Intelligent Diagnosing of Intellectual Disabilities in Offenders: Food for Thought

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Research on offenders with intellectual disabilities (IDs) in the criminal justice arena is on the rise, reflected by a growing number of relevant publications each year. However, there is a long recognized methodological problem that hampers the comparability of empirical studies and that raises doubts about the accuracy of prevalence rates, comorbidities, and various correlates and characteristics. In this paper we will argue that the crux of the problem can, on the one hand, be found in the plurality of assessment methods for intelligence and adaptive functioning, which are not all sufficiently reliable and valid. On the other hand, assessment of IQ in criminal justice and mental health-related areas appears to be informed more by practical aspects and needs rather than grounded in a solid theoretical model. Hence, we suggest that the Cattell–Horn–Carroll (CHC) model of intelligence has potential value in this regard, and deserves a closer look. Finally, we will discuss its incorporation into, and possible implications for, criminal justice practice and future study designs. Copyright © 2012 John Wiley & Sons, Ltd.

RESEARCH AND ASSESSMENT OF OFFENDERS WITH INTELLECTUAL DISABILITIES

A recently published double issue of *Psychology, Crime & Law* (Lindsay, Hastings, & Beech, 2011a,b) reflects the thriving research interest in offenders with developmental and/or intellectual disabilities (IDs). The state-of-the-art contributions also demonstrate that as in most fields of criminal justice research, ID offenders comprise a heterogeneous and complex population, where divergent methods of sample selection add to the confusion of correct prevalence rates and relevant correlates (Lunsky et al., 2011). There are at least two reasons for this. First, as le Grand, Lutjenhuis, and Solodova (2003, p.83) have pointed out, a review of the literature offers a confusing panoply of synonyms and distinct terms, such as "developmental disability intellectual disability, mental retardation, learning disability, mental handicap, low functioning, borderline functioning." For example, somebody with borderline functioning is predominantly characterized by a low, standardized IQ between 71 and 84, whereas a diagnosis of mental retardation implies more severe IDs and significant impairments in other areas as well (see 'Definitions' below). By

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contrast, learning disability/disorder can be understood as a sub-diagnosis of ID-related pathology with more heterogeneous subcategories and very specific impairments. It is not within the scope of the current paper to untangle all the differences and overlaps in these areas. For reasons of convenience, we will primarily focus on the diagnosis and its shortcomings of mental retardation as a synonym of ID in criminal justice research.

Secondly, the lack of studies using adequate measures to evaluate IDs has been repeatedly and systematically demonstrated over the last 30 years (MacEachron, 1979; McBrien, 2003; Simpson & Hogg; 2001). Despite some positive developments, we will show that this trend has not changed significantly, and that partial responsibility lies within the field of practitioners. Taking an overly simplistic stance, this is predominantly due to how an individual IQ is measured, which is a necessary but not sufficient step to diagnose ID. The correct identification and diagnosis of ID may be highly relevant for all major areas in forensic practice and research, ranging from comprehending legal rights, to interrogative suggestibility and competence to stand trial, to risk assessment and assessment for adequate treatment planning (e.g., Jones, 2007; Lindsay et al., 2002). After reviewing the various ways of establishing ID and associated methodological problems in current criminal justice studies, we will argue that a gap still exists between the practical assessment of intelligence and its theoretical underpinnings in this domain. Therefore, we will put forward a proposal to incorporate the well-researched, multi-dimensional Cattell–Horn–Caroll model (CHC; Flanagan, Fiorello, & Ortiz, 2010) of cognitive abilities into criminal justice practice and research of offenders with ID to better capture the individual differences within this population. Finally, we will discuss the possible wide-ranging implications of using the CHC model for various purposes in criminal justice settings.

DEFINITIONS AND DEMARCATIONS OF INTELLECTUAL DISABILITIES

Definitions

The most used synonym for ID stems from the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition – Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) and the International Classification of Diseases and Related Health Problems (ICD-10; WHO, 1992). The DSM defines 'mental retardation' as an Axis-II disorder with a significantly "subaverage general intellectual functioning" (i.e., at least two standard deviations below the mean / IQ < 70; criterion A) as a central characteristic. Additionally, significant deficits in adaptive functioning in at least two areas (e.g., communication, self-care, interpersonal skills, etc.; criterion B), and an onset before 18 years (criterion C) are also necessary but frequently overlooked features. DSM-IV-TR (American Psychiatric Association, 2000) differentiates four subcategories of increasing severity, which are defined by decreasing IQ boundaries,[1] as well as a residual group of unspecified severity where suspicions of mental retardation cannot be corroborated for various reasons (American Psychiatric Association, 2000). The ICD-10 criteria on

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[1] The boundaries are the following: mild mental retardation: 50–55 > IQ < 70 (−2.01 to −3 SDs);moderate mental retardation: 35–40 > IQ < 50–55 (−3.01 to −4 SDs); severe mental retardation: 20–25 > IQ < 35–40 (−4.01 to −5 SDs); profound mental retardation: IQ < 20–25 (−5.01 to −6 SDs).

mental impairment are in general quite similar. However, an accompanying 82 page manual gives supposedly more extensive guidance than the DSM.

Because problems of adaptive functioning are much more visible and malleable for treatment than stable, cognitive aspects of mental retardation, the need for a proper assessment of adaptive functioning (e.g., via the Vineland Adaptive Behavior Scales [VABS], Sparrow, Balla, & Cicchetti, 1984; Hayes Ability Screening Index [HASI], Hayes 2000) has been repeatedly stressed, particularly the assessment of the specific social context of each individual. The association between IQ tests and adaptive ability measures (e.g., $r = 0.49$–0.78; Hayes, 2005; Søndenaa, Rasmussen, Palmstierna, & Nøttestad, 2008) signifies that one construct cannot be substituted for the other. For example, Hayes (2005) found a greater discrepancy between the scores of the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) and the HASI with juvenile offenders, which means that a low score on intelligence would not necessarily imply a low score on adaptive functioning. Hence, a thorough assessment of all mental retardation criteria appears to be necessary. Nevertheless, and as has been stated before (e.g., McBrien, 2003), this is not always the case. Either diagnoses in published studies were not made on the basis of all criteria, or they didn't explicitly state the used criteria (see the section on 'Assessment of Intellectual Disability in Criminal Justice Research' below).

