmer	56	.017	.076
	Construction Industry	38	.012	.082
	Others	61	.018	.076
	Firefighters	9	.003	0.90
	Missing	9		
	Active Total		.091	.468
Qualifications	Without/Primary	118	.033	.052
	Middle School	67	.019	.066
	High School/College	41	.012	.073
	Missing	83		
	Active Total		.064	.191

After taking this into consideration, the two dimensional model is repeated only with the 11 variables more significant. Analyzing the contents of each dimension, it was possible to understand that the first dimension is related with arsonists' psychological and social characteristics and the second one with arsonists' individual characteristics (Table 8). The first dimension has an alpha of .808 and the second dimension an alpha of .673. This way, the mean Cronbach's Alpha for both dimensions based on the mean Eigenvalue is .754, which means this solution has acceptable consistency (George & Mallery, 2016). The total inertia also increased to 28.9%.

Table 8.
Discrimination Measures for the Substantial Variables.

Variables Name	Dimension 1	Dimension 2	Mean
	Psychological Social Characteristics	and Individual Characteristics	
Age	.135	.609	.372
Community Integration	.528	.006	.267
Consumption at the Moment of the Crime	.510	.193	.351
Consumption Problems	.534	.125	.330
Expressive Motivation	.448	.144	.296
Instrumental Motivation	.448	.144	.296
Lives with...	.119	.484	.301
Marital Status	.146	.281	.213
Psychiatric History	.606	.024	.315
Occupation	.088	.319	.204
Victim Relationship	.211	.248	.230
Active Total	3.773	2.577	3.175

To identify the number of clusters that should be considered for this analysis, the *Hierarchical Cluster* procedure was calculated. *Ward's Method* was used since it is possible to understand the distance of all clusters to the sample average. The results show a tendency on obtaining three clusters (Figure 3).

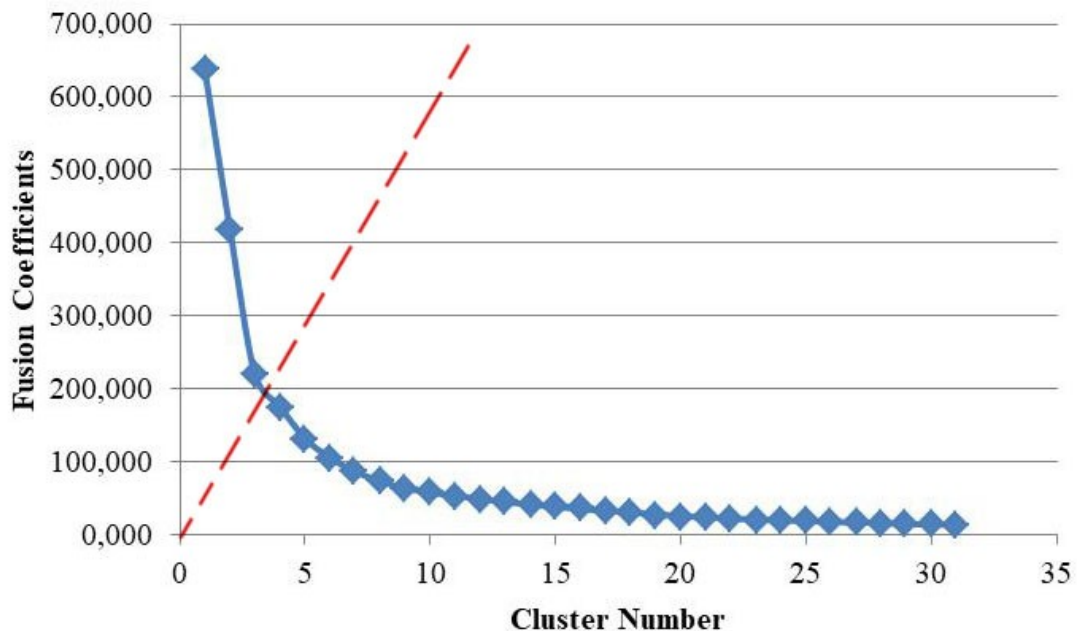


Figure 2. Clusters' selection using *Ward's Method*.

After demonstrating the three clusters dimensionally (Figure 4), it is possible to understand what these clusters represent. The first cluster (20.7%) includes: offenders

older than 65 years old; married/non-marital relationship; integrated; live with their family; have no psychiatric history; have no consumption's problems; no presence of consumptions at the moment of the crime; sets fire to their own rural property or to friend's; instrumental motivation. The second cluster (26.5%) contains: offenders younger than 40 years old; students or firefighters; live with their parents or in institutions; single/widowed; have consumption of drugs or medicine at the moment of the crime; do not know who the owner of the rural property is. Finally, the third (52.8%) covers: offenders between 41 and 60 years old; live alone; divorced; difficulties in being integrated in the community; unemployed, retired, work in the construction industry or have other jobs; consumption problems; alcohol consumption at the moment of the crime; knows the victim: can be their neighbor or family; expressive motivation.

To contributing for clusters further analysis, it was considered supplementary variables in order to deepen the information of rural arsonists' criminal profiling. This consideration, though, is merely to comprehend how the remaining variables not included in the main model are distributed within clusters so it is possible to retain additional qualitative information. As so, Cluster 1 includes women and offenders with no criminal history, who usually set fire to forest at morning (6 a.m. to 1 p.m.) and stay in the crime scene. Cluster 2 shows the presence of offenders with middle school or higher qualifications, have mental diseases indicators and offenders who usually do not confess the crimes and commit the crime at night (7 p.m. to 6 a.m.). The presence of coauthors and complex ignition is visible here. Motivation such as pleasure and revenge is also associated with this cluster. Cluster 3 also contains offenders with lower to none qualifications, with previous arson convictions. There is a diverse burned area (pasture, bushes, farming field) and the fire set is usually in the afternoon (1 p.m. to 7 p.m.). The expressive motivation is usually related to boredom, attention seeking or rage and the offender confesses the crime (Figure 5, 6 and 7).

