Part I

The development and evaluation of a uniform multidisciplinary diagnostic procedure for children with speech and language problems

Part I describes the first two research purposes of this study: the development of a multidisciplinary diagnostic procedure for children with speech and language problems, and the usefulness of this MultiDD protocol. Chapter 2 describes the choice for disciplines which are part of the multidisciplinary team, based on the many factors influencing language acquisitions and development. Chapter 3 describes the development of the MultiDD protocol and scheme for a diagnosis related treatment recommendation, and Chapter 4 describes three explorative studies in which the usefulness of the MultiDD protocol is examined.
2 MultiDD for children with speech and language problems:
which disciplines should participate?

2.1 Introduction

For the development of a multidisciplinary protocol, we first analysed the factors influencing language acquisition and development. Risk and/or causative factors likely to be associated with speech and language problems consist of external and internal factors, i.e. the language input and the infant’s linguistic competence resulting in the process of language development, see Table 2.1 (Fletcher & Hall, 1992; Bishop, 1997; Leonard, 1998; Goorhuis-Brouwer & Schaerlaekens, 2000; Kuhl, 2000; Cutler & van de Weijer, 2000). Language input is influenced by external factors like socioeconomic status, family composition, and way of caring. Internal factors determine the way in which the child can handle the language input. Many factors are mentioned in the literature, e.g. linguistic competence, genes, gender, birth weight, hearing, learning capacity, speech motor capacity, neurological and psychiatric status.

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2.2 External factors influencing language input

Language input at the pre-lingual stage (0 - 1;6 years) is necessary to prepare the brain for language acquisition. Kuhl demonstrated that in the first year of life prior to the time infants begin to master higher language skills, children learn a great deal about the perceptual characteristics of the native language (Kuhl, 2000). At birth, all infants react to many types of sounds, even those not belonging to their own language. In the first year of life, their phonetic perception will increasingly adapt to the native-language patterns. Discrimination of speech sounds therefore becomes language specific. This also brings about the developmental change from universal babbling to language-specific babbling. This developmental change is caused by a complex “mapping” of linguistic input. The brain becomes organised and develops a sensibility for the native language (Kuhl, 2000; Cutler & van de Weijer, 2000). The development of native language perception and speech develops according to a time frame of critical or sensitive periods. The phonemic critical period is assumed to be in the first year of life. It forms the basis for semantic organisation, which is assumed to have a critical period in the first four years. The critical period for syntax extends into the late teens (Ruben, 1997).

In order to facilitate the process of language learning, parents tend to adjust their speech to the age and capacities of their infant. This “motherese” or Child Directed Speech (CDS) is unique in its kind and is used universally. It has a characteristic prosodic structure with a higher pitch, a slower tempo, and exaggerated intonation contours, and it is syntactically and semantically simplified. Although motherese has been universally observed, there are considerable differences in the amount and quality of language input, based on socioeconomic status, family composition and day-care versus home-care (Goorhuis-Brouwer & Schaerlaekens, 2000; Kuhl, 2000; Mellon, 2000).

2.2.1 Socioeconomic status

Differences in language addressed to the child can be influenced by parental education and socioeconomic status (SES). Within this framework, Bernstein introduced the terms
‘restricted code’ and ‘elaborated code’ (Bernstein, 1971). The restricted code is connected to parents from lower social classes. They tend to be more directive, and they forbid and command more and talk less frequently to their children. The elaborate code is connected to parents from higher social classes. They tend to be more explanatory, and they name and verbalise objects and situations, and speak more frequently to their children. Since Bernstein, a great deal of research has been carried out regarding the relation between SES and language development in children. Many studies have concluded that speech and language problems could be traced back to differences in parental education and SES (Wright, et al. 1983; Scottish Low Birthweight Study Group, 1992; Hack, et al. 1992; Lee & Barratt, 1993; Walker, et al. 1994; Smith, Ulvund, & Lindemann, 1994; Hart & Risley, 1995; Tomblin, Smith, & Zhang, 1997). The overall idea in the literature is that language input is rudimentary for speech and language development, and that amount and quality can influence the speed and quality of language development. However, it remains unclear as to which language aspects are most strongly influenced by the amount and quality of language input.