Prevalence of ID in Criminal Justice Research

For a long time, there was an erroneous belief that low cognitive abilities, as in ID, comprise a major, causal factor for crime, which was supposedly reflected by high prevalence rates of ID in offender populations (Lindsay et al., 2011a). Such views as found in the highly controversial book *The Bell Curve: Intelligence and Class structure in American Life* (Herrnstein & Murray, 1994) are a testament to this misconception. However, it has since been shown that a low general intelligence is just one of the weaker risk factors for committing offences, with effect sizes smaller than $r = 0.20$ (e.g., Cullen, Gendreau, Jarjoura, & Wright, 1997). Despite the discrepancies in definitions and assessment methods, today it seems that offenders with ID are present but not significantly over-represented in prisons (e.g., 0.5–1.5% in a large meta-analysis by Fazel, Xenitidis, & Powell, 2008; 1.3% in a recent study in the Australian prison system by Holland & Persson, 2011). The prevalence of offenders with ID in mental health settings appears to be substantially higher. Lunsky et al. (2011) found a rate of 12.8% in in-patients with forensic involvement and 20.8% in psychiatric in-patients with ID in general. Obviously, because of the standard error of measurement there is always a chance of over- or under-estimating an actual IQ score (American Psychiatric Association, 2000). Also, the inclusion of individuals with borderline intelligence can inflate the actual prevalence rate of IDs in a population (Noble & Conley, 1992, in Lindsay, 2009).

The type of the index offence and subsequent referral appear also to influence the various prevalence rates. For example, Hogue et al. (2006) found that ID offenders who committed arson were not equally distributed across settings (e.g., 21.4% ID offenders with arson index offences in low/medium security vs. 2.9% in community settings), despite uniform assessment of ID across all three groups. Earlier assumptions (Walker & McGabe, 1973, in Lindsay et al., 2011a) that certain types of offence (e.g., sexual offending) are the hallmark of offenders with ID have not been substantiated thus far (Holland & Perrson, 2011; Lindsay, 2002). Although intelligence levels do not appear to differ between various

"types" of ID offenders (such as ID sex offenders, ID violent offenders), the index offence appears to be related to age, distinct problems with relationships, anger, aggression, physical and sexual abuse, and recidivism rates (Lindsay, Steele, Smith, Quinn, & Allan, 2006).

ASSESSMENT OF INTELLECTUAL DISABILITY IN CRIMINAL JUSTICE RESEARCH

McBrien (2003) noted that prevalence research on ID offenders departs from one of two different perspectives, asking either which offenders do meet the criteria for mental retardation or which individuals with ID do offend. This will obviously influence the findings of a study. No matter what perspective researchers take, it is usually the setting within its administrative framework that dictates the circumstances and further elaboration of the study design. In some studies, the diagnosis of ID has been made *a priori* by someone else without any influence of the researchers in question (e.g., trained facility staff in Lunsky et al., 2011). In others, the researchers had the possibility and responsibility to make the selection according to their own proposed standards (e.g., Søndenaa et al., 2008).

Others have already pointed out the drastic influence of varying assessment methods to identify ID offenders correctly (McBrien, 2003; Simpson & Hogg, 2001). Therefore, we wanted to know whether this repeated criticism of the last 30 years has resulted in any changes in how detailed and accurate is the diagnosis of IDs in forensic studies. We conducted a search for ID-related, empirical studies in a criminal justice context within the Web of Knowledge database for the last 5 years (2006–2011). We used the same keywords as in McBrien (2003, p. 96): "Learning disabil★ or intellectual disabil★ or mental retardation or developmental disabil★ or learning diffic★ or mental handicap or developmental delay or mental impairment. Offend★, criminal justice system, prevalence, epidemiology". To keep the results to a manageable size, we excluded published reviews, case studies and conference proceedings, and confined our query to the following subject areas: psychology, behavioral sciences, criminology and penology, psychiatry, education and educational research. We ultimately retrieved 37 peer-reviewed, empirical studies that fitted into one (or more) of the following categories of reported ID assessment (see Table 1 for an overview) : at least seven papers lacked specific details as to the exact method of diagnosis; 13 studies made reference to prior clinical or psychiatric judgment extracted from case files; eight employed an IQ screening device and partially assessed adaptive behavior; eight described the results of full-scale IQ testing without establishing the degree of adaptive functioning; only three papers reported on measurement of full-scale IQ scores and adaptive behavior; and only five studies explicitly covered all three core criteria of mental retardation.[2] Contrary to nine studies described by McBrien (2003), we found only one that partially relied on self-report. We will briefly review the implications of this diagnostic plurality in more detail.

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[2] Because of a lack of detailed assessment information, several studies could be placed in more than one category at a time (see Table 1).