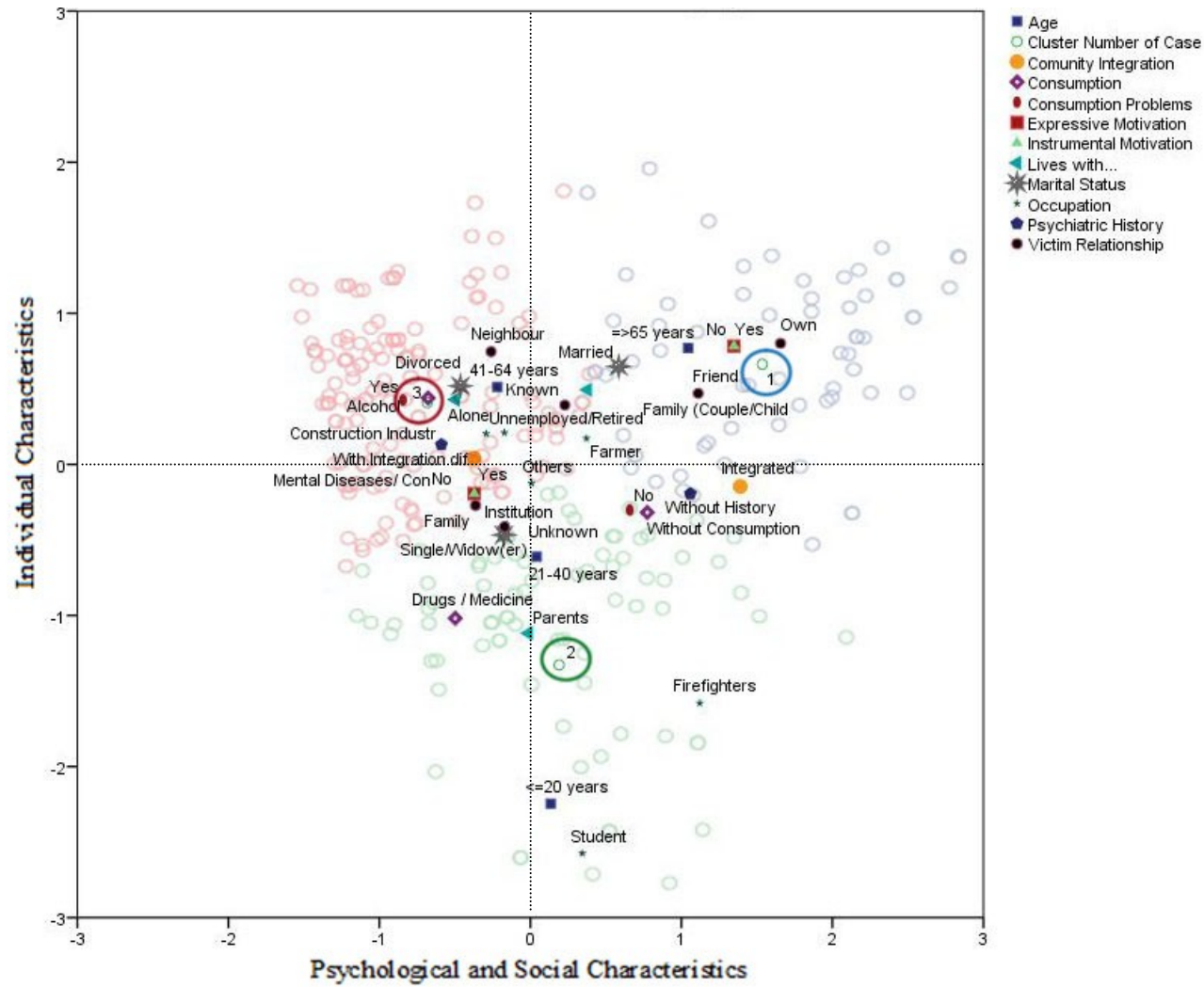


Figure 3. Clusters represented in two dimensions.

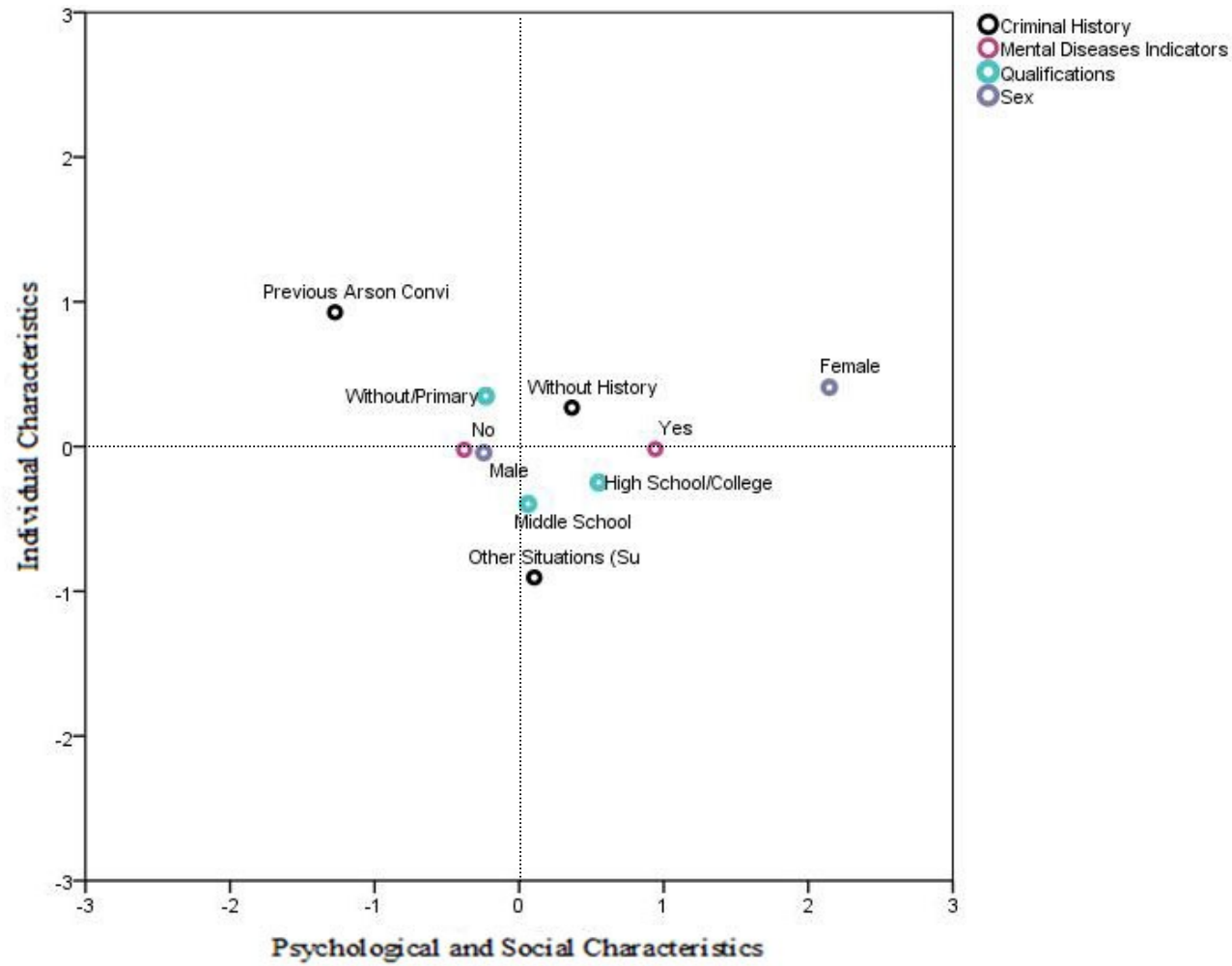


Figure 4. Supplementary variables: Arsonists' characteristics.