2.2.2 Family composition

Like SES, family composition, i.e. presence of siblings, presence of one or two parents and birth order, can influence speech and language development. One well-established finding is that first-born children tend to develop faster than subsequent siblings (Bishop, 1997). However, this does not mean that only younger siblings develop speech and language disorders. The influence of a single-parent or two-parent household is not yet clearly understood. Some studies find better communication skills and less communication problems in children from single-parent homes (Madden & Laurence, 1995). Others studies report opposite findings: children in single-parent families have one and a half times more chance of developing speech and language problems than children from two-parent homes (Verschuren & Thijs, 1995).
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2.2.3 Day-care versus home-care

Language input is often provided within the family, but also comes from other caregivers outside the family. Particularly in contemporary society characterised by both parents working outside the house, children are often cared for by babysitters, host families, and day-care centres. Language input from babysitters and host families will be similar to the language input from the home-family: there is at least one adult and possibly there are other children. However, language input from day-care centres is different. The number of children cared for in child centres is higher compared to home settings. This can result in less individual attention, but more child-to-child interaction. Furthermore, teachers at day-care centres may or may not be professionally trained, and thus the quality of day-care centres can rather differ. The assumption is that children in day-care centres are more able to express themselves compared to other children, which may lead to improved expressive language performance, whereas there is less individual contact with a language-competent adult which may lead to weaker perceptive language development. However, uncertainty remains concerning the influence of day-care on the language development of young children. Research results are ambiguous, e.g., expressive language development is better in day-care children but they have weaker auditory comprehension abilities (Buelow, 1988); day-care girls and in-home care boys exhibit more positive language development, i.e. quality of language and self-expression (Medcalf-Davenport, 1993). There is no difference in the receptive and expressive language development in home-care and high quality day-care children (Ackerman-Ross & Khanna, 1989). At the same time, however, children who are not taken care of in day-care centres are at risk of experiencing delays in speech and language development (Verschuren & Thijs, 1995). Thus, the influence of day-care on language development remains unclear.

2.3 Internal factors: the language-learning child

Children are able to acquire language from language input because they are born with a genetically-based capacity for language learning called Language Acquisition Devices
(LAD), “linguistic competence” or Universal Grammar (UG) (Chomsky, 1965; McNeill, 1970; Pinker, 1995). This capacity enables them to recognise the features that are universal to all languages, and transform and develop their linguistic knowledge to their own language structures, as described above. Genes and gender are thought to influence linguistic competence. Apart from genes and gender, which basically influences the language learning capacity of the child, other child factors can be present which can retard language development.

2.3.1 Genes
Although there does not seem to be one “language gene”, pedigree analyses support the idea of a genetic influence on language learning (Fletcher & Hall, 1992; Leonard, 1998; Plomin & Dale, 2000; Bishop, 2002). Although not all children with language problems have a family history of language problems, many children with language impairments have parents with similar problems. In addition, twin studies suggest that genes play an important part in the etiology of language disorders (Fletcher & Hall, 1992; Bishop, 1997; Bishop, 2001).

2.3.2 Gender
Gender also influences language development: language development in boys tends to be slower than in girls (Verhulst-Schlichting, Morelli-Kayser, & Peddemors-Boon, 1987; van Eldik, 1998; Leonard, 1998). Moreover, language disorders are more prevalent in boys than in girls, with a ratio of approximately 3:1 (Goorhuis-Brouwer, 1988; Bishop, 1997; Leonard, 1998; Shriberg, Tomblin, & McSweeny, 1999). Perhaps this is due to cultural influences, but a more plausible explanation can be found in biogenetic differences (Goorhuis-Brouwer, 1988). In a recent study, it was pointed out that boys mainly showed specific language disorders, whereas girls showed more non-specific language disorders (Knijff & Goorhuis-Brouwer, 2001). This perhaps indicates that the language learning capacity in boys often is weaker than in girls. In girls the language problem mostly appears when physical and psychological factors are
inadequate. In boys the language problem can be present under normal physical and psychological status.