Table 1. Overview of reported ID measurement with offenders in 37 peer-reviewed studies published during the period 2006–2011

Reported ID measurement	Study
Limited or insufficient ID assessment details	Alder & Lindsay (2007)
	Hays et al. (2007)
	Keeling et al. (2007a,2007b)★
	Lindsay & Skene (2007)
	Lindsay et al. (2008a, 2010b★)
Prior clinical/psychiatric judgment/case files	Gray et al. (2007)
	Lindsay et al. (2008a)★
	Lunsky et al. (2007)
	McGrath et al. (2007a,2007b)
	Morrissey et al. (2007a★,b★; 2010)
	Proctor & Beail (2007)★
	Oliver et al. (2007)
	Rice et al. (2008)
	Rose & Gerson (2009)
	Stupperich et al. (2009)
Self-report	Langevin & Curnoe (2010)★
Screening device/quick test and adaptation	Elbeheri (2009)
	Frize et al. (2008)#
	Hayes (2009)
	Herrington (2009)#
	Pert & Jahoda (2008)#
	Proctor & Beail (2007)★
	Søndenaa et al. (2008)#
	Vanny et al. (2009)#
Full-scale IQ without adaptation	Gast & Hart (2010)
	Keeling et al. (2007a,2007b)★
	Langdon et al. (2007)#
	Langevin & Curnoe (2010)★
	Lindsay et al. (2007; 2008b)
	Ståhlberg et al. (2010)#
	Twill et al. (2010)★
	Williams, Wakeling & Webster (2007)#
Full-scale IQ and adaptation	Murphy et al. (2007, 2010)#)
	Twill et al. (2010)★
Full-scale IQ and adaptation and early onset	Lindsay et al. (2008a, 2010a, 2010b)★)
	Morrissey et al. (2007a,2007b)★

Note: The aforementioned studies of the *Psychology, Crime & Law* double issue (Lindsay et al., 2011a,2011b) are not included in this overview. Also several of the reviewed studies used the same or a partially overlapping dataset.
★Denotes studies that fitted into several categories since they either provided some very general information on the ID criterion used without any further specification (e.g., reporting a "full-scale IQ" or "Wechsler-based instrument") or reported insufficient information for a portion of their samples.
#Denotes studies that further differentiated between different IQ components such as 'verbal' and non-verbal IQ.

Lack of detail on ID diagnosis or reliance on case files

At least seven published papers did not provide any specific details on how the diagnosis of ID was established in the sample under study (Alder & Lindsay, 2007; Hays, Murphy, Langdon, Rose, & Reed, 2007; Oliver, Crawford, Rao, Reece, & Tyrer, 2007; Rice, Harris, Lang, & Chaplin, 2008). For example, Oliver et al. (2007, p. 370) referred to their participants simply as "people with ID" based on ICD-10 criteria, whereas one of the inclusion criteria in Hays et al. (2007, p. 108) was "a history of involvement in ID services" without any further diagnostic specifications. Quite a few papers gave more details, clearly

revealing that the respective diagnosis of a form of ID had been carried out by others prior to the study. For example, Lunsky, Frijters, Griffiths, Watson, and Williston (2007), and McGrath, Livingstone, and Falk (2007a,b) relied on DSM-IV criteria but gave no details as to who made the diagnosis based on what instruments. Several studies are reasonably austere in their descriptions of how IDs were specifically assessed (e.g., Gray, Fitzgerald, Taylor, Macculloch, & Snowden, 2007; Lindsay et al., 2008a; Lindsay, Whitefield, & Carson, 2007; Morrissey et al., 2010; Stupperich, Ihm, & Strack, 2009). Obviously, the lack of clarity regarding the exact circumstances of an ID diagnosis leaves some doubt as to the accuracy of the diagnosis in question (Lunsky et al., 2011). This might also influence the interpretation of the results in terms of reliability and validity.

Self-report

We found only a single study that partially relied on self-report for making an ID-related diagnosis. In a large sample of sex offenders and controls, 2010 had IQ scores at their disposal but vetted their participants via a questionnaire and subsequent interviews regarding any diagnoses or history of IDs during childhood. Positive indicators were checked with medical and records of special education classes, but the limitations of self-report in this context are self-evident (e.g., denial of earlier treatment, providing the wrong information, or simply not being able to remember earlier treatment due to impaired memory functions).

Screening for Intelligence and/or Adaptive Functioning

To circumvent pragmatic problems with the often lengthy intellectual assessment instruments, several abbreviated or screening instruments for intelligence have been developed over recent years. Several studies (e.g., Frize, Kenny, & Lennings, 2008) relied only on screening tests for intelligence, such as the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), or employed an estimation of limited IQ characteristics only, such as the British Picture Vocabulary Scale (BPVS; Dunn, Dunn, Whetton, & Burley, 1997) (e.g., Rose & Gerson, 2009) or the Raven Progressive Matrices (RPM; Raven, Court, & Raven, 1983) (Elbeheri, Everatt, & AlMalki, 2009). Others combined intelligence and level of adaptation screening with different instruments (e.g., WASI and HASI in Søndenaa et al., 2008; K-BIT and HASI in Hayes, 2005; K-BIT and the VABS in Hayes, 2009). Obviously, fully or partially relying on a screening instrument for an ID diagnosis will introduce some form of measurement error. For example, the HASI has been shown to be over-inclusive and to increase the rate of false-positives (Ford et al., 2008; Hayes, 2005).

Full-scale IQ Testing

Some studies reported full-scale IQ testing but no assessment of adaptive functioning [e.g., Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) in Keeling, Rose, & Beech, 2007b] or were unclear regarding the specific IQ test ("Wechsler based measurement"; Keeling, Rose, & Beech, 2007a). In rare instances, authors are as explicit as Lindsay et al. (2010a, 2010b); but for details see, Hogue et al., 2006), who clearly state that their participants fulfilled all three criteria of mental retardation/intellectual

disability. However, they do not reveal in detail how the level of adaptive functioning has been assessed.