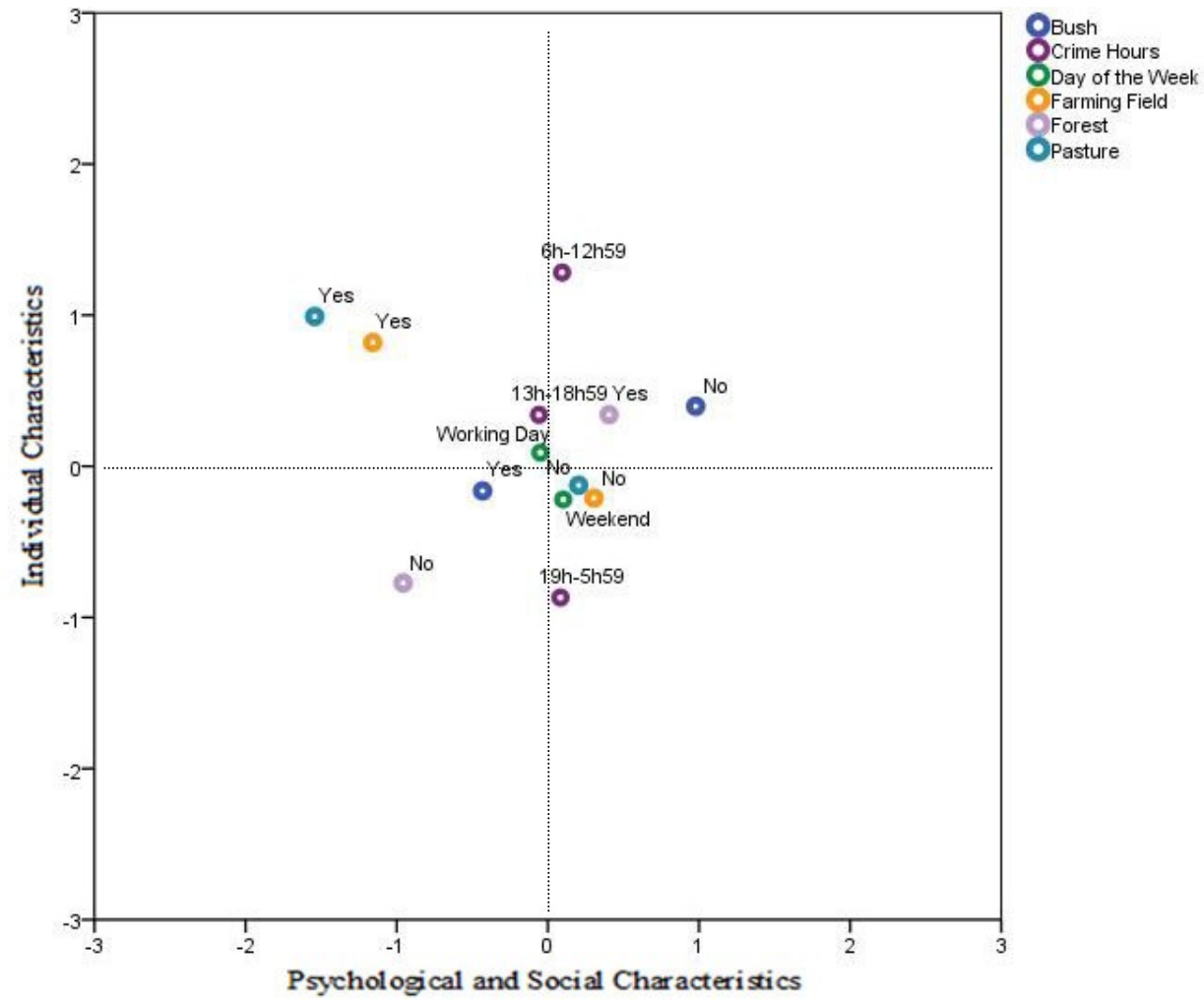


Figure 5. Supplementary variables: Crime scene characteristics

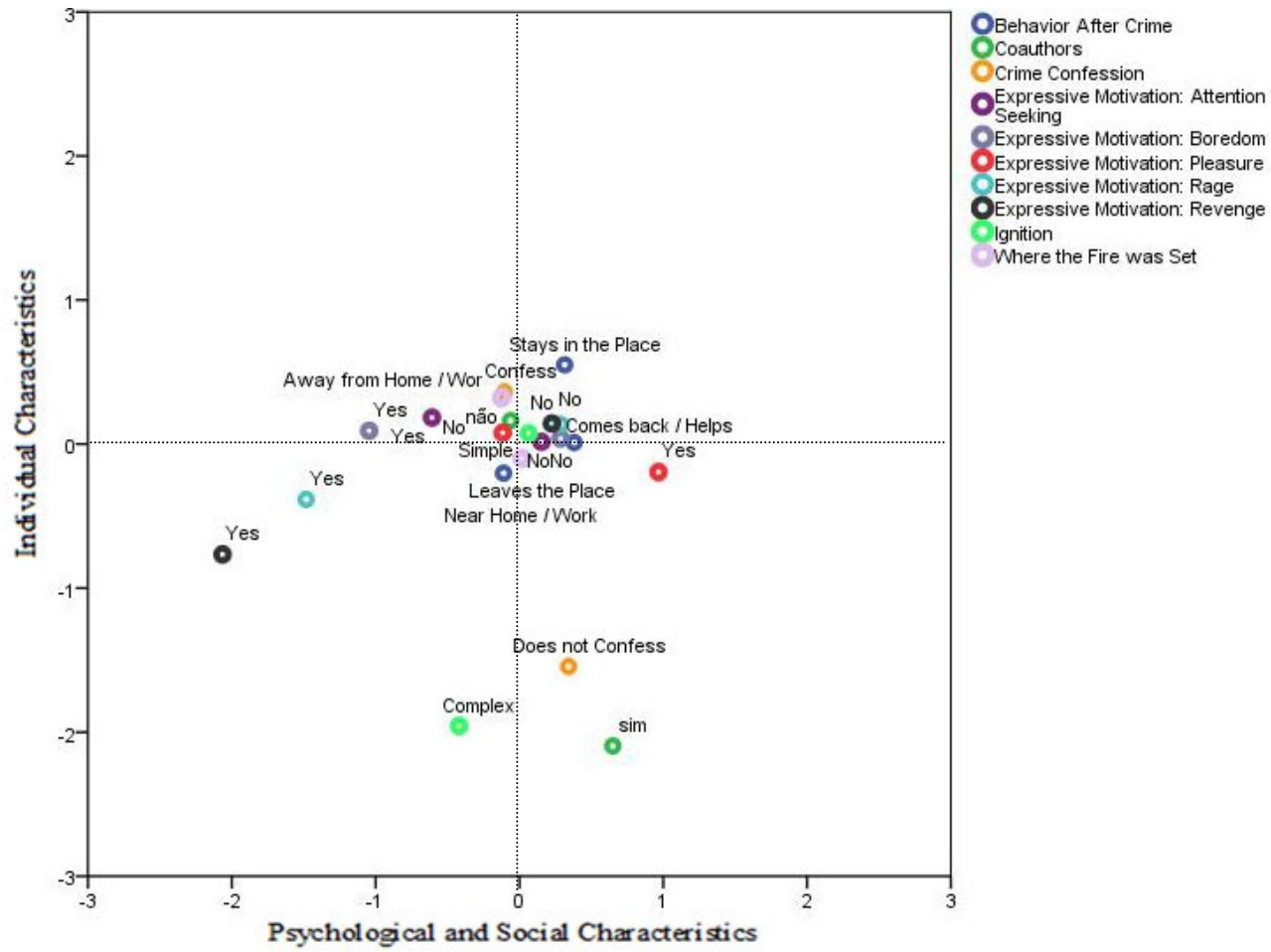


Figure 6. Supplementary variables: Arsonists' behavior.

Results with LCA

Similar to MCA, it is important to understand how many clusters should be considered. However, LCA is useful when it comes to simplifying some of the steps used. However, the software does not support many variables with many categories, creating high bivariate residuals which will bias the outcome. For this reason, LCA will be used as a test to see if there is convergent validity between the following results with the previous by using the same 11 variables that resulted from MCA in order to understand if the variables weight, the clusters number selection and the general distribution of the variables amongst the clusters concur.

Contrary to MCA, LCA firstly explains how many clusters should be considering by evaluating the Bayesian information criterion in how many models we decide to evaluate (in this case, six models were chosen to be tested since anymore would result in less representativeness of the sample) (see Porcu & Giambona, 2017). The lowest score was visibly when the model considered three clusters, which means three clusters are enough to better characterize rural arsonists, which corroborates with what found by the MCA analysis (Figure 8).

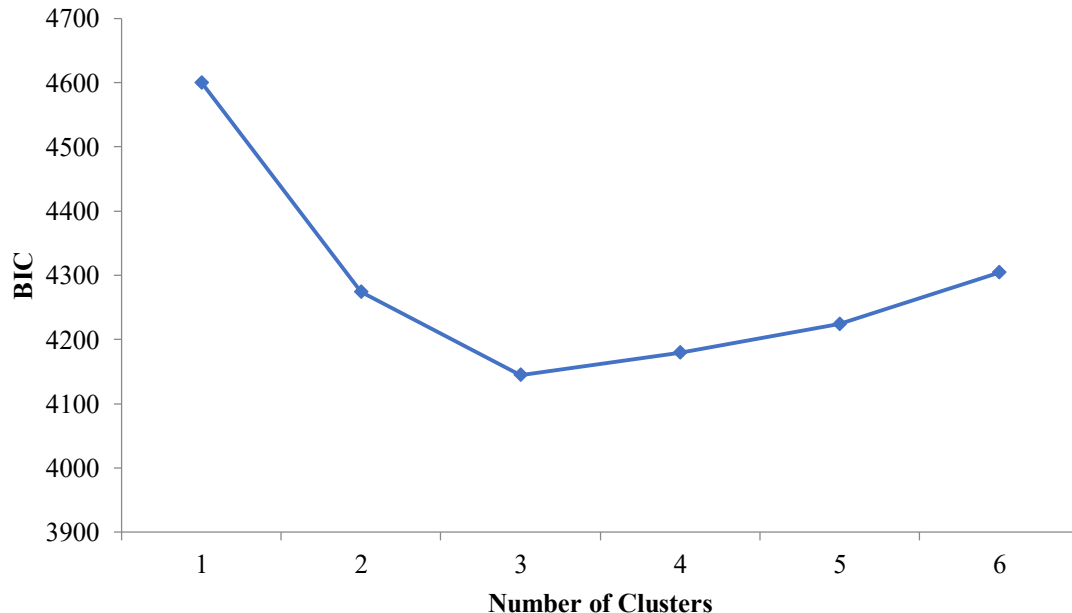


Figure 7. Screen plot of Bayesian Information Criterion values by each cluster

Note. BIC = Bayesian Information Criterion

When considering the significance of the 11 variables in the model, all of them with the exception of “Occupation” ($p=0.23$) have significant values, which explains that the remaining variables contribute to the model significantly. When considering the

clusters distribution, it is possible to notice a few differences (Table 9). The first cluster (44.1%) includes: offenders aged 41 to 64 years old; divorced; unemployed, retired or that work in the construction industry; live alone and have integration difficulties; have psychiatric history, especially consumption problems; the owner of the rural property they set fire on is usually their neighbor; have presence of alcohol consumes at the moment of the crime. The second cluster (39.7%) contains: offenders younger than 40 years old; single; students, firefighters or with other jobs; live with their parents or in an institution; have an expressive motivation; do not know who the rural property owner is; might be under drugs/medicine consumption at the moment of the crime. The third cluster (16.1%) embraces: offenders older than 65 years old; married; farmer; live with their family or in an institution; are integrated; have no psychiatric history or consumption problems; have instrumental motivation; know the rural property owner, which is either a friend, family or their own rural property; have no consumes at the moment of crime. A tri-plot characterizing this distribution was also done to represent what was described (Appendix C).