2.3.3 Prematurity and low birth weight

(Very) low birth weight and premature birth are often considered to be risk factors for speech and language development. Some studies confirm the theory that children with (very) low birth weight are at risk for speech and language developmental problems (Wright, et al. 1983; Veen, et al. 1991; Scottish Low Birthweight Study Group, 1992; Gallagher & Watkin, 1998; Briscoe, Gathercole, & Marlow, 1998; Gutbrod, et al. 2000). Others found no significant difference in children with low birth weights and full-term infants (Aram, et al. 1991; Tomblin, et al. 1997). Contradictions in language outcomes are probably due to methodological differences: studies varied in the characteristics of comparison groups that were used (if used at all), studies varied in the measures of language skills, and studies varied in the characteristics of the research group (Gallagher & Watkin, 1998). Despite these differences, it is suggested that differences in language and speech outcomes are more related to socioeconomic aspects rather than to birth weight and prematurity (Hack, et al. 1992; Lee & Barratt, 1993; Tomblin, et al. 1997). Gallagher & Watkin (1998) concluded that although the research regarding the language developmental risk of prematurity has been mixed, being born too young, too small or both represent language developmental risk factors that increase in that order. Although the effect of low birth weight on speech and language development is still unclear, there seems to be evidence to support the idea of monitoring the language development of these children.

2.3.4 Hearing

In children with hearing problems, the development of the auditory perception is at risk. Especially in young children, (sub)normal hearing is essential for central auditory processing and phonemic awareness, which is the basis for language comprehension and thus for language production. When children are not able to hear all the contrasts between phonemes, they do not learn which sounds are distinctive to their language
(Bishop, 1992; Goorhuis-Brouwer & Schaerlaekens, 2000). Both perceptive and conductive hearing loss can have a negative influence on language development (Bamford & Saunders, 1994; McCormick, 1996). The association between fluctuating conductive hearing loss based on otitis media with effusion (OME) and language development is a topic of discussion in the literature (Schilder, et al. 1994; Bishop, 1997; Groenen, 1997; Vernon-Feagans, 1999; Shriberg, et al. 2000; Rovers, 2000). Otitis media with effusion (OME) is thought to muffle the reception of sound and typically causes a conductive hearing loss of some 20 to 40 dB, which especially complicates the speech intelligibility in the presence of background noise or during group conversation (Bishop, 1997). It seems likely that a negative effect of otitis media (OM) on speech reception or production would occur during the first few years of life when the child is acquiring the sounds of the language. There is much less evidence of an effect of OM on expressive language at school age (Vernon-Feagans, 1999). The influence of OME on speech and language development still remains ambiguous.

2.3.5 Speech motor problems

In children with problems in speech motor capacities, sometimes based on neurological problems or anatomical problems (e.g. children with cleft lip and/or palate), the linguistic competence cannot be converted to the correct speech signal. The problem is an output disorder (Bishop & Mogford, 1989; Bishop, 1992; Goorhuis-Brouwer & Schaerlaekens, 2000). Limitations in the range of articulatory movements in the first place affect phonological development, but later influences all language structures, not only the superficial, but also the deep phonological structure (i.e. the lexical inventory, syntax and grammar) (van Lierde, et al. 2001). Severe language disorders can result.

2.3.6 Mental retardation

Children with mental retardation have limitations in their learning capacity. Because of restricted memory, they show limitations of cognitive processing capacity. They cannot build up their language as quickly, and often not as completely, as children with normal learning capacities (Kievit, et al. 1992). In most children with mental retardation
language develops according to their non-verbal skills (a harmonious development), but there are also children in which verbal and non-verbal skills diverge. Some mentally retarded children show discrepancies between verbal and non-verbal capacities in favour of the non-verbal capacities. These children are called language impaired. Other mentally retarded children show discrepancies in favour of verbal capacities, for instance children with Williams syndrome (Bishop, 1997).

2.3.7 **Psychiatric status**

Language problems are often found in children with an abnormal psychiatric status, for instance in children with an autistic or pervasive developmental disorder or children with Attention Deficit Hyperactivity Disorder (ADHD). In fact, according to DSM-IV, verbal and non-verbal communication problems are part of the diagnostic criteria for autism (DSM-IV, 1994). Children with PDD-NOS lack opportunities for social learning and show impaired development of social cognition. When social cognition is inadequate, comprehension problems will develop (Bishop, 1997; Gillberg, 1998). Children with PDD-NOS often show a semantic-pragmatic language disorder, i.e. the content of language is abnormal, the child is weak in turn-taking in conversation and in maintaining a topic (Rapin & Allen, 1987; Bishop, 1997).