Several studies seem to rely on clinical judgment or psychiatric assessment by others, or on a range of various standardized, brief or extensive IQ tests, predominantly originating from the Wechsler (e.g., WAIS-III; WAIS-R, WASI, WISC, etc.) and the Kaufman test families (K-ABC, KAIT, K-BIT, etc.). It is important to understand that, despite some degree of exchangeability between several IQ measures (Floyd, Clark, & Shadish, 2008), they are not parallel forms of each other, but often represent fundamentally different latent intelligence factors. This is illustrated by the discrepancies in IQ total and index scores found between IQ instruments (e.g., Canivez, Neitzel, & Martin, 2005; Floyd et al., 2008; Morgan, Sullivan, Darden, & Gregg, 1997; Robinson, 1999; Thompson, Browne, Schmidt, & Boer, 1997). Despite the decreasing disparity between total test scores across intelligence batteries – as the expanding factor structures cover an increasing amount of cognitive abilities (Flanagan et al., 2010) – Floyd et al. (2008) noted that still 25% of assessed individuals will obtain a 10-point IQ-score difference with another IQ battery. Even though not all studies indicate significant discrepancies between intelligence batteries at the group level (e.g., Thompson et al., 1997), the absence of differences at the individual level cannot be automatically assumed. Thompson et al. (1997) reported, for instance, the staggering difference of 50–63 points between the K-BIT and the Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991) in two participants of their sample of adolescent offenders. It goes without saying that such discrepancies may have a significant impact on the individual concerned. Furthermore, even if an individual achieves similar general IQ scores on two distinct tests, this IQ may mask the underlying diverse pattern of measured abilities. The latter will be elaborated in the presentation of the CHC model later on.

On a positive note, it appears that at least more researchers do actually assess the level of adaptive functioning, compared with one single study in McBrien's (2003) review. Although probably most of the studies we have reviewed, did rely on full IQ testing, we observe a persistent lack of detailed assessment information to date. Returning to the aforementioned double special issue of *Psychology, Crime & Law* from 2011, it appears that none of seven empirical studies (Blacker, Beech, Wilcox, & Boer, 2011; Fitzgerald, Gray, Taylor, & Snowden, 2011; Holland & Perrson, 2011; Lindsay et al., 2011; Lunsky et al., 2011; Singh et al., 2011; Snoyman & Aicken, 2011) reported both full-scale IQs and a description of how exactly the level of adaptive functioning had been measured. Only a few provided some/more details on the circumstances of the IQ assessment. More surprising, however, is the fact that despite tackling a variety of highly relevant research issues, no article dealt exclusively with the problems of the correct assessment of ID in the first place. Low cognitive abilities appear to be part of the inclusion criteria in assessment, but this is done in a rather routine and atheoretical manner.

In summary, and as was expected, ID-related diagnoses are still made with a variety of brief or full IQ instruments, sometimes gauging the level of adaptive behavior with different methods, where studies do not always disclose the full details of assessment. We have to remind ourselves that the variety of employed IQ and adaptive functioning measurements are not as interchangeable as we would like. In favor of several studies, it can be assumed that the diagnostic process has been done thoroughly according to proposed diagnostic standards in specialized settings, but this remains an assumption. Obviously, researchers often do not have the luxury for time-consuming in-depth assessment of inclusion criteria, and they have to rely on practitioners for a correct field

diagnosis prior to the study. It is interesting to note that the level of interrater reliability (IRR) for any form of diagnosis is hardly ever mentioned, or questioned. This is neither a trivial matter nor one that is unique to this field. Though a manual of a standardized instrument will hopefully give the user some idea of what to expect in this regard, the reality concerning the IRR of psychiatric diagnoses and other instruments has been known to differ. A recent study by Edens, Boccaccini, and Johnson (2010) regarding IRR of the Psychopathy Checklist –Revised (PCL-R; Hare, 2003) illustrates that IRR calculated between practitioners appears to be much lower than expected, even after the standard error of measurement has been taken into account. To our knowledge, similar studies regarding the diagnosis of ID in offender populations have not been carried out as yet, but this should be done sooner rather than later.

A NOVEL CONCEPTUAL APPROACH TOWARDS A MULTI-DIMENSIONAL IQ:

THE CHC MODEL

As described earlier, we face a muddle of diagnostic problems in research and practice with ID offenders. Specifically with regard to intelligence, a broad spectrum of related, but not fully interchangeable, instruments are being used, whereas it is highly probable that psychologists use one or several intelligence batteries assuming that they will all yield similar IQ scores and, hence, that they all tap similar, if not entirely identical, cognitive abilities constructs. Furthermore, if intelligence is fully assessed, most of the time only the total IQ or the index scores are reported, averaging out the individual strengths and weaknesses. This masks the complexity of the underlying construct, and in turn hides the heterogeneity of individuals with regard to their cognitive abilities.

All these issues reflect a startling lack of attention for the theoretical underpinning of the construct of intelligence within the forensic literature. When referring to ID and intelligence as such in offenders, authors tend to primarily differentiate the offenders based on a total IQ score, typically indexing an individual's overall level of cognitive functioning. Indicating an individual's cognitive abilities with one score is comparable to synthesizing an individual's personality with one number (McGrew, 2009), which suggests an oversimplification of the underlying construct. A further refinement of the intelligence construct within the forensic literature is often restricted to the use of the two-factor structure consisting of verbal and non-verbal or performance components, and to a much lesser extent of fluid and crystallized intelligence (e.g., Table 1). However, such dichotomies are expected to gradually disappear with the increased use of more recent intelligence instruments distinguishing four or more components. The Wechsler Adult and Child Intelligence Scales have, for instance, evolved from assessing two cognitive abilities (i.e., verbal and performance intelligence) to assessing four cognitive abilities (i.e., verbal comprehension, perceptual organization, working memory, and processing speed). Although these aforementioned four-factor models are still far from flawless (MacLean, McKenzie, Kidd, Murray, & Schwannauer, 2011), this is an evolution that should be acclaimed given the extensive and still growing factor analytic work

challenging any two-factor model of intelligence model (e.g., Carroll, 1993). Despite the promising and ever-evolving intelligence research, a possible first pitfall is worth mentioning: far too many people are tempted to equate the factor structure of such instruments with intelligence; the instrument becomes the underlying construct. This problem is reflected in the rather exclusive focus on the index scores obtained with the intelligence instruments, without taking into account other components of intelligence. Hence, it is necessary to go back to basics, namely what intelligence really comprises. Here, the CHC model of cognitive abilities has the potential to capture the complexity of intelligence in a psychometric substantiated model. Over the past 15 years, this model has been adopted in several areas in psychology (e.g., school, developmental, and neuropsychology; Davis, Shunk, Finch, Dean, & Woodcock, 2006; Keith & Reynolds, 2010; McGrew & Wendling, 2010; Elliott, Hale, Fiorello, Dorvil, & Moldovan, 2010), but to our knowledge, this has not happened yet in forensic psychology. We want, therefore, to seize the opportunity to introduce the CHC model into the criminal justice and forensic research arena. We will then illustrate its possible relevance and benefits.