Considering now the supplementary variables, the distribution is done the following way: Cluster 1 includes offenders with low to no qualifications; criminal history, principally previous arson convictions; crime occurring during nighttime (7 p.m. to 6 a.m.); motivated by rage or revenge and the offender leaves the place. Cluster 2 contains offenders with middle school qualifications; presence of mental disorders; mostly in forest; more prevalence of complex ignition; crime happening during morning (6 a.m. to 1 p.m.); motivated by boredom, attention seeking or pleasure; usually away from home/work; the offender usually comes back to the crime scene or helps in the fire extinguish and confesses the crime. Finally Cluster 3 includes mostly females' sample; high school or higher education qualifications; no criminal history; presence of coauthors; set the fire in bushes, pastures or farming fields; the fire is set in the afternoon (1 p.m. to 7 p.m.); the offender stays at the crime scene and most times do not confess the crimes (Table 10).

Table 9.
Main Variables Distribution within Clusters with LCA

Variables	Categories	Cluster1	Cluster2	Cluster3
Age	<=20 years	.020	.119	<.001
	21-40 years	.283	.453	.350
	41-64 years	.651	.348	.401
	=>65 years	.046	.080	.249
Marital Status	Single/Widowed	.567	.653	.401
	Married	.236	.242	.474
	Divorced	.197	.105	.125
	Unemployed/Retired	.448	.398	.351
Occupation	Student	<.001	.101	<.001
	Farmer	.181	.122	.349
	Construction Industry	.188	.105	.076
	Others	.184	.210	.200
	Firefighters	<.001	.071	.025
Household	Alone	.397	.205	.151
	Parents	.203	.421	.250
	Family (Couple/Children)	.381	.324	.549
	Institution	.019	.050	.050
Community Integration	Integrated	<.001	.222	.547
	With Integration difficulties	.999	.778	.453
Psychiatric History	Without History	.001	.545	.771
	Mental Diseases/ Consumption Problems	.999	.455	.229
Consumption Problems	Yes	.977	.026	.005
	No	.024	.974	.996
Expressive Motivation	Yes	.909	.999	.007
Instrumental Motivation	Yes	.091	<.001	.993
	Unknown	.548	.705	.203
Victim Relationship	Known	.145	.141	.200
	Neighbor	.207	.084	.200
	Family	.055	.050	.075
	Friend	.018	<.001	.124
	Own	.027	.020	.199
	Alcohol	.917	.193	.104
Consumptions at the moment of the crime	Drugs / Medicine	.045	.081	.025
	Without Consumption	.039	.725	.871
Total		.441	.397	.161

Table 10.
Supplementary Variables Distribution within Clusters with LCA

Variables	Categories	Cluster1	Cluster2	Cluster3
Sex	Male	.940	.859	.844
	Female	.060	.141	.565
Qualifications	Without/Primary	.593	.381	.469
	Middle School	.323	.348	.188
	High School/College	.084	.271	.344
Criminal History	Without History	.568	.627	.781
	Previous Arson Convictions	.241	.141	.063
	Other Crimes Convictions	.107	.065	.031
Mental disorders	Other Situations (Suspects)	.084	.167	.125
	Yes	.195	.447	.250
Coauthors	Yes	.050	.080	.111
Bush	Yes	.728	.662	.750
Forest	Yes	.711	.738	.556
Pasture	Yes	.056	.102	.167
Farming Field	Yes	.201	.193	.278
Ignition	Simple	.940	.943	.972
	Complex	.050	.057	.028
Hours	19h-5h59	.521	.317	.250
	6h-12h59	.071	.216	.194
	13h-18h59	.409	.467	.556
Day of the Week	Weekend	.661	.670	.778
	Working Day	.661	.668	.778
Attention seeking	Yes	.206	.290	.020
Revenge	Yes	.147	.131	.020
Rage	Yes	.246	.186	.020
Boredom	Yes	.274	.282	<.001
Pleasure	Yes	.097	.172	<.001
Place	Near Home / Work	.919	.811	.959
	Away from Home / Work	.081	.189	.041
	Leaves the Place	.738	.737	.592
Behavior	Stays in the Place	.144	.113	.286
	Comes back / Helps	.118	.150	.122
Confession	Does not Confess	.202	.158	.245
	Confess	.798	.842	.755

Final Results

Comparing the outcomes from MCA and LCA, it is possible to verify major similarities between the two (Table 11). Overall, there is a high concordance in Cluster 1 (Instrumental Motivation – Socially Adjusted) (91%) and a good concordance in Cluster 2 (Expressive Motivation – Socially Maladjusted) (71%) and Cluster 3 (Expressive Motivation – Psychiatric/ Alcohol Problems) (70%) which by itself allows explaining the rural arson phenomenon. However, there are many differences regarding supplementary variables, which should be expected since they did not have statistical support to be included in the model and were only used to understand their distribution and to deepen the knowledge on each cluster. For methodological reasons, LCA results should be taken into account since it considers the distribution of the variables in each cluster, as it was seen previously, unlike MCA, which demonstration is based on visual representation. Plus, it is imperative to underline that LCA only includes data from completed cases (i.e. without missing values), which does not happen with MCA that includes all cases, even if there are missing values. This fact can also possibly explain some of the differences found between the outcomes, since Cluster 1 reported 9.7% of missing values, especially in Instrument ($n=8$) and Expressive motivation ($n=8$), Cluster 2 showed 8.7% missing data with more missing cases on Consumption Problems ($n=5$) and Psychiatric History ($n=5$) and Cluster 3 presented 12.3% missing values, with more incident in Household ($n=10$). Nonetheless, the final results present a great and positive importance on the creation of a new criminal profiling methodology.

Table 11.
Comparison between MCA and LCA Results.