Children with ADHD are easily distracted by irrelevant information (Althaus, 2000). Their learning capacities are within normal range (Bishop, 1992; Luthar, et al. 1997; Gillberg, 1998). However, their hyperactive behaviour and short attention span lead to inadequate analysis of visual, auditory and phonetic features. In addition, social learning is in jeopardy. The behaviour problem of the child influences all learning strategies, and therefore language learning is also at (Luthar, et al. 1997; Gillberg, 1998; Goorhuis-Brouwer & Schaerlaekens, 2000).
2.4 The choice for disciplines co-operating in the multidisciplinary team

2.4.1 Introduction

Considering the various external and internal factors influencing language development, diagnostics in speech and language disorders includes linguistic, medical, audiological and psycho-social aspects.

Linguistic aspects are connected with the language abilities of the child. An analysis of different language modalities (language comprehension and language production) is necessary to conclude if there is a language problem or not. A linguist or a speech pathologist is equipped for this task. Medical aspects are connected with aspects of ears, nose and throat (connected to possible hearing problems), anatomy of the speech organs, speech motor development and neuro-psychiatric status. Different medical specialists can examine these different medical aspects e.g. an otorhinolaryngologist, a child neurologist, or a child psychiatrist. Audiological aspects are connected with hearing possibilities, which can be examined by an audiologist. Psycho-social aspects are connected with the cognitive and the social-emotional development of the child. A child psychologist is equipped for the examination of these psycho-social aspects.

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<th>What has to be examined</th>
<th>Equipped disciplines</th>
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<td>Background variables (SES, family composition, gender, birth weight, day-care/home-care)</td>
<td>all (anamnesis)</td>
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<tr>
<td>Language analysis</td>
<td>speech pathologist, linguist</td>
</tr>
<tr>
<td>Hearing</td>
<td>audiologist, otorhinolaryngologist</td>
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<tr>
<td>Learning capacity</td>
<td>child psychologist</td>
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<tr>
<td>Speech motor capacity and anatomy</td>
<td>otorhinolaryngologist</td>
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<tr>
<td>Neurological status (e.g. tonus, spontaneous movement, consciousness)</td>
<td>child neurologist</td>
</tr>
<tr>
<td>Psychiatric status (e.g. behaviour, attention)</td>
<td>child psychiatrist, child psychologist</td>
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2. Disciplines in a MultiDD protocol

With these influencing factors and aspects in mind, various disciplines can be selected which are equipped for diagnostic tasks in children with speech and language problems, see Table 2.2.

2.4.2 The choice for four disciplines

The Department of Otorhinolaryngology, University Hospital Groningen, Communication Disorders in Children section, made a choice for four disciplines in the MultiDD protocol for children with speech and language problems: the otorhinolaryngologist, the audiologist, the speech pathologist and the child psychologist, see Figure 2.1.

Figure 2.1 The four co-operating disciplines in the multidisciplinary diagnostic procedure for children with speech and language problems
These four disciplines belong to the regular disciplines which are working within a Department of Otorhinolaryngology. The speech pathologist is responsible for the speech and language analysis of the children and the analysis of the parental language stimulation.

The audiologist is essential for an appropriate hearing examination by audiometry and tympanometry.

The otorhinolaryngologist is essential as hearing problems, which often are present in children with speech and language problems (Schönweiler, 1992), must be interpreted from the medical perspective. This means co-operation between the audiologist and the otorhinolaryngologist. Moreover, the otorhinolaryngologist is qualified for the examination of the anatomy and movement of speech organs, which links speech problems to anatomical variance and speech motor capacity. Also the detection of other medical problems, connected to speech and language problems, is of importance. If the otorhinolaryngologist is aware of this, and screens the child in global medical sense, quick referrals to other medical specialist can be done if necessary, e.g. the child neurologist, the child psychiatrist, the paediatrician, or the rehabilitation specialist.

For the examination of learning capacity, behaviour (socioemotional development), and attention, a child psychologist is of importance. With these examinations, if necessary together with the medical examination, possible referrals to other medical specialists, such as a child psychiatrist, can be discussed.

With the choice for these four disciplines, it was thought that the linguistic and audiological factors could be examined adequately and also most of the medical and psycho-social factors, influencing language development.