The CHC model is the most prominent psychometric theoretical model of human cognitive abilities (Alfonso, Flanagan, & Radwan, 2005). It owes its name to two concepts that were integrated under one taxonomic framework of human cognitive abilities: Cattell and Horn's *Gf-Gc* model (Cattell, 1943; Horn, 1985, 1988, 1991, 1994) and Carroll's (1993) hierarchical three-stratum theory. Cattell's theory forms the first precursor to the current CHC model and comprises a dichotomous conceptualization of cognitive abilities. According to Cattell, fluid intelligence (*Gf*) refers to both inductive and deductive reasoning abilities that are influenced by biological and neurological factors, as well as incidental learning through interaction with the environment (Alfonso et al., 2005). Crystallized intelligence (*Gc*) refers to the primarily acquired knowledge abilities that largely reflect the influence of acculturation (Alfonso et al., 2005). Horn (1965) expanded this dichotomy by eventually including seven additional broad abilities. This resulted in the birth of the Cattell–Horn *Gf-Gc* theory (Horn & Blankson, 2005). In 1993, Carroll placed these cognitive abilities in three strata dependent on their perceived breadth and narrowness (Alfonso et al., 2005; Carroll, 2005). These two theories are nowadays synthesized under the CHC umbrella (see Figure 1). Stratum III represents the general ability *g* or intelligence factor. Stratum II holds eight broad abilities besides the *Gf* and *Gc*: quantitative knowledge (*Gq*), reading and writing (*Grw*), short-term memory (*Gsm*), visual-spatial processing (*Gv*), auditory processing (*Ga*), long-term storage and
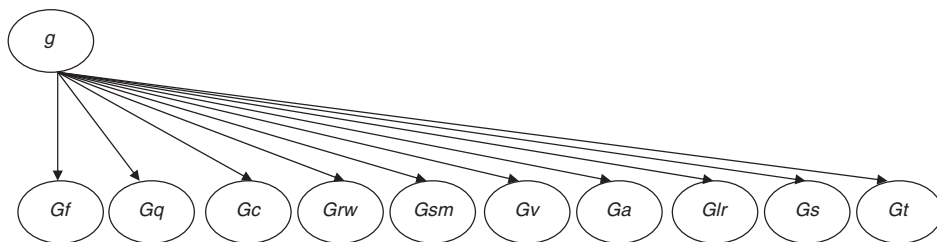

Figure 1.   Schematic representation of the Cattell–Horn–Carroll (CHC) model. Stratum III (*g*) and stratum II (broad cognitive abilities) are depicted, whereas the narrow abilities are not listed due to space limitation. *g*, general intelligence factor; *Gf*, fluid; *Gq*, quantitative knowledge; *Gc*, crystallized intelligence; *Grw*, reading and writing; *Gsm*, short-term memory; *Gv*, visual-spatial processing; *Ga*, auditory processing; *Glr*, long-term storage and retrieval; *Gs*, cognitive processing speed; *Gt*, decision and reaction speed.

retrieval (*Glr*), cognitive processing speed (*Gs*), and decision and reaction speed (*Gt*). Stratum I contains over 70 narrow abilities. It is beyond the scope of the current article to describe the model from a historical perspective, the nature of each ability, and the latest adaptations. Those interested are referred to McGrew (2005, 2009) and Alfonso et al. (2005).

The CHC model has many strengths. First, it provides a common nomenclature for describing cognitive abilities. Second, it serves as a comprehensive and empirically based framework to identify and understand cognitive abilities (Phelps, McGrew, Knopik, & Ford, 2005), as well as a platform for hypothesis testing in research and in practice (McGrew, 2009). Hence, it bridges the theory-to-practice gap (McGrew, 2009). From this perspective, it is no surprise that some claim that the CHC model may be considered as the "Rosetta stone" (McGrew, 2005) or the periodic table of intelligence (Horn, 1998, p. 58), providing a better understanding of the intelligence structure and a necessary aid for classifying cognitive abilities (McGrew, 2009).

This praise for the CHC model seems to be supported by recent intelligence research to a large extent. Explicit or implicit influences from the CHC model in nearly all new intelligence batteries can be found. The manuals of the Woodcock–Johnson III Tests of Cognitive Ability (WJ III; Woodcock, McGrew,& Mather, 2001), the Kaufman Assessment Battery for Children, Second Edition (KABC-II; Kaufman & Kaufman, 2004) and the Stanford–Binet Intelligence Scales, Fifth Edition (SB5; Roid, 2003), to name a few, all endorse the CHC model. In addition, factor analytic studies generally provide evidence for the structure of these instruments, as well as for the underlying theory (see for a critical review, Keith & Reynolds, 2010). Also, instruments based on alternate theories or an eclectic mix of theories seem to be consistent with the CHC model. The Wechsler scales, for instance, are doubtlessly the most researched and clinically administered intelligence scales (Zu & Weiss, 2005, p. 297). Based on mainly clinical and practical considerations, the subtests of the first versions of the Wechsler scales were grouped into verbal and performance or non-verbal scales (Wechsler, 1958). Although Wechsler recognized that these were not the only abilities involved in these tests (Wechsler, 1958), it was not before the recently revised Wechsler scales, the WAIS-III (Wechsler, 1997) and the WISC-III (Wechsler, 1991), that more cognitive abilities were being recognized. After this, the newer versions incorporate four index scores, as described earlier, and are more in line with the CHC model, albeit to a limited extent (Benson, Hulac, & Kranzler, 2010; Keith & Reynolds, 2010). Nevertheless, looking at current practice and research, one may wonder how long it will take before practitioners and researchers will able to let go of this outdated dichotomy (Herrington, 2009).