	MCA	LCA
	Main Variables	
	(52.8%)	(44.1%)
Expressive Motivation – Psychiatric/Alcohol Problems	41 to 60 years old; divorced; unemployed; live alone; in integration difficulties; retired, work in the construction industry, or other jobs; consumption problems; alcohol consumption at the moment of the crime; knows the victim (neighbor or family); expressive motivation.	41 to 64 years old; divorced; unemployed; live alone; integration difficulties; retired or work in the construction industry; consumption problems; alcohol consumption at the moment of the crime; psychiatric history; knows the victim (neighbor).
	(26.5%)	(39.7%)
Expressive Motivation – Socially Maladjusted	Younger than 40 years old; single; students or firefighters; living with parents or institutions; drugs or medicine consumption at the moment of the crime; do not know who the rural property owner is.	Younger than 40 years old; single; students, firefighters or with other jobs; living with parents or institutions; drugs/medicine consumption at the moment of the crime; do not know who the rural property owner is; expressive motivation.
	(20.7%)	(16.1%)
Instrumental Motivation – Socially Adjusted	Older 65 years old; married; integrated; living with family; farmer; no psychiatric history; no consumption problems; no presence of consumptions at the moment of the crime; own rural property or friend's; instrumental motivation.	Older than 65 years old; married; integrated; living with their family or in an institution; farmer; no psychiatric history; no consumption problems; no presence of consumptions at the moment of the crime; friend, family or their own rural property; instrumental motivation.
	Supplementary Variables: Arsonists Characteristics	
Expressive Motivation – Psychiatric/Alcohol Problems	Low to none qualifications; previous arson convictions; pasture, bushes, farming field; afternoon (1 p.m. to 7 p.m.); Motivation: boredom, attention seeking or rage; confess the crime.	Low to none qualifications; criminal history, principally arson convictions; night (7 p.m. to 6 a.m.); Motivation: rage or revenge; leaves the place.
Expressive Motivation – Socially Maladjusted	Middle school or higher qualifications; mental diseases; do not confess; complex ignition; night (7 p.m. to 6 a.m.); coauthors; Motivation: pleasure and revenge.	Middle school; mental disorders; forest; confess; complex ignition; morning (6 a.m. to 1 p.m.); Motivation: boredom, attention seeking or pleasure; away from home/work; comes back to the crime scene or helps in the fire extinguish.
Instrumental Motivation – Socially Adjusted	Women; no criminal history; forest; morning (6 a.m. to 1 p.m.); stay in the crime scene.	Women; no criminal history; afternoon (1 p.m. to 7 p.m.); stay at the crime scene; high school or higher education; coauthors; bushes, pastures or farming fields; do not confess.

Discussion

Arson is a crime that still needs plenty attention considering the impact it can cause on society. Moreover, the lack of consensus between definitions and the poor investment on rural arson studies underline the importance for future studies to focus more on this crime behaviour.

Overall, even with the lack of consensus, studies focusing on arson typologies show that the motivation might be instrumental, especially profit, or expressive, being the most congruent revenge. Most differences, however, lay on how many categories are created and how they are analysed: if by offenders' motivation, by their clinical history or by how many fires they set and how (dis)organized they are. A fitting and unique criminal profiling should be created and adapted to each country context in order to overcome the lack of consensus with arson typologies and to outline these offender characteristics, so they can be easier identified and intervened. Moreover, getting to know the different types of arsonists within criminal profiling – especially rural arsonists – will help to create and adapt prevention programs suitable for each reality.

The findings on this study contributed not only to increase the knowledge on rural arsonists but also to create a new valid methodology of criminal profiling, characterizing the different three types of rural arsonists.

The most common typology (Expressive Motivation – Psychiatric/Alcohol Problems) represents around half percent of the sample and consists on offender with 41 to 64 years old, who usually are unemployed, retired or work in the construction industry. They are most likely divorced. These arsonists typically live alone and have difficulties being integrating with the community due to alcohol problems – which is frequently present at the moment of the crime – and/or due to psychiatric history. Rural arsonists in this typology know the victim, which is usually their neighbour. Other characteristics underlined by supplementary variables show that these offenders have more commonly low to none qualifications; most likely have criminal history, which is usually the presence of arson convictions; have more probability of leaving the place of the crime scene and set the fire more often at night (7 p.m. to 6 a.m.); Motivations such rage or revenge are more linked to this typology than with the remaining.

The second most common typology (Expressive Motivation – Socially Maladjusted) comprehends offenders 20 years old or younger and between 21 and 45

years old, who are single. They are usually students, firefighters or have other jobs that are not typically related with the construction industry or farmers. Most of them are living with parents or in host institutions. The presence of drugs or medicine at the moment of the crime is also more prevalent here than on the remaining typologies. Most offenders do not know who the rural property owner is. These offenders set fire for expressive/intrinsic motivations. According to the qualitative study of the supplementary variables, these offenders are more frequently associated with middle school education, with the presence of mental disorders, with crime confession and complex ignition. They will set the fire most likely in forests, away from their home or workplace, coming back to the crime scene or helping in the fire extinguish procedure and have more probabilities of setting the fire in morning (6 a.m. to 1 p.m.). Motivations more frequently associated with this typology are boredom, attention seeking or pleasure.

Finally the typology with less representativeness (Instrumental Motivation – Socially Integrated) characterizes rural arsonists 65 years old or older, who are usually married and work as farmers. They usually live with their family and in some situation in a host institution. These offenders are usually socially integrated in the community, which means they typically do not have psychiatric history, no consumption problems and no presence of consumptions at the moment of the crime. They also either have a close relationship with the victim (friend or family) or they set the fire to their own rural property. The reason underneath this crime in this typology is usually an instrumental/extrinsic motivation (such as profit or land clearing). When considering the qualitative contribution of the supplementary variables, these show that female firesetters appear more often in this typology, as such as offenders with high school or higher education, with no criminal history, who usually do not confess the crime and might have the help of an accomplice. These arsonists are more associated with setting the fire in bushed, pasture or farming fields, in the afternoon (1 p.m. to 7 p.m.) and remaining at the crime scene instead of leaving or returning.

This new criminal profiling for rural arsonists is found to be validated when concerning convergent validity and content validity. Both statistical procedures, MCA and LCA, are different (and have different softwares) but both of them were created to analyse clusters and variables significance and contribution for the models. By the selection of the same variables and by the high coincidence of the variables on the

clusters when comparing both MCA and LCA, it is possible to assume this CP for rural arson has convergent validity (American Psychological Association, 2018). Plus, this variables selection were supported by most literature review and especially by the Portuguese typology by Soeiro and authors (2008) which is why it is possible to confirm that the new methodology has content validity. When comparing with the Australian, Portuguese and Spanish rural arson CP's, it is possible to see that this methodology is closer to the Soeiro and colleagues' Portuguese version when it comes to its structure. Nonetheless, while the 2008 version represents four groups, the one presented in this dissertation shows clearly the presence of three clusters. Even so, most underline characteristics (such as motivation and mental diseases/alcohol problems) are presented in both criminal profiling.