Research into the validity of the CHC model has been growing rapidly over the last 15 years (for a review, see Keith & Reynolds, 2010). Researchers have mainly been focusing on the construct validity of the model, which has well been substantiated by "synthesizing hundreds of factor analyses conducted over decades by independent researchers using many different collections of tests. Never before has a psychometric ability model been so firmly grounded in data" (Daniel, 1997, as cited in Flanagan, 2010). The model has largely found support through confirmatory factor analyses (CFAs), and, to a lesser extent, through other factor analytic techniques (Keith & Reynolds, 2010). Both broad and narrow abilities as formulated in the model are found to have predictive value for a diverse range of academic outcomes (McGrew & Wendling, 2010). Notwithstanding this, we do not claim that the CHC model is perfect or finished. Factor analytic evidence for the model primarily comes from CFAs;

other factor analytic work is more ambiguous. Hence, researchers and practitioners alike should be aware of the model's imperfections, or as Carroll (2005, p. 75) modestly states: "much work remains to be done in the factor analytical study of cognitive abilities. The map of abilities provided by the three-stratum theory undoubtedly has errors of commission and omission, with gaps to be filled in by further research" (cited in McGrew, 2009). Future research should explore further the aforementioned caveats in current intelligence research, as well as its utility for other domains such as forensic psychology.

RELEVANCE AND IMPLICATIONS OF THE CHC MODEL FOR FORENSIC RESEARCH AND CLINICAL FORENSIC WORK

To illustrate the possible significance of the CHC for forensic research and practice, we will first challenge the usefulness of total IQ scores in offenders with and also without ID. Then the value of a more thorough strengths-and-weaknesses profile of the offenders' cognitive abilities will be explored. Finally, we will describe how CHC-consistent intelligence profiles can be obtained and what challenges this could raise in terms of research and practice.

Beyond the IQ of the Offender: Challenging the Usefulness of Global IQ Scores

To parse the heterogeneity within the group of offenders with IDs, different categorizations are being recognized. Offenders with ID are often classified based on their index offence, which is illustrated, for instance, in several papers focusing on specific offender types (e.g., Guay, Ouimet & Proulx, 2005; Keeling, Beech, & Rose, 2007c). This is undoubtedly one valuable way to create more homogenous offender groups for research or treatment purposes (e.g., Alexander, Crouch, Halstead, & Pischaud, 2006). However, this will always remain a very arbitrary distinction, ignoring the complexity of the intelligence construct. Consequently, offenders with ID are being lumped together based on their IQ scores, although a diverse range of intelligence profiles can be expected when taking the CHC model into consideration. Fiorello and Primerano (2005) described two cases who were officially diagnosed with mental retardation when using a Wechsler-based instrument and WJ-III. However, the researchers' additional CHC-consistent assessment shed another, more nuanced light on their intellectual functioning. Only one of these individuals could be actually diagnosed with ID, obtaining low scores on all high g-tasks. The second person performed well on high g-tasks as long as the tests didn't too heavily rely on language skills (e.g., low Ga and Gs). Additional testing confirmed that the latter had a language disorder, and not ID. Although this example stems from the school psychology domain, it can be assumed that similar erroneous diagnoses occur with offenders. The CHC framework might help to identify other mechanisms as learning or language disorders which may underlie the low IQ scores, especially when taking the high language demands of the Wechsler scales into consideration (Fiorello & Primerano, 2005). By acknowledging this diversity, further assessment and treatment could be more focussed. Returning to the aforementioned case studies, the therapy of the first person, for instance,

concentrated on his skills (i.e., his *Gsm* and *Grw* were relatively strong), whereas the therapy for the other person focused on speech and language.

In this way the CHC framework might also help to shed more light on the very prominent but muddled group with mild to borderline ID that has been difficult to properly diagnose and treat for various reasons (Lindsay et al., 2011b). Although this group forms a substantial part of ID populations (Holland & Persson, 2011), and is probably more pronounced in forensic than in non-forensic populations (Raina & Lunsky, 2010), specific knowledge on their capabilities and weaknesses is scant and diffuse. This is reflected in the as yet unanswered but prominent questions in criminal justice practice regarding their competence to stand trial, their understanding of their rights, and their accountability in the charges. For instance, Colwell et al. (2005) found that intelligence, and particularly verbal intelligence as measured with the WASI, was one of the strongest predictors in the comprehension and apprehension of the Miranda warnings. However, the authors were reluctant to offer clear solutions for cases where the suspect exhibits restricted cognitive abilities. Consequently, questions about whether such individuals are capable of retaining the warnings in their (short-term) memory, or whether they benefit from information-giving primarily through the auditory or non-verbal mode, are likely to remain unanswered when relying on instruments that focus on the common two- or four-factor structure. However, such information can be acquired when using the CHC framework. This line of questions can also be asked in the case of those without a formal diagnosis of ID. By assessing the total spectrum of cognitive abilities, a more profound and useful cognitive profile could be obtained from those without ID, but who are socially and cognitively disadvantaged in comparison to the general population. This group is likely to be overrepresented in the criminal system (Jones, 2007).

Fleshing out Links Between Intelligence and Offending

Through the CHC model, new insights could be obtained into the relation between intelligence and offending. Total IQ scores seem to add relatively little to this relationship (Levine, 2008; Richter, Scheurer, Brannett, &Krober, 1996). Rather, certain intelligence components seem to relate to relevant correlates, such as recidivism. When applying the two-factor model of intelligence, one consistent finding is that low verbal intelligence, rather than performance intelligence, is related to antisocial behavior and recidivism (Bassarath, 2001; Isen, 2010; Vermeiren, Schwab-Stone, Ruchkin, De Clippele, & Deboutte, 2002). To date, however, only a few studies have fleshed out the relation between intelligence and recidivism in more detail. For example, scores on Finger dexterity and Motor and Spatial Aptitude, as measured with the General Aptitude Battery (Dvorak, 1947) were found to predict recidivism in rape (Levine, 2008), and scores on the Verbal Scale and on Block Design-subtests from the Wechsler Intelligence Scale were predictive of recidivism in general offending (Richter et al., 1996). However, besides the fact that these studies still need to be replicated, the assessment of the different intelligence components in these studies also exhibits important shortcomings. For instance, Richter and colleagues relied on the separate subtests for unraveling the IQ- and index scores further, a methodology that is not recommended in the general intelligence literature (e.g., Flanagan, Ortiz, S.O., & Alfonso, 2007, p. 30). Nonetheless, these results question the utility of relying solely on the total IQ-score, and urge forensic researchers to look into the relevance of the separate intelligence components, which is in line with the CHC model. Relevant hypotheses can be hence

derived from the CHC model. For example, one interesting research path would be to study whether offenders are particularly impaired in *Gf* or *Gc*. Taking into consideration that offenders are often disadvantaged with regard to education (Richter et al., 1996; Rossegger et al., 2009), it can be hypothesized that they primarily exhibit problems on *Gc*. However, if the problem would mainly regard *Gf*, schooling programs offered in prisons for instance might not be the (sole) answer to this problem.

From IQ Scores Towards a Strengths-and-Weaknesses Profile

Forensic researchers and practitioners might benefit from mapping the cognitive capabilities and weaknesses of an individual within a CHC intelligence profile in several ways. It is important to form a picture of the individual's cognitive abilities, taking into account the implications for further assessment. Not all instruments included in the regular assessment batteries are suitable for offenders with ID or even for those with below average intellectual functioning (Keeling et al., 2007a). The CHC model may assist in exploring further assessment possibilities in the individual. To illustrate, despite the ongoing debate regarding the empirical evidence for its validity (Musewicz, Marczyk, Knauss, & York, 2009), researchers and practioners still quite commonly use projective assessment material in forensic settings. This is reflected in the attention in the literature paid to the validity of such instruments in various offender groups (e.g., Daderman & Jonson, 2008; Wood et al., 2010). However, an often overlooked but relevant question for obtaining reliable and valid results with projective material is whether an offender has the necessary capacity for visual processing and processing speed to apprehend and react to the visual stimuli of the Rorschach, for example. RPM-based IQ scores (e.g., Vandevelde, Broekaert, Schuyten, & Van Hove, 2005), indexing only *Gf* (Alfonso et al., 2005), will not yield such necessary information, whereas CHC-consistent measurement will.

Given that intelligence is predictive for treatment attrition (Olver, Stockdale, & Wormith, 2011), that an ID diagnosis is related to relatively high recidivism rates (Barron, Hassiotis, & Banes, 2004; Holland & Persson, 2011), and that current treatment programs for ID offenders are often inadequate (Barron et al., 2004; Lunsky et al., 2011; but see, Lindsay, 2009), there can be little dispute that the development of proper treatment programs aimed at (or based on) the specific cognitive abilities of these offenders is of key importance. As Flanagan et al. (2010) state, the CHC model is a useful tool to obtain insights into why certain intervention methods do not work, what interventions, compensatory strategies, and accommodations might be more effective, and what are the most promising means of delivering instruction and implementing intervention. For (forensic) clinicians it is of fundamental importance to know how to communicate and organize their interventions to obtain a maximal result with the respective offender, especially when taking into account the responsivity principle. Following this principle, which is still one of the most common approaches in the correctional domain (Ward & Langlands, 2009), interventions should match certain characteristics of offenders, such as their learning style, and more broadly, their intellectual functioning. By doing so, the intervention will make more sense to offenders, will enhance the probability that the program is being sufficiently understood, and will allow necessary life changes to be made to reduce the likelihood of reoffense (Andrews & Bonta, 2003). Abilities like improving perspective-taking and social problem-solving skills often form central therapeutic goals in criminal behavior programs in various groups of offenders (e.g. sex offenders; Marshall,

Marshall, Serran, & O'Brien, 2009; Palmer, 2003). These programs rely on a wide range of abilities involving inhibition of unwanted/antisocial behavior and emotion recognition (Marshall et al., 2009; Reeder, Smedley, Butt, Bogner, & Wykes, 2006), each mandating a diverse set of cognitive abilities, such as visual processing and short-term memory (see e.g., Flanagan, Alfonso, Ortiz, & Dynda, 2011). In line with the responsivity principle, it is therefore important to explore whether the offender possesses the necessary cognitive abilities. To investigate these cognitive abilities, however, mainstream intelligence batteries as WAIS-R and KAIT may be inadequate. They do not tap the respective abilities at all (see Alfonso et al., 2005), or their total and index test scores will not explain well enough whether these abilities are attenuated in the individual. Only a test battery that allows sufficient differentiation of these cognitive abilities, and which is embedded in a solid theory, such as the CHC theory, can assist the clinician in developing appropriate interventions. This brings us to the implementation of the CHC model in practice.