Regarding the study limitation, it is especially underlined the heterogeneous sample. This could be prevented if there were more completed cases (without missing values) or with a bigger sample that would increase the density of the clusters and, therefore, improve the representation of the three typologies (especially in MCA). Nonetheless, this sample already helped with the rural arson phenomenon understanding, which is why it is suggested for future studies to create a quantitative measure (e.g. checklist) based on this criminal profiling in order to evaluate the remaining validity types on this technique (e.g. construct validity). Replicating this experimental analysis with a sample from another country and comparing the results with the Portuguese sample used in this study is also suggested in order to contribute for the consistency of the three-cluster typology and validity. Another suggestion for a future study is testing this criminal profiling methodology with of offenders for other crimes, such as homicide or sexual crimes. Finally, although this study did not cover recidivism rates, it would be interesting to understand the percentage of recidivists' offenders – since some of them have previous arson convictions – and how are they distributed in the clusters. This is rather pertinent to contribute for a step forward on crime investigations and crime prevention.

Conclusion

Criminal profiling is a forensic technique that sought to find offenders' demographic, behavior, personality characteristics and their motivation and crime scene information, which will allow comprehending who could commit a specific crime, where and why. This is technique, however, was still lacking validity, which was

especially concerning since it could bias investigations when it was used to help finding the culprits. For this reason, this dissertation main aim was to explore criminal profiling lack of validity in order to leave suggestions for future studies on this matter, taking into account the several types of validity that should be tested, and to propose a valid methodological technique using a sample of Portuguese rural arsonists that has been found to have content and convergent validity. Thus, regarding limitations mentioned throughout this study and regarding future studies suggested, it is imperative to continue validating this technique by replicating the exploratory and confirmatory analysis on other crimes in order to create a criminal profiling with valid typologies, enabling the possibility of finding convergent and content validity. By doing so, the development of adequate quantitative measures, such as checklists, will not only ease criminal investigations to find the offenders of a crime much faster and more accurately considering the typologies found in the first analysis, but will also enable the possibility of testing other validity types to reinforce the validity of criminal profiling as a psychological forensic technique.

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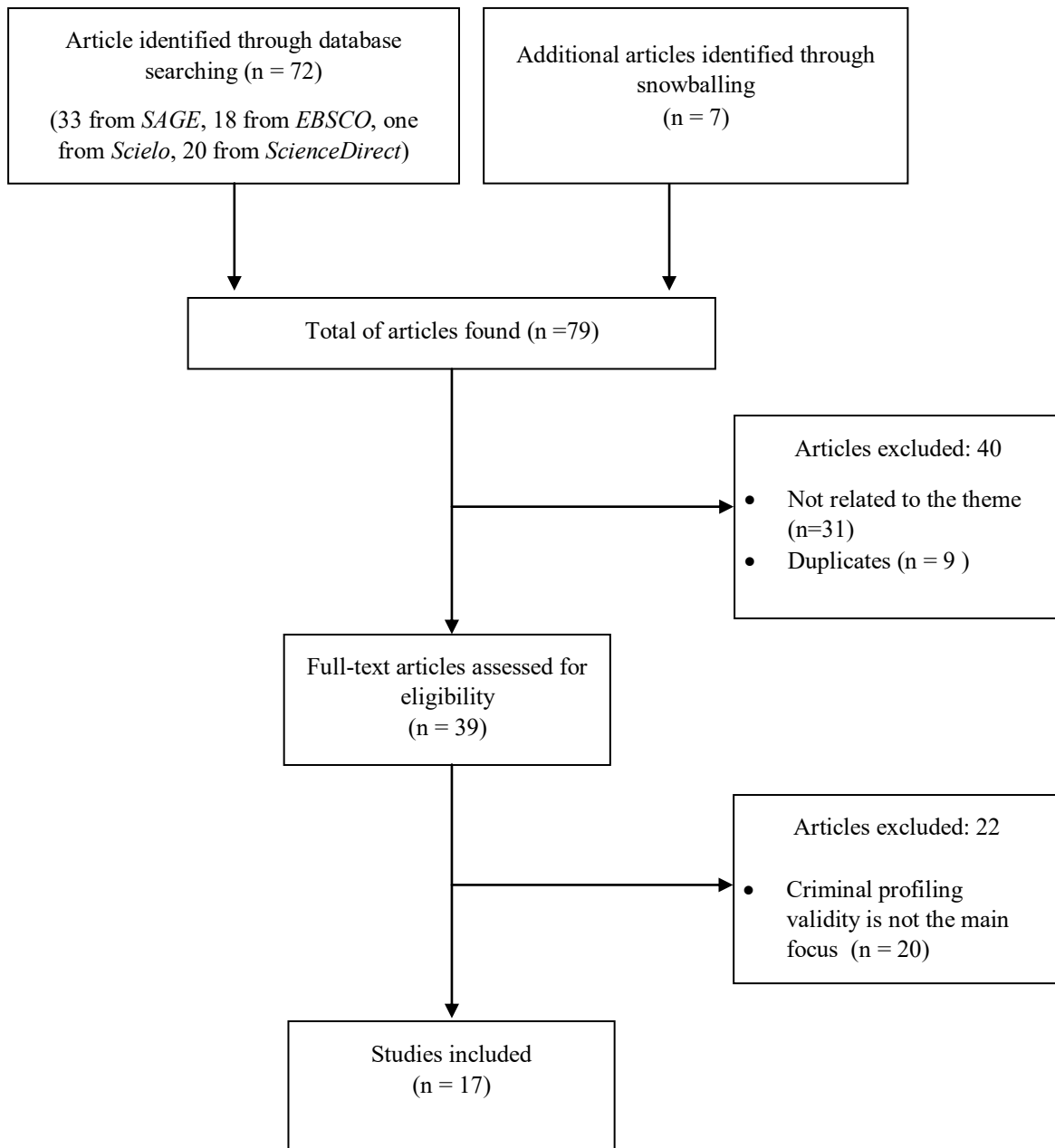
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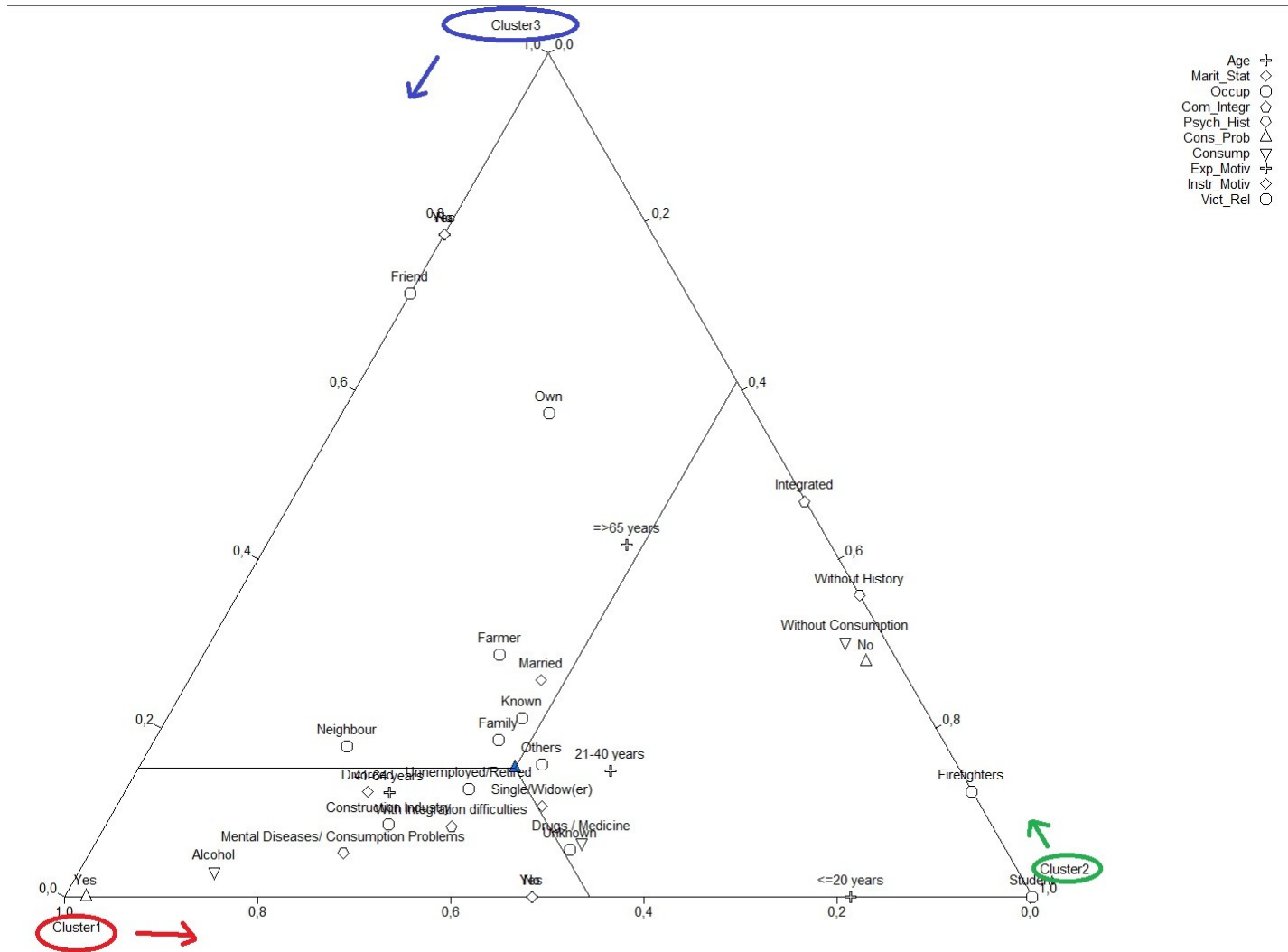
Appendix A