PUTTING IT INTO PRACTICE: CHC-CONSISTENT INTELLIGENCE MEASUREMENT

We have illustrated that CHC-consistent intelligence measurement can improve our understanding of ID in offenders, of the relationship between intelligence and offending, and may help to refine and optimize the assessment and treatment of offenders. But the question remains, how can the CHC model be put into practice? At this moment, there are only two methods that allow assessing the breadth of broad cognitive abilities: the WJ III tests (Woodcock et al., 2001), being the first cognitive test to be based explicitly on the CHC model and covering all broad cognitive abilities (Flanagan et al., 2007, pp. 14–18), and the CHC-based Cross Battery (CB) assessment procedures (McGrew & Flanagan, 1998), a psychometrically defensible method of evaluating data within and across intelligence and achievement batteries. Because none of the current standard batteries is able to encapsulate the entire theory (Newton & McGrew, 2010), the CB procedure was constructed based on theory-driven joint factor analyses and expert consensus studies (Alfonso et al., 2005), and is still generating empirical support (Phelps et al., 2005). The CB procedure helps practitioners to organize assessment, to generate and test hypotheses regarding an individual's functioning, and it allows them to draw reliable and valid conclusions from cross-battery data in a systematic manner (Alfonso et al., 2005). Following the CB procedure, the user starts the assessment with the administration of a standard intelligence test. When this intelligence test does not cover all broad abilities, the user (restrictively) administers additional subtests from other intelligence tests that cover the missing abilities. Within each cognitive domain, at least two subtests should be administered, each assessing a unique narrow cognitive ability of that domain. Through this procedure, the user can obtain information on the general ability g and all broad and some narrow cognitive abilities (see Flanagan et al., 2007 for an extensive address of the CB-assessment guidelines).

Although the CHC model holds a lot of promise, applying this model might not always be achievable because of pragmatic issues, nor can the model be assumed to be flawless. First of all, practitioners and researchers might be reluctant to apply the CHC model because of its complexity. However, the CHC model is construed to elucidate the complexity of the intelligence construct, not to enhance it, and should therefore be

applied in this way. In the first place it should be used to put the IQ scores of an individual into the right perspective. Several authors have already modeled the existing intelligence batteries within the CHC framework (see, e.g., Alfonso et al., 2005) by indicating which specific cognitive abilities as depicted in the framework the current batteries are measuring. For instance, although the RPM are easy to administer and less time-consuming than other tests, they are found to assess only the *Gf*. Also, the WAIS-III primarily taps *Gf*, *Gc*, *Gv*, *Gsm*, and *Gs*, and the KAIT primarily measures *Gf*, *Gc*, *Gv*, and *Glr* (see, for an extensive overview, Alfonso et al., 2005). Such overviews can guide the practitioner in giving a nuanced interpretation of a given intelligence profile, and will contravene the over-stressing of the IQ scores as such. They will also provide a common nomenclature in both research and practice, by, for example, enhancing the comparability among studies applying different intelligence batteries. A related issue concerns the possible pragmatic problems of a CHC-consistent assessment (e.g., the relatively long duration of such a thorough intelligence assessment, and the unavailability of CHC-consistent assessment batteries such as the WJ III in certain languages). Such situations can be countered with the following two approaches:

1. The practitioner assesses two subtests, each tapping a distinct narrow cognitive ability for as many cognitive abilities as possible; if five or six broad cognitive abilities are being assessed, a reliable indication of '*g*' can be obtained.
2. Based on clearly defined hypotheses, the practitioner selects particular cognitive abilities to measure; however, if not enough broad abilities are being measured, the practitioner does not make any statements about the general IQ of the individual in question (see the guidelines of Flanagan et al., 2007).

Second, the current CHC model is not the end of the road. Although the latest studies validating the factor structure of the CHC model are promising (e.g. Phelps et al., 2005), further research focusing on the validity of broad and narrow cognitive ability constructs is still scarce and is needed for more refinement and development of the model. Looking at the complex structure one might, however, wonder whether we are over-factoring not only the current intelligence instruments (Frazier & Youngstrom, 2007), but also the intelligence construct. This discussion is far from conclusive (Keith & Reynolds, 2010). Without disrespecting the work of previous giants in intelligence research (e.g. Spearman, 1904; Thurstone, 1938; Vernon, 1950) no other model has yet theoretically or statistically sufficiently shown the intelligence construct to be less complex, let alone existing out of a single general intelligence factor *g* or even two factors (Flanagan & McGrew, 1998). Taking into account the fact that, in true science, predictions are made from theories and are then tested against the data (Keith & Reynolds, 2010), it seems paradoxical that intelligence research within the forensic domain still focuses to a large extent on models such as the Wechsler-Bellevue scale dating from the late 1930s, which do not adequately incorporate advances in the understanding of cognitive functioning (Boake, 2002). Nevertheless, we do not assume that the CHC model is the Holy Grail of intelligence models. Validation studies are needed: not only should the construct validity be studied in various populations, but so too should the predictive validity of the different CHC broad and narrow factors. Only with this information can we evaluate whether the time and effort required in assessing extensive batteries are worth it. Notwithstanding this, we owe it to offenders to develop a thorough understanding of their cognitive abilities, given the huge impact of psychological evaluations on their mental well-being within the juridical process

(Vandevelde et al., 2011), as well as to the community, in order to ensure cost-effective psychological assessment and treatment (Frazier & Youngstrom, 2007).

CONCLUDING REMARKS

The aim of the current article was twofold. We first evaluated the current situation of intelligence assessment in offenders with ID. Unfortunately, despite previous researchers having pointed out such problems, we have to conclude that diagnostic chaos still remains. Over the years, the clinging to IQ and general index scores has resulted in the forensic community losing sight of the multi-dimensionality and complexity of the cognitive abilities spectrum. Therefore, and secondly, we introduced the CHC model, a psychometrically well validated theoretical model of cognitive abilities, and elaborated on its possible benefits for forensic research and practice. By mapping both intelligence and adaptive functioning in a reliable and valid manner, we could start bridging the gap between intelligence theory and forensic practice, which could result in a major leap towards intelligent assessment of offenders' intelligence.

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