Appendix B

Variables Names	Variables' Values Categorization
Sex	1 = Male ; 2 = Female
Age	1 = 20 years or less; 2 = 21 to 40 years; 3 = 41 to 64 years; 4 = 65 years or less
Qualifications	1 = Without/Primary; 2 = Middle school; 3 = High School/College
Marital Status	1 = Single/Widowed; 2 = Married; 3 = Divorced
Occupation	1 = Unemployed / retired; 2 = Student; 3 = Farmer; 4 = Construction Industry; 5 = Others; 6 = Firefighters
Household	1 = Alone; 2 = Parents; 3 = Family (Couple and/or Children); 4 = Institution
Community Integration	1 = Integrated; 2 = Integration Difficulties
Criminal Record	1 = Without; 2 = With Arson Convictions; 3 = With Other Crimes Conviction; 4 = Other (e.g. Suspect)
Psychiatric History	1 = Without; 2 = Mental Illness / Consumption Problems
Consumption Indicators	1 = Yes ; 2 = No
Mental Illness Indicators	1 = Yes ; 2 = No
Consumption at the time of the crime	1 = Alcohol ; 2 = Drugs / Medicine; 3 = No Consumptions
Coauthors	1 = No ; 2 = Yes
Number of Fires Set Before Caught	1 = One ; 2 = Two to Three; 3 = Four or more
Bush	1 = Yes ; 2 = No
Forest	1 = Yes ; 2 = No
Pasture	1 = Yes ; 2 = No
Farmer Field	1 = Yes ; 2 = No
Ignition	1 = Simple; 2 = Complex; 3 = Others (e.g. Preventing firefighting)
Instrumental motivation	1 = Yes ; 2 = No
Expressive Motivation	1 = Yes ; 2 = No
Attention Seeking	1 = Yes ; 2 = No
Revenge	1 = Yes ; 2 = No
Rage	1 = Yes ; 2 = No
Boredom	1 = Yes ; 2 = No
Pleasure	1 = Yes ; 2 = No
Place Distance from Offender's House/Work	1 = House/Work Area; 2 = Outside House/Work area
Behavior After Crime	1 = Abandonment of the Crime Scene; 2 = Remains at the Crime Scene; 3 = Returns/Helps Firefighting
Confession	1 = Does Not Confess; 2 = Confesses
Relationship with the Owner	1 = Unknown ; 2 = Known; 3 = Neighbor; 4 = Familiar; 5 = Friend; 6 = Own
Time of the Crime	1 = 7 p.m. to 5:59 a.m.; 2 = 6 a.m. to 1:59 p.m.; 3 = 1p.m. to 6:59 p.m.
Week Day(s) the Arson Happened	1 = Working Days ; 2 = Weekends

Appendix C



Appendix D



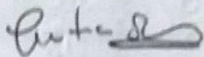
Declaração autorização de recolha de dados

Eu, Cristina Branca Bento de Matos Soeiro, responsável pelo Gabinete de Psicologia e Seleção da Escola de Polícia Judiciária, declaro que a aluna do Mestrado em Psicologia Forense e Criminal, do Instituto Universitário Egas Moniz Rita Ribeiro, se encontra a desenvolver o seu trabalho de dissertação de mestrado, integrada no estudo de investigação sobre o perfil psicológico do incendiário florestal português, projeto da responsabilidade da Escola de Polícia Judiciária. Neste contexto aluna está autorizada a efetuar a recolha de dados para o seu projeto de dissertação na Escola de Polícia Judiciária.

Barro, 4 de fevereiro de 2019

Gabinete de Psicologia e Seleção

Cristina Soeiro



(Especialista Superior)